ANALYSIS OF RESEARCH GAPS AND PRIORITIES IN THE FIELD OF DIGESTIVE HEALTH IN THE EUROPEAN REGION

WHITE BOOK 2: PART 2

SEPTEMBER 2022

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PREFACE

This report was prepared by Tanith C. Rose[a] and Ben Barr[a].

The report was funded by United European Gastroenterology (UEG). UEG commissioned this report as part of the White Book 2, which consists of two parts. Part 1 provides an international comparative analysis of the public health burden of digestive diseases and cancers, and an assessment of the economic impact of digestive diseases amongst UEG national society member countries. In Part 2 (this report), research gaps and priorities in the field of digestive health are explored by consulting UEG national society members and examining distributions of research activity and European Commission funding for digestive disease related research. Executive summaries of both reports can be found in the UEG Journal.

The authors would like to thank the UEG Research Committee for providing feedback on the project. The authors would especially like to thank the UEG Research Taskforce and UEG Secretariat for their involvement in the design and implementation of the survey of UEG national society members.

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INTRODUCTION

United European Gastroenterology (UEG) is a non-profit organisation which provides services for all healthcare professionals and researchers in the broad area of digestive health. Members include pan-European specialist societies and national gastroenterology societies which represent countries located within Europe and the Mediterranean area.

UEG's overarching research aim is to encourage innovation and excellence in research by supporting research facilitation and cooperation in the field of digestive health.[1] Identifying research gaps and priorities in the field of digestive health is fundamental to achieve this aim and to inform the development of a comprehensive research support agenda. Establishing research priorities and setting research agendas can support research efforts by helping to reduce duplication of work, encourage collaboration and improve the quality of research proposals and subsequent likelihood of obtaining research grants. Gaining a better understanding of priorities and unmet needs can also assist UEG in developing strategies for advocating for resources for digestive disease research amongst policymakers and funders.

Member involvement in the identification of priority areas is of great importance for umbrella organisations like UEG and can confer several benefits. For example, engaging with stakeholders to gain insight about research priorities can help to ensure research agendas are relevant, feasible and meet critical evidence gaps.[2] Furthermore, stakeholder participation in research priority setting exercises can foster a sense of ownership of the priorities amongst those involved, thus increasing the likelihood of implementation.[3] In an effort to realise benefits such as these and provide evidence to European Union (EU) funding bodies on priority areas, in 2018 a survey of UEG's specialist society members was conducted to collect information on the most urgent research needs as perceived by each society.[4] Topics that were of common interest to at least two societies were identified and sorted into 10 priority research areas.[4] However, due to the diverse research interests of UEG's members, identifying a harmonised set of research priority areas was not without difficulty. This highlights the need for wide consultation to obtain a range of perspectives on priority areas. Gaining a balanced view will enable UEG to develop credible research agendas and advocacy strategies which are aligned with the research needs of its members.

In addition to stakeholder perspectives, information gathering to capture areas where research attention and funding has been focused can also help to ascertain gaps and unmet needs to inform decisions regarding avenues for further research. For example, identifying areas that are under-researched in relation to need may encourage increased activity and stimulate targeted funding. A previous analysis of European Commission research grants

awarded between 2007 and 2017, found that funding for research into functional gastrointestinal disorders was scarce despite the high level of burden attributable to disorders such as irritable bowel syndrome.[5] Updating and extending this work to examine EU funding per level of burden for digestive and other diseases is needed to provide evidence to develop a strong rationale for increased research support and assist UEG in designing a research agenda that is responsive to health needs and salient evidence gaps.

To address some of the needs that have been mentioned and continue efforts to encourage research in the field of digestive health, UEG commissioned this report as part of the White Book 2. This report provides an exploratory overview of research priorities, activity and funding in the field of digestive health, on which to inform further discussions and exercises to develop future UEG research support agendas and advocacy strategies. The report builds upon the results of previous UEG surveys to gain insights about the priorities and preferences of national society members, whilst also creating an opportunity for national societies to communicate their research priorities to UEG and other societies. To enhance understanding of the research environment the report also provides an overview of the distribution of research activity and EU funding in the field of digestive health, and how patterns of activity and funding relate to differences in burden of disease. Recommendations for further research and additional exercises that may be useful in priority and agenda setting processes are also provided. It is intended that the evidence generated will aid UEG in identifying areas where research and investment are required based on evidence gaps, population health needs and priority research areas identified by its members. It is also hoped that the report will be of interest to national and specialist gastroenterology societies seeking opportunities for collaboration.

Aims and objectives

The overarching aim of the report is to explore priorities and potential gaps in the field of digestive health research in the European region.

The objectives are:

- To collect, analyse and disseminate information about the research priorities and preferences of UEG national society members.
- To provide an overview of the distribution of research activity in the field of digestive health by estimating quantities of published literature by topic and disorder.
- To identify and quantify European Commission funding within Horizon 2020 for digestive disease research in relation to disease burden in the EU.

METHODS

To achieve the three objectives of this report, the following methods were used.

Research priorities and preferences of UEG national society members

In consultation with the UEG Research Taskforce, we designed an online survey to identify the research priorities and preferences of UEG national gastroenterology society members. The survey was designed to collect information on these priorities using a taxonomy of research topics, enabling analyses that identified the most popular research areas, and dissemination of the responses mapped to each national society to stimulate collaborative research efforts. Additionally, the survey collected information on research preferences by asking societies to rank research areas using criteria of importance to the UEG Research Taskforce. The study was granted research ethics approval by the University of Liverpool Health and Life Sciences Research Ethics Committee in April 2021.

The online survey consisted of four questions. Firstly, national societies were asked to submit up to five research priorities in the field of digestive health. To enable quantitative analysis of the most popular research areas without limiting restrictions on responses, societies were asked to categorise each research priority in addition to describing the priority in a free-text field. For each research priority, societies selected from separate drop-down lists, the research domain, the major topic which best described the research and the disease category, if applicable. The research domain categories were based on a previously published framework for systematically categorising health research to inform prioritisation decisions.[6] The major topic categories were based on subheadings within the Medical Subject Headings (MeSH) thesaurus associated with digestive disease research (see below). The disease categories were organised by ICD-10 codes, including disorders of the gastrointestinal tract, liver, pancreas, and biliary tract. National societies were finally asked to provide a concise description of each research priority in their own words (max. 60 characters).

For the remaining three questions, societies were asked to rank 10 research areas previously identified as research priorities by UEG's specialist society members.[4] Societies were asked to rank each of the research areas across the following three domains: (1) relevancy to national health policy or national goals; (2) feasibility to conduct; and (3) potential to strengthen collaboration between partners from different organisations, disciplines or sectors. These criteria were chosen in consultation with the UEG Research Taskforce and were deemed suitably informative and useful for differentiating between the research areas.

Before proceeding to answer the questions, participants were required to confirm, via the online survey, that they had discussed the survey with relevant colleagues and were answering on behalf of their organisation. Additionally, participants were required to confirm they had read the study information sheet and understood responses to the survey (including the name of the national society to which the responses relate) would be made openly available. To ensure useability, a pilot online survey was tested and reviewed by the UEG Research Taskforce and UEG Secretariat. A copy of the survey questions can be found in the Appendix.

At the time of implementation there were 49 UEG national gastroenterology society members (representing 45 countries located within Europe, Western Asia and Northern Africa) and all were invited to participate. Societies within countries that had two national society members (i.e., societies within Belgium, Italy, Spain and the Netherlands) were asked to collaborate to ensure that only one survey was completed per country. Before the survey was launched, an online meeting was held with national society representatives to introduce the purpose of the study and potential benefits of participating, to explain what answering the survey would involve and what would happen to the results and to answer any initial questions. Following this meeting, the UEG Secretariat sent an email invite, information sheet and PDF copy of the survey questions to representatives of each national society who were asked to discuss the survey with colleagues and respond on behalf of their society. The online survey was open for four months and closed on 31st August 2021.

Analysis of the survey data was conducted in R (version 4.0.4). To analyse responses to the ranking questions, mean ranks, pairwise frequencies and marginal frequencies were calculated using the 'pmr' package.[7]

The UEG Research Taskforce was involved in the design of the survey questions, selected the priority ranking criteria, tested the pilot survey and provided feedback. The Taskforce was not involved in the analysis of the data.

Distribution of research activity in the field of digestive health

A bibliometric analysis was used to provide an overview of the distribution of research activity in the field of digestive health. For this analysis, the number of publications in academic journals was used as an indicator of research activity. We estimated quantities of digestive disorder related publications by research topic and disorder, and where possible examined publication output in relation to disease burden.

A search strategy was developed to identify digestive disorder related academic journal publications, limited to human studies, published since the year 2000, by research topic and

disorder. The MEDLINE database was used to identify relevant publications. MEDLINE is a bibliographic database that contains more than 28 million references to journal articles worldwide, with a concentration on biomedicine and health.[8] Articles within MEDLINE are indexed using the MeSH thesaurus - a controlled and hierarchically organised vocabulary produced by the National Library of Medicine.[9] Each article is assigned a set of MeSH terms that characterise its subject matter to enable cataloguing and electronic searching. Search terms for the analysis were developed based on main headings and qualifiers (also known as subheadings) within the MeSH thesaurus, and were selected to permit synthesis of the results across the three main research objectives of the report.

Search terms for the research topics were based on MeSH qualifiers related to the main heading: 'Digestive system diseases'. Digestive system diseases are defined within the thesaurus as diseases in any part of the gastrointestinal tract or the accessory organs (liver, biliary tract, pancreas). All narrower terms within the main heading (encompassing digestive neoplasms as well as diseases) were included in the search. The qualifiers that are linked to a main heading, group together articles concerned with a particular aspect of a subject (e.g., drug therapy, epidemiology, genetics). In total, 26 qualifiers or combinations of qualifiers were included in the search in conjunction with the main heading. Two additional topics which were not qualifiers (information science and health care quality, access and evaluation) were searched as major concepts in combination with the main heading and presented separately.

The digestive disorder search terms were based on narrower headings within the 'Digestive system diseases' main heading. To facilitate comparison with disease burden estimates, concordance with ICD-10 classifications was assessed where possible. A previously published concordance table between ICD-10 codes and MeSH terms provided some assistance with this task.[10] Additionally, where available, cross-referencing between MeSH terms and ICD-10 codes was performed using the Unified Medical Language System Metathesaurus.[11]

Searches were performed in January 2022. To enhance the relevancy of the results, searches were limited to human studies, published since the year 2000 in academic journals. Database search limits were used to refine the results to publications in academic journals published since the year 2000, and a search term filter was used to refine the results to human studies.[12] All publication types (e.g., primary research and reviews) were included. Depending on the subject matter, publications may have been indexed to more than one research topic or digestive disorder, however it was not feasible to screen the publications to apply a weighting scheme to adjust for double counting due to the broad scope of the analysis. Additionally, only 14% of the results were indexed to a geographical location and therefore it was decided not to limit by location. The results are therefore reflective of global research activity. The search terms are shown in the Appendix.

The results by digestive disorder underwent further analysis to examine the extent to which research activity was aligned with disease burden as measured by Disability-Adjusted Life Years (DALYs). A DALY is a measure of the overall burden of a disease, combining the years of life lost due to premature mortality and the years of healthy life lost due to disability.[13] DALYs can therefore be used to compare the burden of a wide range of disorders, from life-threatening to those which predominantly cause disability. The global number of DALYs per disorder in 2019 were extracted from the publicly available Global Burden of Disease Study (GBD) 2019 database.[14] GBD 2019 uses highly standardised and systematic methods to estimate disease burden metrics in 204 countries and territories.[15] DALY estimates were not available for irritable bowel syndrome, dyspepsia, eosinophilic oesophagitis or coeliac disease, hence publication output in relation to burden was not estimated for these diseases. Since higher income countries tend to produce more research publications compared to lower income countries, a sensitivity analysis was conducted to compare digestive disease global publication output with disease burden in the EU.

European Commission funding for digestive disease research (Horizon 2020)

Analysis of Horizon 2020 funded research projects was performed to identify and quantify European Commission funding for digestive disease research. We examined how patterns of funding for digestive disease research related to differences in the burden of disease in Europe, and how this compared to funding granted for other diseases.

Horizon 2020 is an EU research programme which ran from 2014 to 2020. With available funds of nearly €80 billion, the programme aimed to enhance innovation in science and encourage public-private partnerships, with the ultimate goal of driving economic growth in Europe.[16] During the first four years of the programme, the European Commission aimed to invest more than €2 billion in health research.[16] Details about funded projects are publicly available via the CORDIS database,[17] including project abstracts (otherwise known as objectives), European Commission funding contributions and fields of science categories based on the European Science Vocabulary (EuroSciVoc). The EuroSciVoc is a taxonomy of fields of science based on OECD's 2015 Frascati Manual taxonomy, and was extended with fields of science categories extracted from CORDIS content.[18] Fields of science are hierarchically organised, from broad research areas (e.g., medical and health sciences) to specific subjects, such as individual diseases.

Horizon 2020 project data were downloaded from the CORDIS database in December 2021, and over 90% of the projects were classified with at least one EuroSciVoc field of science category (which could include one or more disease specific fields). A search strategy was developed to identify research projects related to digestive and non-digestive diseases from

which to extract data on the amount of European Commission funding awarded per project. Projects classified with a 'medical and health sciences' field of science category were eligible for inclusion. All types of research (including basic science), and projects at all stages (including terminated projects) were eligible for inclusion.

Projects related to non-digestive diseases (including cardiovascular, neurological, sense organ, mental and respiratory diseases) were identified using disease specific EuroSciVoc fields. Diseases with corresponding disease burden estimates were selected. Since inflammatory bowel disease was the only digestive disease with a specific EuroSciVoc field, research projects related to digestive diseases were identified by automated computer assisted searching of project abstracts using digestive disease search terms, performed in R.

The digestive disease search terms were developed based on ICD-10 classifications to facilitate comparison with disease burden estimates (see Appendix). Potentially relevant projects that were identified by the computer assisted searching of abstracts were then manually screened for inclusion based on the criteria that an aim of the research was to gain a better understanding of the disease, or to directly reduce the burden of the disease. Projects that did not mention the disease specifically were excluded.

European Commission funding per project was summed by disease, and analyses were conducted to examine the relationship between European Commission funding for Horizon 2020 research projects and disease burden in the EU using DALYs (see above). Sensitivity analysis examining the relationship using global DALYs was also conducted.

Since the projects relating to digestive diseases and other diseases were identified using different methods, a sensitivity analysis was performed to compare the results obtained from each method for inflammatory bowel disease (the only digestive disease with a specific EuroSciVoc field). It was found that the amount of funding for inflammatory bowel disease research derived from project abstract screening was 4% less than the amount derived using the inflammatory bowel disease EuroSciVoc field. This difference may have occurred due to the strict inclusion criteria applied to the project abstract screening which may have excluded projects distally related to the disease, however a 4% difference was deemed acceptable to make general comparisons and to provide a broad overview of the funding landscape.

Identifying Horizon 2020 projects related to digestive cancers fell outside the scope of this study, however cancer related projects were relatively well indexed within the CORDIS database compared to digestive disease projects. Research funding in relation to burden was therefore examined for cancers with specific EuroSciVoc fields and corresponding DALY estimates.

RESULTS

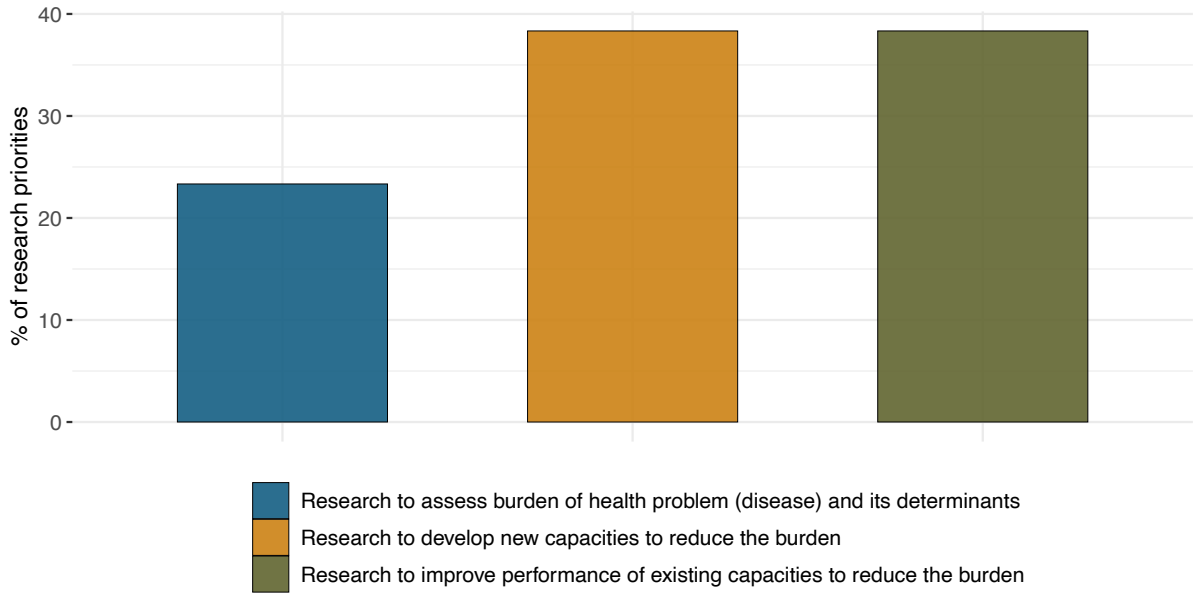
Research priorities and preferences of UEG national society members

In total, 33 responses to the survey were received from UEG national society members - a response rate of 73%. National societies were asked to submit up to five research priorities in the field of digestive health, and in total, 120 research priorities were submitted. Full details of the research priorities identified by the national societies can be found in the Appendix. Here we present the most popular research areas identified for prioritisation by the societies, broken down by research domain, major topic and disease category.

Figure 1 shows how the 120 research priorities were categorised by the societies according to the research domain. Research to assess the burden and determinants of diseases made up 23% of the 120 research priorities, whereas 77% of the priorities were categorised as research to either develop new capacities or improve the performance of existing capacities to reduce the burden of disease.

Figure 1.

Proportion of 120 research priorities identified by UEG national society members, by research domain category



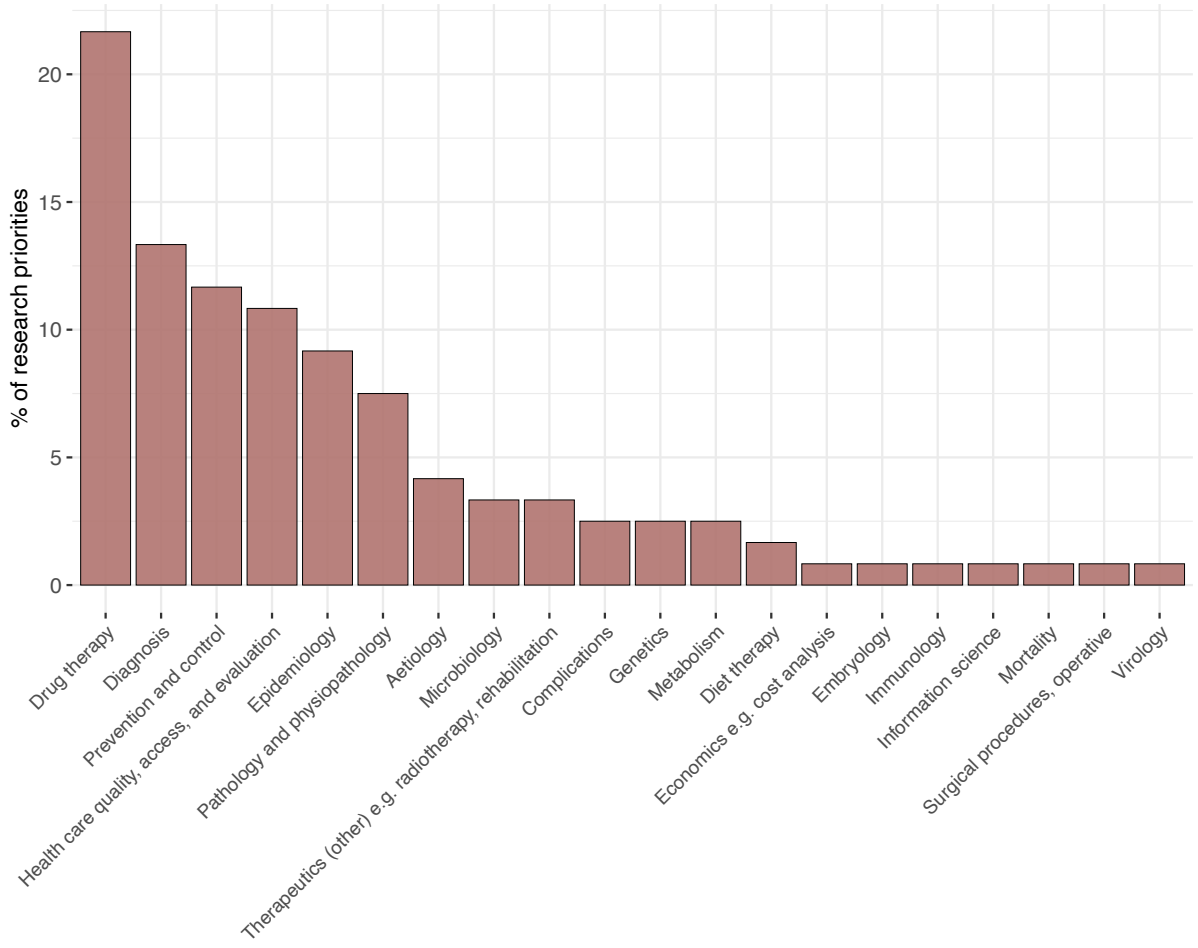
Source: authors' compilation using survey data from UEG national society members.

For the major topic, over a fifth of the 120 research priorities were described by the national societies as drug therapy research (Figure 2). Combined, drug therapy (22%), diagnosis (13%), and prevention and control (12%) research made up nearly half of all the identified research priorities. Healthcare quality, access and evaluation research, and epidemiological research accounted for 11% and 9% of the priorities, respectively.

Results were similar when investigating the percentage of societies that prioritised each topic, with drug therapy research prioritised by 52% of the societies, diagnosis research prioritised by 42% of the societies, and prevention and control research prioritised by 39% of the societies (see Appendix for plot).

Figure 2.

Proportion of 120 research priorities identified by UEG national society members, by major research topic



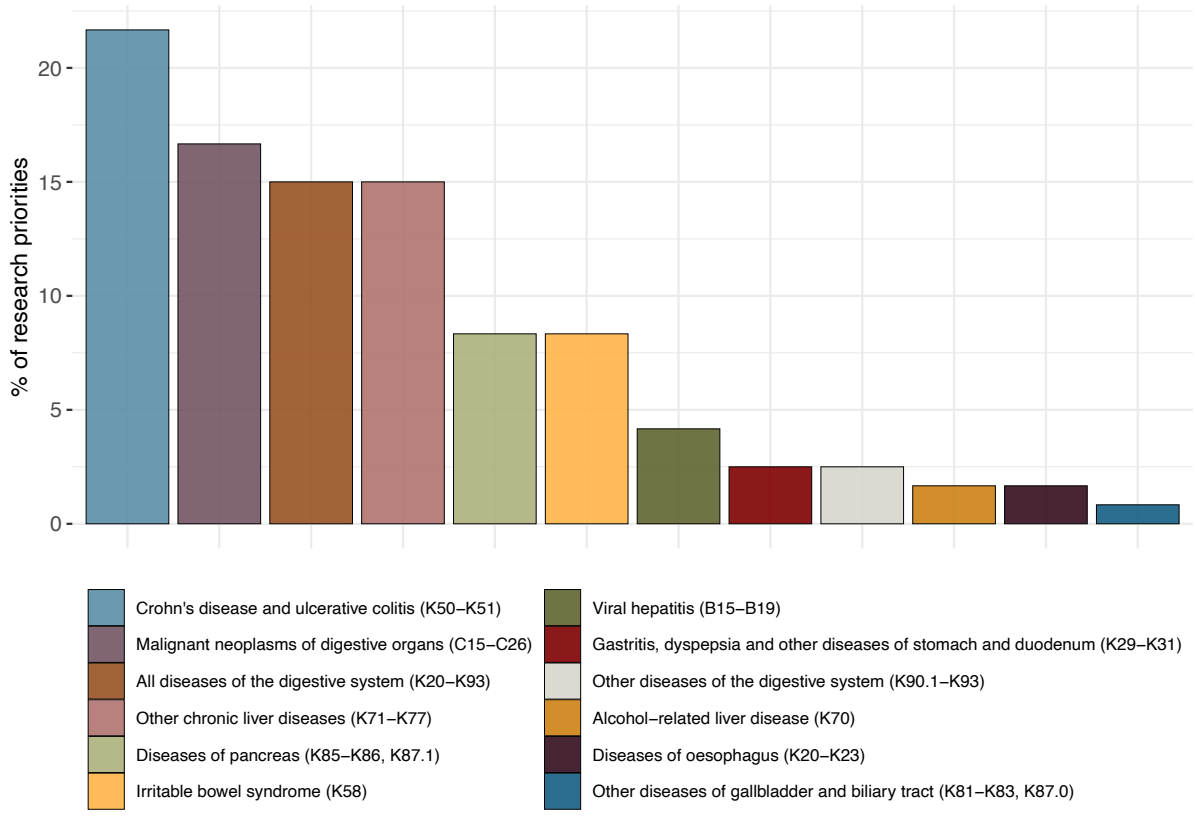
Source: authors' compilation using survey data from UEG national society members.

In terms of disease categories, research to investigate Crohn's disease and ulcerative colitis accounted for over a fifth of the priorities (22%), followed by research to investigate digestive cancers which made up 17% of the priorities (Figure 3). Combined, research to investigate alcohol-related liver disease and other chronic liver diseases accounted for 17% of the priorities identified by the national societies, and viral hepatitis made up 4%. Research to investigate diseases of the pancreas, and irritable bowel syndrome were also identified for prioritisation by the societies, each making up 8% of the priorities.

Results were similar when investigating the percentage of societies that prioritised each disease category, with Crohn's disease and ulcerative colitis research prioritised by 70% of the societies, and digestive cancer research prioritised by 42% of the societies (plot in Appendix).

Figure 3.

Proportion of 120 research priorities identified by UEG national society members, by disease category



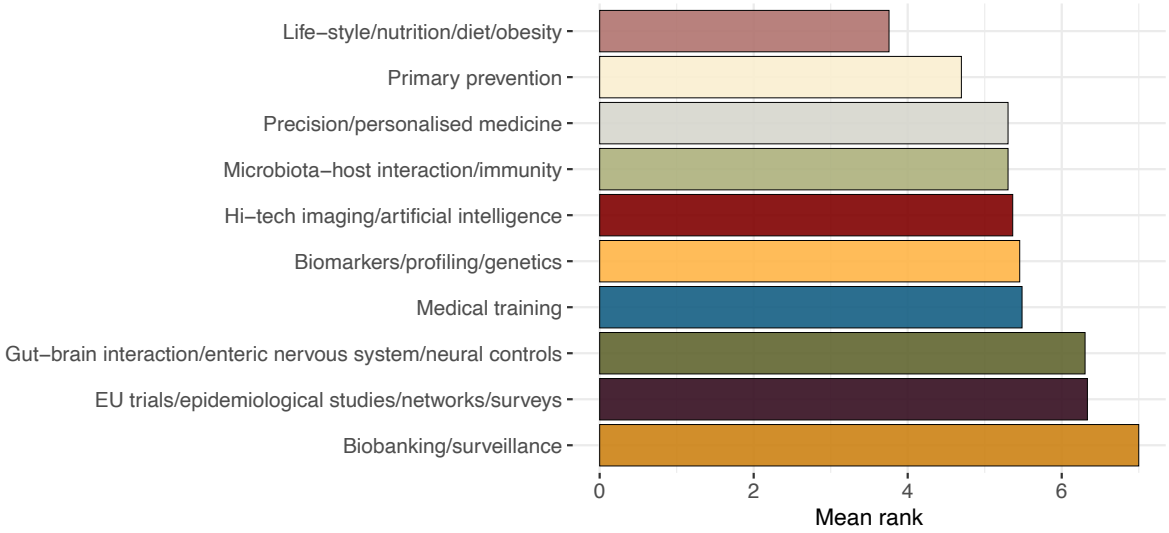
Source: authors' compilation using survey data from UEG national society members.

Overall, Crohn's disease and ulcerative colitis drug therapy research was the most popular disease and topic combination identified for prioritisation by the societies, accounting for 10% of the 120 research priorities. This was followed by digestive cancer prevention research which made up 6% of the priorities.

National societies were also asked to rank 10 research areas which were previously identified as research priorities by UEG's specialist society members. Life-style/nutrition/diet/obesity and primary prevention were, on average, the most highly ranked research areas in terms of relevancy to national health policy or national goals, as determined by the overall mean rank (Figure 4). Life-style/nutrition/diet/obesity was ranked higher than biobanking/surveillance by 26 out of 33 societies. Additionally, primary prevention was ranked most relevant by 8 societies (24%), and life-style/nutrition/diet/obesity was ranked most relevant by 7 societies (21%) (Figure 5). Medical training and precision/personalised medicine were each ranked most relevant by 4 societies (12%).

Figure 4.

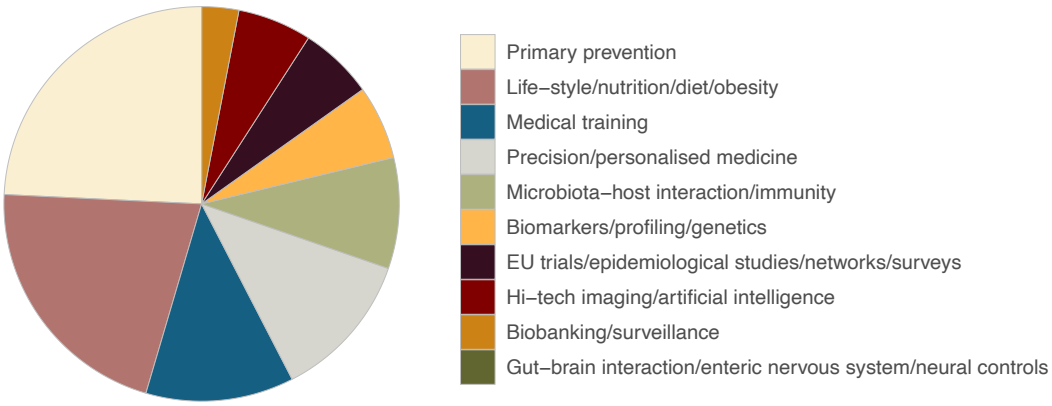
Average rankings of research areas in terms of relevancy to national health policy or national goals



Source: authors' compilation using survey data from UEG national society members.
Note: Lower mean rank values indicate more preferred research areas.

Figure 5.

Proportion of societies that ranked each research area as most relevant

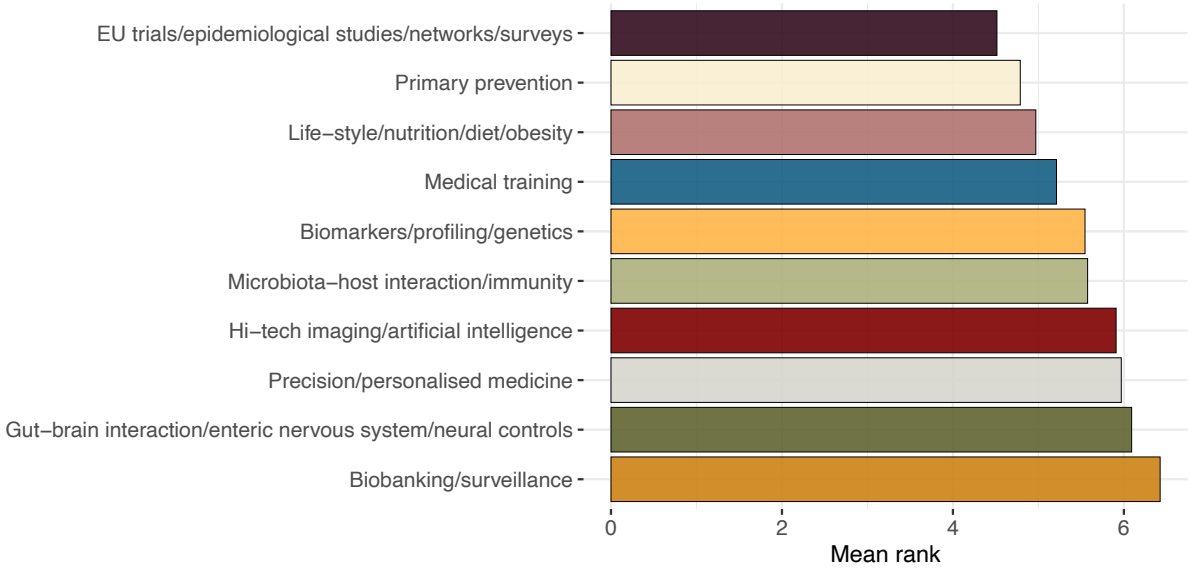


Source: authors' compilation using survey data from UEG national society members.

EU trials/epidemiological studies/networks/surveys and primary prevention were, on average, the most highly ranked research areas in terms of feasibility to conduct (Figure 6). EU trials/epidemiological studies/networks/surveys was ranked higher than biobanking/ surveillance by 22 out of 33 societies. Furthermore, primary prevention was ranked most feasible by 8 societies (24%) (Figure 7). Biomarkers/profiling/genetics and medical training were each ranked most feasible by 5 societies (15%). EU trials/epidemiological studies/ networks/surveys was ranked most feasible by 4 societies (12%).

Figure 6.

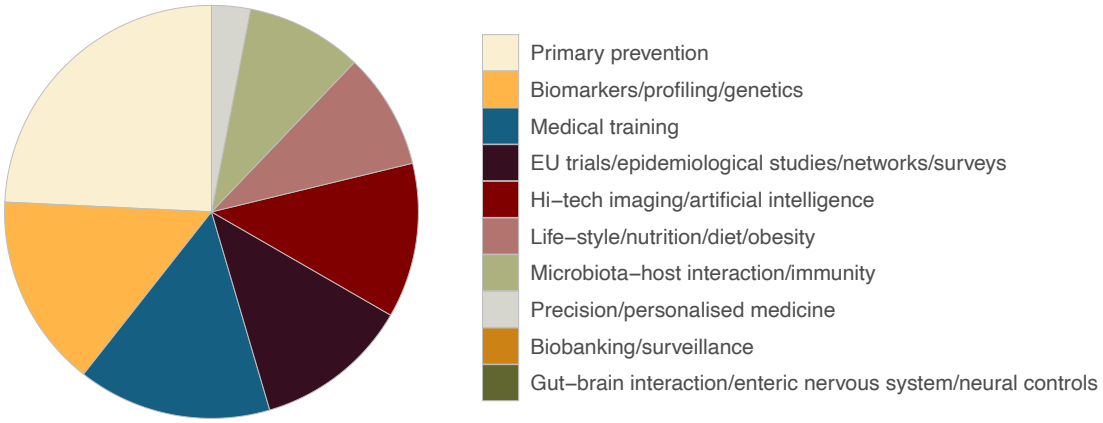
Average rankings of research areas in terms of feasibility to conduct



Source: authors' compilation using survey data from UEG national society members.
Note: Lower mean rank values indicate more preferred research areas.

Figure 7.

Proportion of societies that ranked each research area as most feasible

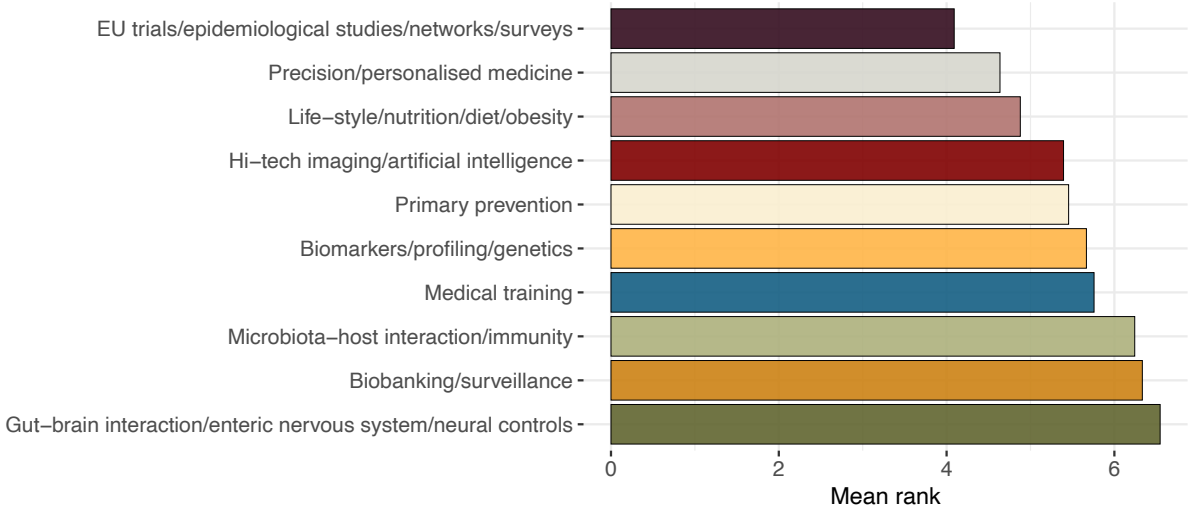


Source: authors' compilation using survey data from UEG national society members.

EU trials/epidemiological studies/networks/surveys and precision/personalised medicine were, on average, the most highly ranked research areas in terms of potential to strengthen collaboration between partners from different organisations, disciplines or sectors (Figure 8). EU trials/epidemiological studies/networks/surveys was ranked higher than gut-brain interaction/enteric nervous system/neural controls by 22 out of 33 societies. Life-style/ nutrition/diet/obesity and precision/personalised medicine were each ranked as having most potential for collaboration by 7 societies (21%) (Figure 9). EU trials/epidemiological studies/ networks/surveys and medical training were each ranked as having most potential for collaboration by 4 societies (12%).

Figure 8.

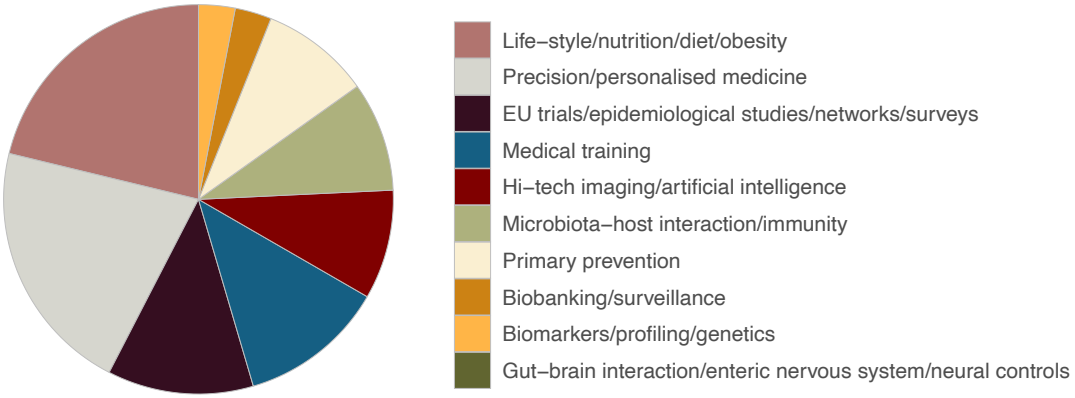
Average rankings of research areas in terms of potential to strengthen collaboration between partners from different organisations, disciplines or sectors



Source: authors' compilation using survey data from UEG national society members.
Note: Lower mean rank values indicate more preferred research areas.

Figure 9.

Proportion of societies that ranked each research area as having most potential for collaboration



Source: authors' compilation using survey data from UEG national society members.

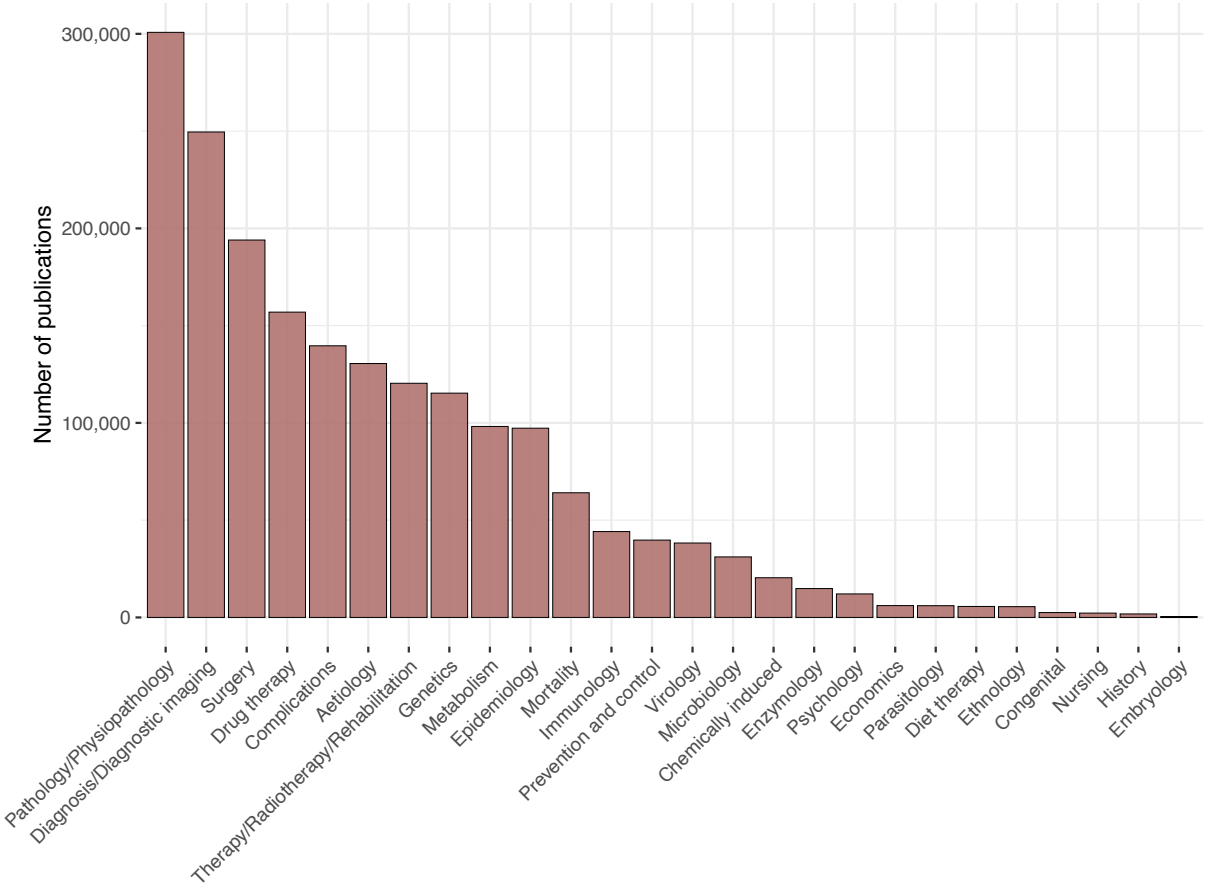
Distribution of research activity in the field of digestive health

In total, there were 944,059 digestive disorder related academic journal publications, limited to human studies, published since the year 2000, which may have been indexed to more than one research topic and digestive disorder.

The number of digestive disorder related academic journal publications by research topic is shown in Figure 10. A large number of digestive disorder related publications were classified as pathology/physiopathology (300,784), diagnosis/diagnostic imaging (249,559), surgery (194,020), and drug therapy (156,951) research. Relatively few digestive disorder related publications were classified as congenital, nursing, history or embryology research (<3000 each). There were also 43,408 publications related to digestive disorders and health care quality, access and evaluation, and 20,416 publications related to digestive disorders and information science, however these figures were estimated using different methods to the other topics and therefore may not be directly comparable.

Figure 10.

Number of digestive disorder related academic journal publications by research topic

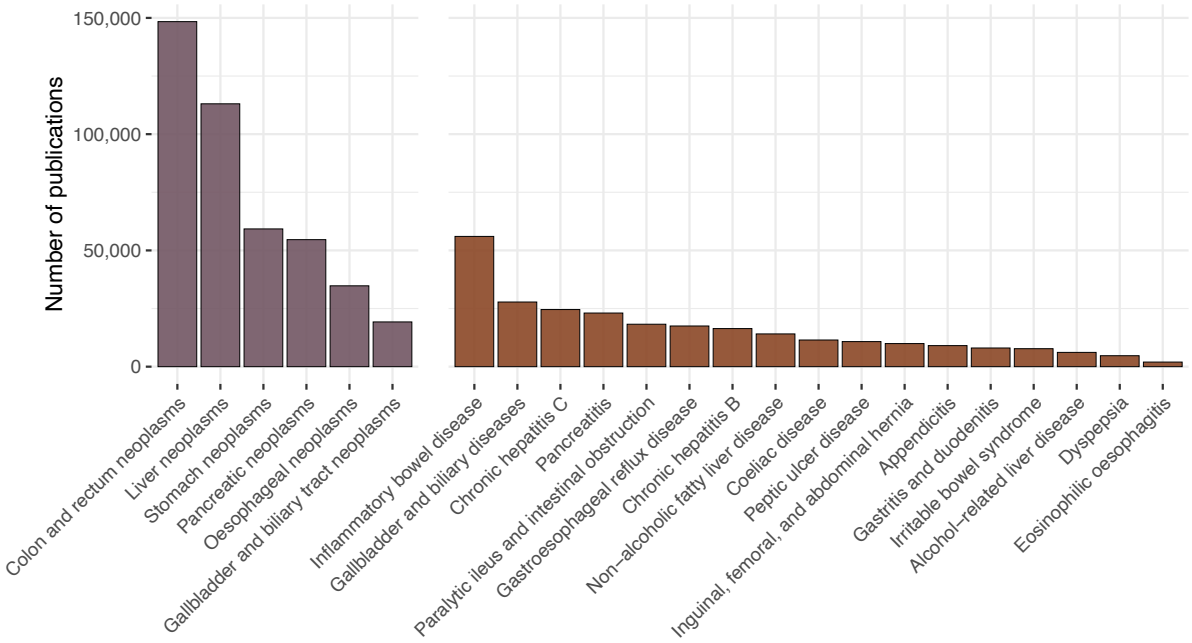


Source: authors' compilation using data extracted from MEDLINE database.
Publications limited to human studies, published since the year 2000. Publications may be assigned to more than one topic.

The number of academic journal publications by digestive disorder is shown in Figure 11. Among the digestive neoplasms, colon and rectum (148,401) and liver (113,060) neoplasms had a large number of publications, compared to oesophageal (34,772) and gallbladder and biliary tract (19,242) neoplasms. Among the digestive diseases analysed, inflammatory bowel disease (56,027) had a large number of publications, whereas dyspepsia and eosinophilic oesophagitis each had <5000 publications. Only the chronic liver disease sub-categories are shown in Figure 11, and chronic liver diseases overall had 123,125 related publications.

Figure 11.

Number of academic journal publications by digestive disorder



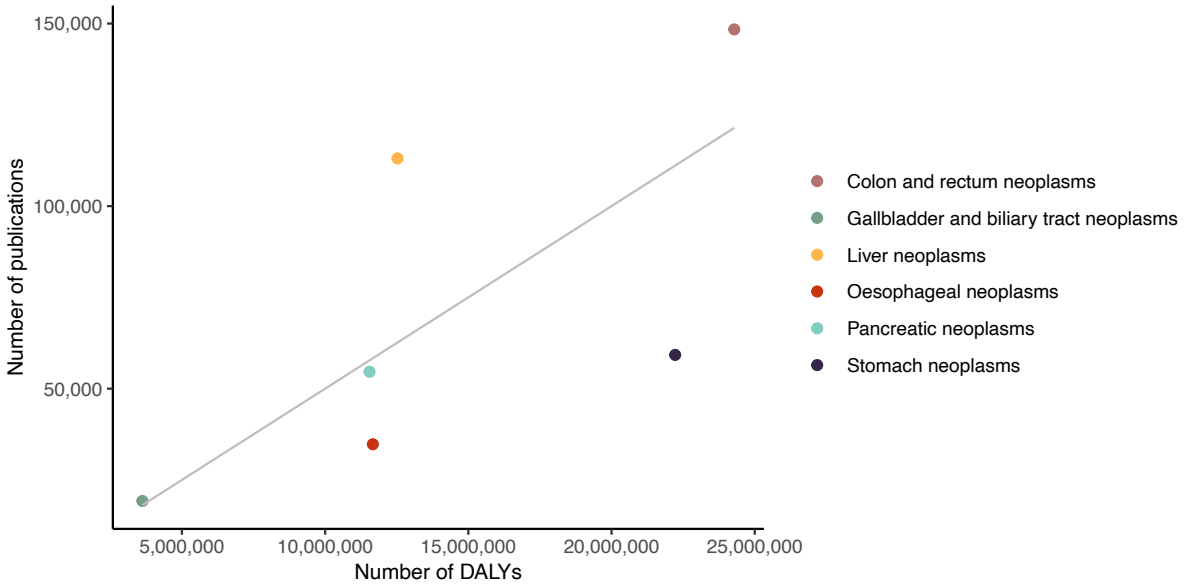
Source: authors' compilation using data extracted from MEDLINE database.
Publications limited to human studies, published since the year 2000. Publications may be assigned to more than one disorder.

Figure 12 andFigure 13 show the relationship between the number of digestive disorder related academic journal publications and the global number of DALYs per disorder in 2019 (for which data were available). Stomach and oesophageal neoplasms appeared to be under-researched in relation to global disease burden compared to the other digestive neoplasms. Amongst the digestive diseases, alcohol-related liver disease had few publications compared to a relatively high level of burden. Inflammatory bowel disease, on the other hand, had almost 50,000 additional publications compared to alcohol-related liver disease, but over 9 million fewer DALYs.

Higher income countries tend to produce more research publications and may have different research priorities compared to lower income countries, however, the main findings in relation to inflammatory bowel disease and alcohol-related liver disease were observed when comparing global publication output with disease burden in the EU (see Appendix).

Figure 12.

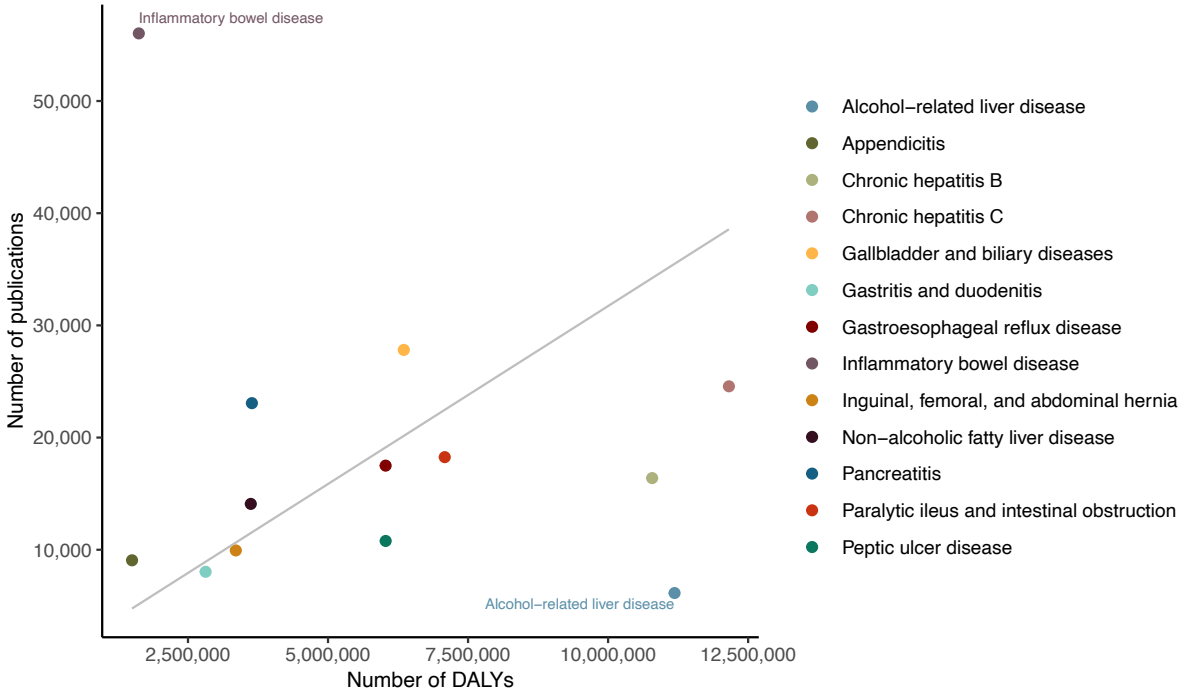
Relationship between the number of digestive neoplasm related academic journal publications and global disease burden (measured as Disability–Adjusted Life Years)



Source: authors' compilation using data extracted from MEDLINE and GBD 2019 databases.
The grey line represents the number of publications that would be expected if publication output was proportional to disease burden.
Displaying DALYs for malignant neoplasms.

Figure 13.

Relationship between the number of digestive disease related academic journal publications and global disease burden (measured as Disability–Adjusted Life Years)



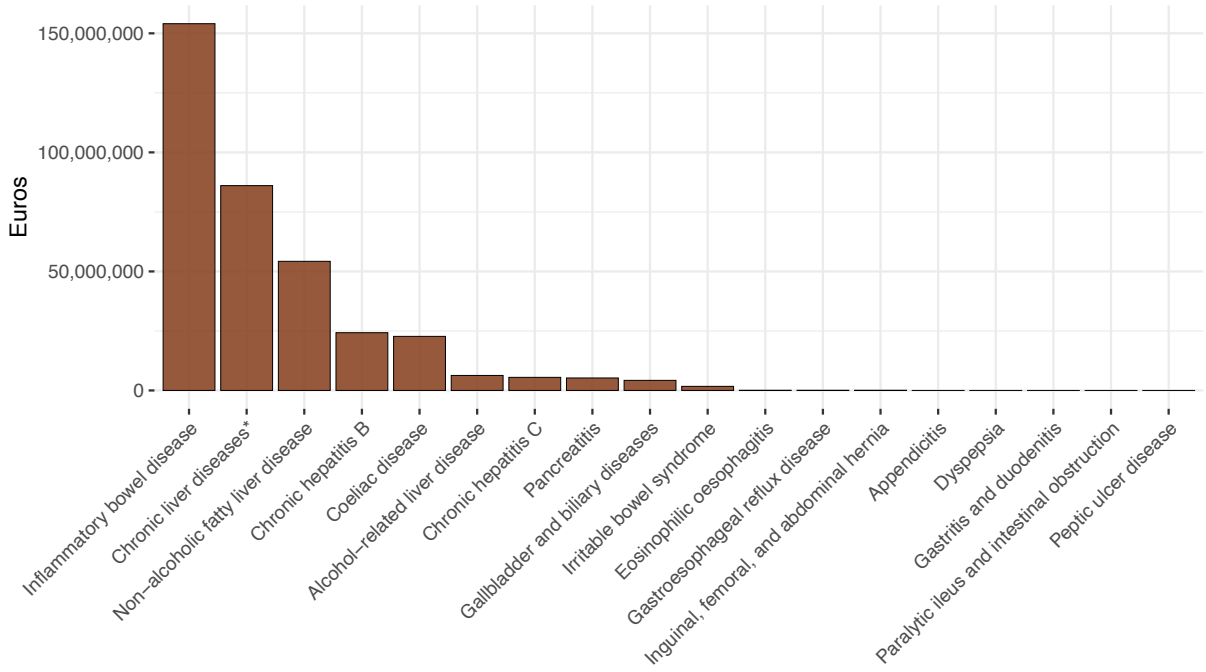
Source: authors' compilation using data extracted from MEDLINE and GBD 2019 databases.
The grey line represents the number of publications that would be expected if publication output was proportional to disease burden.

European Commission funding for digestive disease research (Horizon 2020)

In total, 166 Horizon 2020 funded digestive disease related research projects were identified, with combined European Commission funding of €352,777,536 (see Appendix for list of projects). A small number of identified projects (n=6) were assigned to more than one disease field (excluding sub-categorisation). Stated start dates amongst the projects ranged from the years 2015 to 2022.

Figure 14 and Table 1 show European Commission funding in Euros for digestive disease related Horizon 2020 projects summed by disease. Inflammatory bowel disease received a large amount of research funding at over €150 million. Chronic liver disease related projects that were not assigned to a particular disease sub-category were granted around €86 million in total. Additionally, non-alcoholic fatty liver disease, chronic hepatitis B, and coeliac disease each received over €20 million. Most of the digestive diseases analysed, however, received relatively small amounts of research funding. Irritable bowel syndrome received €1.7 million, and three digestive diseases, including gastroesophageal reflux disease, received €50,000 each. Five diseases did not receive any funding, including dyspepsia and paralytic ileus and intestinal obstruction. Whilst there were no identified projects specifically related to peptic ulcer disease or gastritis and duodenitis, nearly €375,000 was awarded to Helicobacter pylori screening or treatment related projects.

Figure 14.
European Commission funding for Horizon 2020 digestive disease related research projects



Source: authors' compilation using data extracted from CORDIS database.
Funding per project may be assigned to more than one disease.
*Chronic liver diseases (not including disease sub–categories).

Table 1. European Commission funding for Horizon 2020 digestive disease related projects

Digestive disease	***European Commission funding***
Inflammatory bowel disease	€154,049,175
Chronic liver diseases (not including disease sub-categories)	€86,031,462
Non-alcoholic fatty liver disease	€54,231,518
Chronic hepatitis B	€24,259,518
Coeliac disease	€22,712,561
Alcohol-related liver disease	€6,305,654
Chronic hepatitis C	€5,504,323
Pancreatitis	€5,237,429
Gallbladder and biliary diseases	€4,236,977
Irritable bowel syndrome	€1,720,851
Eosinophilic oesophagitis	€50,000
Gastroesophageal reflux disease	€50,000
Inguinal, femoral, and abdominal hernia	€50,000
Appendicitis	€0
Dyspepsia	€0
Gastritis and duodenitis	€0
Paralytic ileus and intestinal obstruction	€0
Peptic ulcer disease	€0

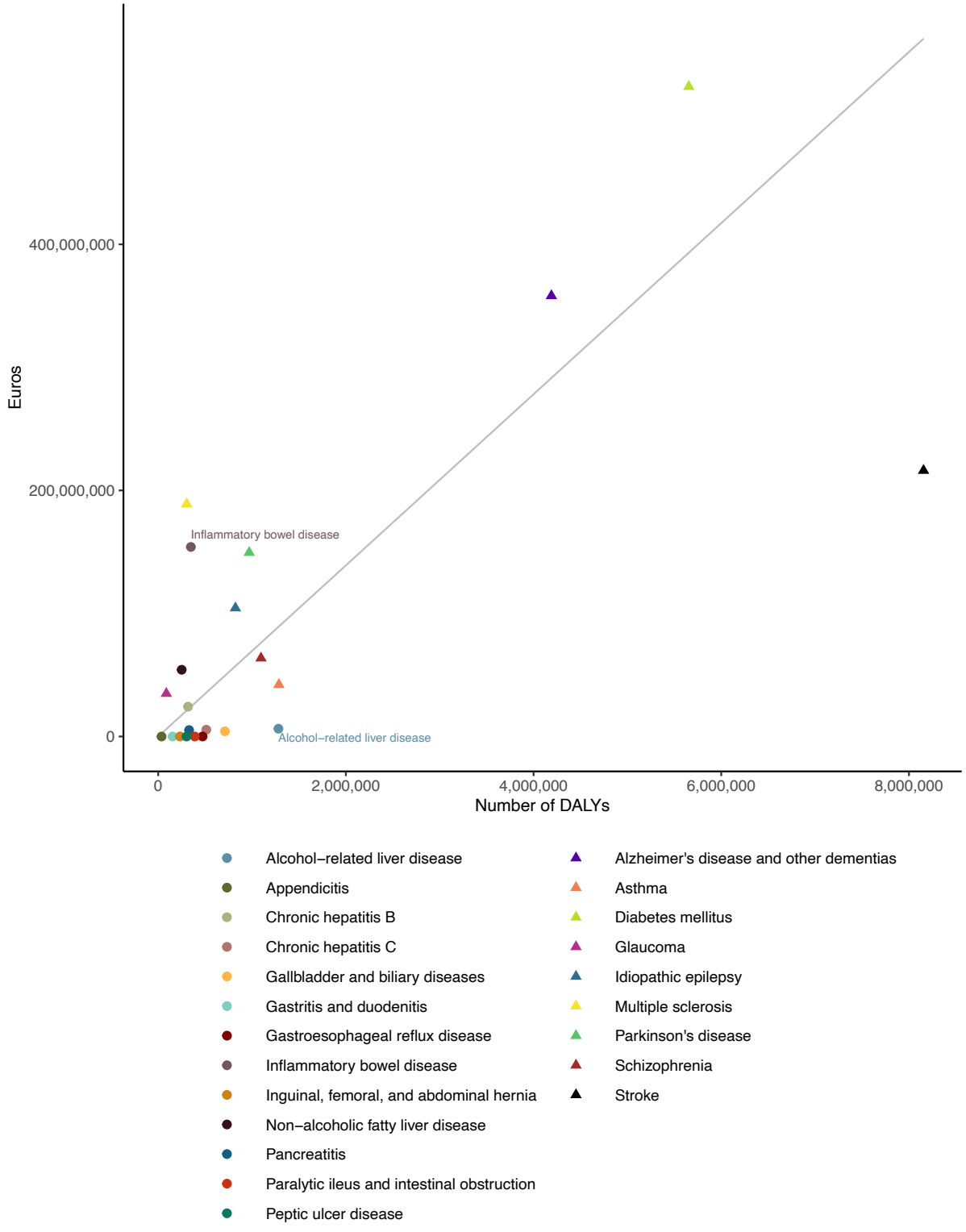
Source: authors' compilation using data extracted from CORDIS database.
Funding per project may be assigned to more than one disease.

Figure 15 shows the relationship between European Commission funding for Horizon 2020 digestive and non-digestive disease related projects, and the number of DALYs per disease in the EU in 2019 (for which data were available). Inflammatory bowel disease research appeared to be very well funded in relation to burden compared with other diseases. With over 900,000 fewer DALYs, inflammatory bowel disease received over €147 million in additional research funding compared to alcohol-related liver disease for example. Funding for non-alcoholic fatty liver disease research appeared to be well funded in relation to burden compared with other diseases, and funding for chronic hepatitis B research appeared to be aligned with disease burden. However, most of the digestive diseases analysed appeared to be under-funded in relation to burden compared with other diseases. Similar findings were observed when global DALYs were used instead of EU DALYs, although chronic hepatitis B research appeared to be under-funded in relation to the global burden associated with this disease (see Appendix).

As an example, we estimate that if nine digestive diseases (gastritis and duodenitis, inguinal, femoral, and abdominal hernia, peptic ulcer disease, pancreatitis, paralytic ileus and intestinal obstruction, chronic hepatitis C, gastroesophageal reflux disease, gallbladder and biliary diseases, and alcohol-related liver disease) received a proportionate amount of research funding relative to their disease burden, an additional €283 million would have been allocated to these diseases in total, including almost €83 million for alcohol-related liver disease research.

Figure 15.

Relationship between European Commission funding for Horizon 2020 research projects and disease burden in the European Union (measured as Disability–Adjusted Life Years)

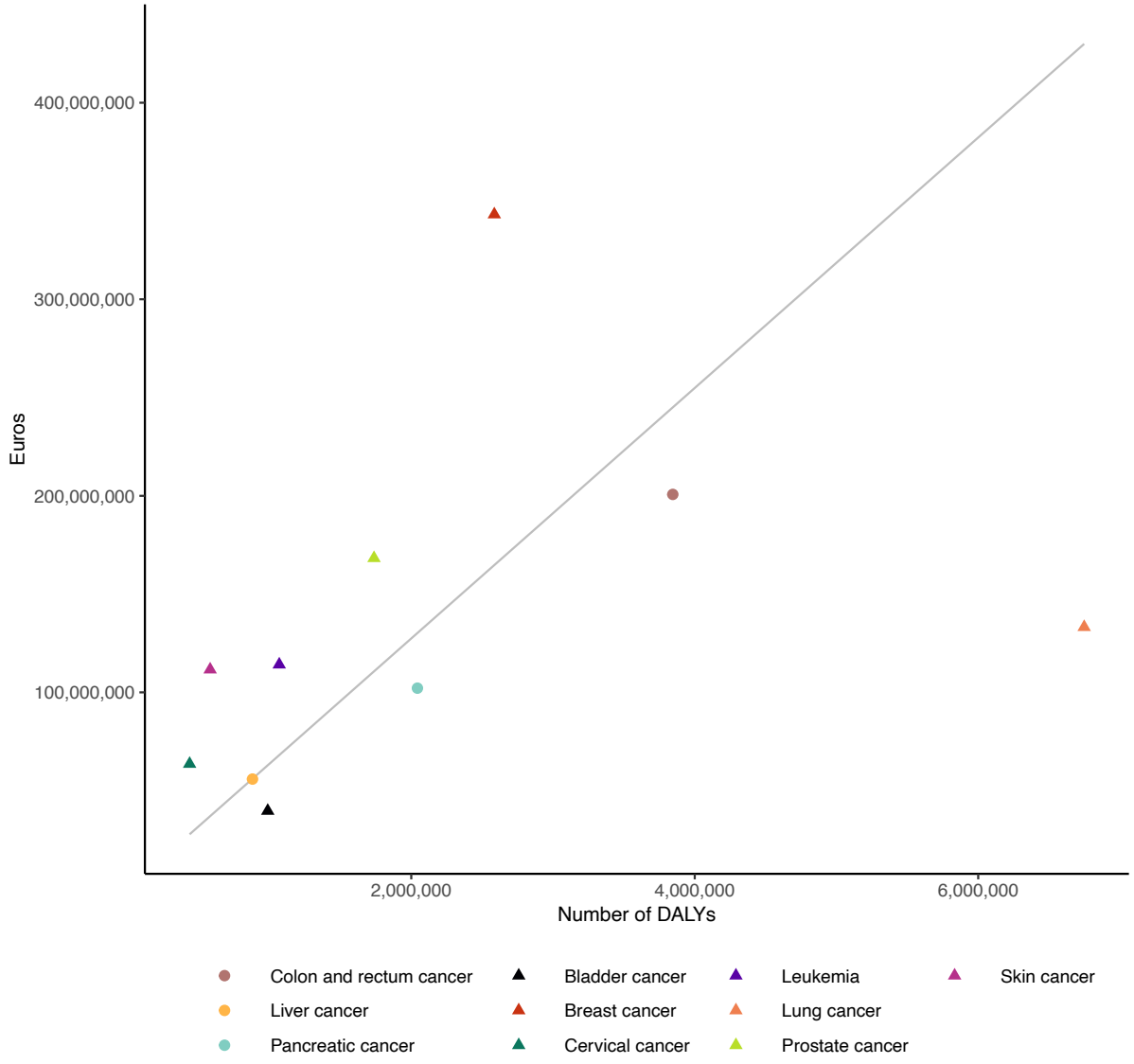


Source: authors' compilation using data extracted from CORDIS and GBD 2019 databases.
The grey line represents the level of funding that would be expected if funding was proportional to disease burden.

Identifying Horizon 2020 cancer related research projects fell outside the scope of this study, however we were able to examine research funding in relation to burden for cancers with specific EuroSciVoc fields and corresponding DALY estimates. Figure 16 shows the relationship between European Commission funding for Horizon 2020 cancer related research projects and the number of DALYs per cancer in the EU in 2019. Of the digestive cancers that were available to analyse, those that were associated with higher levels of burden received higher levels of research funding. Colon and rectum cancer and pancreatic cancer appeared to be under-funded in relation to burden compared with some of the other cancers.

Figure 16.

Relationship between European Commission funding for Horizon 2020 cancer related research projects and disease burden in the European Union (measured as Disability–Adjusted Life Years)



Source: authors' compilation using data extracted from CORDIS and GBD 2019 databases.
The grey line represents the level of funding that would be expected if funding was proportional to disease burden.
DALYs for lung cancer category include tracheal, bronchus, and lung cancer.

DISCUSSION

This report provides an exploratory overview of research priorities, activity and funding in the field of digestive health in Europe. It explores the research priorities and preferences of UEG national society members, and examines how patterns of research activity and EU funding for digestive disease research relate to differences in the burden of disease. Together, the results provide insight into the research landscape, and several observations regarding potential priorities, gaps and unmet needs become apparent when synthesising the results.

Firstly, the results suggest that inflammatory bowel disease is well researched compared to other digestive diseases, with a relatively high number of publications and large amount of Horizon 2020 funding in relation to disease burden as measured by DALYs. Furthermore, research to investigate Crohn's disease and ulcerative colitis accounted for over a fifth of the priorities identified by the national societies. A previous study also found that amongst gastroenterology topics, inflammatory bowel disease research received the largest amount of funding within the EU Seventh Framework Programme for Research and Technological Development (FP7) which ran from 2007-2013.[5] In the United States, a similar study found that Crohn's disease research consistently received the highest amount of National Institutes of Health funding from 2011-2015, compared to five other digestive diseases (coeliac disease, irritable bowel syndrome, eosinophilic oesophagitis, Barrett's oesophagus and non-alcoholic fatty liver disease).[19] The study's authors put forward that the persistently high levels of funding for Crohn's disease research is difficult to justify given that Crohn's disease has many available and emerging treatment options and is associated with lower levels of burden compared to some of the other digestive diseases which received far less funding.[19] It is also important to note that some studies have found inflammatory bowel disease to be more prevalent amongst more socioeconomically affluent groups.[20] Focusing research efforts in disease areas that tend to affect more affluent groups, whilst under-prioritising disease areas that effect more disadvantaged groups could exacerbate existing inequalities.

Several authors have speculated as to why certain research areas attract continuously high levels of interest and funding. A compounding feedback-cycle has been described, whereby ample funding permits high quality research which subsequently attracts higher levels of investment.[19 21] Researchers may be incentivised to study well-known, highly-cited topics, and funders may prefer to invest in more established research areas.[10 22] Additionally, it may be preferable to invest public funds in research which is more likely to produce tangible societal impact, which may be easier to achieve when much is already known about a topic.[23] It may be for these reasons, inflammatory bowel disease research continues to be prioritised over other digestive diseases associated with greater levels of burden.

Whether and to what extent research funding should be distributed in proportion to disease burden is, in itself, an area of debate. Some have put forward that greater health gains can potentially be achieved at no additional cost by allocating resources more fairly in proportion to health needs.[21 24] This argument is supported by studies that have found positive correlations between disease-specific research funding and the development of new therapies and innovations.[25 26] However, more research funding may not necessarily translate into less disease burden in all situations,[27] and appropriate ways to define and measure disease burden may differ depending on the context. Moreover, as already discussed, funders may consider other criteria to be as or more important, such as potential for progress and public interest.[27] Nevertheless, the results of this research suggest that in absolute terms and in relation to burden, some digestive diseases have received little in the way of Horizon 2020 research funding.

This study found that gastroesophageal reflux disease, eosinophilic oesophagitis, dyspepsia, gastritis and duodenitis, peptic ulcer disease, inguinal, femoral, and abdominal hernia, and paralytic ileus and intestinal obstruction received very limited if any research funding in the form of Horizon 2020 grants. Unsuccessful research proposals were not available to analyse, and it is possible that the lack of funding awarded may relate to a shortage of proposals in these areas. However, many of the diseases mentioned did not appear to be similarly under-researched (as measured by publication output) in relation to disease burden. These findings suggest that a lack of research activity in these disease areas is unlikely to be the sole explanation for the scarcity of funding. It is also possible that whilst these diseases did not appear to be under-researched, there may be a lack of pan-European research collaboration in these disease areas, which may present a barrier to obtaining Horizon 2020 funding.

Alcohol-related liver disease appeared both under-funded and under-researched in relation to the high level of burden associated with this disease. Other studies have observed similar findings, with alcohol-related liver disease receiving less research attention (in terms of publication and conference output, research funding and therapies under development) in relation to burden compared with chronic viral hepatitis and non-alcoholic fatty liver disease.[26] Possible explanations underlying this finding relate to the social stigma associated with substance use disorders which can reinforce victim-blaming attitudes and subsequent under-funding of these disorders within research programmes.[24 26] Likewise, the burden associated with alcohol-related liver disease disproportionately falls on more socioeconomically disadvantaged groups,[28] who may have less say and influence over research priority decisions.[29 30 31] Several avenues for further research in relation to alcohol-related liver disease have been proposed, including research to improve large-scale early

detection programmes, develop non-invasive markers of severity, define targets for therapy and increase awareness of the burden associated with the disease.[26]

Additionally, research investigating irritable bowel syndrome, one of the most common digestive diseases with limited available treatment options, was granted €1.7 million in Horizon 2020 funding – equivalent to just over 1% of the amount awarded for inflammatory bowel disease research. Research activity in terms of publication output was also relatively low for irritable bowel syndrome compared to other digestive diseases. Törnblom *et al*. also found a lack of investment in research investigating irritable bowel syndrome and other functional gastrointestinal disorders such as dyspepsia, within the EU research programme FP7 which preceded Horizon 2020.[5] These findings indicate long-term trends in under-investment for these diseases within EU funding programmes.

Importantly, some of the digestive diseases which received little in the way of Horizon 2020 research funding in absolute terms and in relation to burden, were highlighted as areas for prioritisation by the national societies. For example, research to investigate irritable bowel syndrome and pancreatitis each accounted for 8% of the priorities identified by the societies, respectively. Other examples include alcohol-related liver disease, diseases of the stomach and duodenum, and oesophageal diseases, which were highlighted as priorities but received a paucity of research funding. Prioritised disease areas that appear under-funded or under-researched may represent unmet needs that warrant greater consideration.

Potential research gaps in relation to digestive disorder related research topics were also evident when comparing the research priorities of the national societies with publication output by research topic. For example, the top three research topics identified for prioritisation by the societies were drug therapy, diagnosis, and prevention research. Whilst a relatively large number of digestive disorder related publications were classified as drug therapy and diagnosis research, there were far fewer publications classified as prevention research. The national societies also ranked primary prevention research highly compared to other research areas, in terms of feasibility to conduct and relevancy to national health policy or goals. Therefore, in the field of digestive health, prevention research appears to be under-researched yet regarded as an important area for prioritisation and may represent a promising avenue for development.

Limitations and further research

The main limitations to keep in mind when considering the results of this report relate to the broad scope of the analysis. Bibliometric methods were used to summarise large quantities of data, and it was not possible to manually check each publication or non-digestive disease

related funded project to assess whether they had been appropriately indexed. Diseases and topics were grouped into broad categories to capture areas where research attention was focused. Additionally, the quantity of publications and funding were used as measures of research activity and investment, however these measures do not account for the quality or impact of the research. Despite limitations such as these, the methods were considered appropriate to capture general patterns and enhance understanding about the research environment. The analysis is exploratory and is intended to be used to initiate further discussions and more detailed investigations to inform the development of future UEG research support agendas and advocacy strategies.

Several areas in the field of digestive health which may benefit from additional research and investment have been identified based on evidence gaps, population health needs and the priorities of UEG national gastroenterology society members. Further investigations are needed to identify the challenges and barriers associated with conducting research in these areas. Gaining a better understanding of the factors that are hindering progress will inform the development of effective strategies to encourage increased research activity and funding. For instance, promoting awareness of the impact of digestive diseases amongst funding bodies may help to increase investment in under-funded areas where research activity and research proposals are strong. Additional interventions, such as targeted research programmes and grants, may be needed to attract researchers and encourage activity in research areas which appeared to be both under-researched and under-funded (e.g., alcohol-related liver disease and irritable bowel syndrome). UEG has an important role to play in developing strategies to encourage increased support for neglected research areas.

This study created an opportunity for UEG national society members to communicate their research priorities to UEG and other societies, and it is hoped that the results will be of interest to national and specialist gastroenterology societies seeking opportunities for collaboration. For UEG, building upon this work and gaining a range of perspectives on priority research areas will assist in the development of credible research agendas and advocacy strategies. For example, further refinement of the potential areas for prioritisation that have been identified (e.g., prevention research) into specific research questions for investigation can be achieved using systematic review methods and/or focused priority setting exercises. Importantly, wide consultation will help to gain a balanced view of areas which require prioritisation, and the insight of patient groups who represent the intended beneficiaries of the research will be particularly informative.

Capturing the views of marginalised and disadvantaged patient groups who may be more difficult to engage but likely have greater unmet health needs is especially important to inform decisions regarding avenues for further research. This study found that alcohol-

related liver disease, a condition highly associated with socioeconomic disadvantage,[28] was both under-funded and under-researched in relation to the high level of burden associated with this disease. In contrast, inflammatory bowel disease, which some studies have found to be more prevalent in more socioeconomically affluent groups,[20] appears to have received consistently high levels of funding and research attention in relation to burden. A contributing factor to these differences may be that socioeconomically disadvantaged groups have less say and influence over research priority setting, resulting in their health needs being overlooked.[29 30 31] To develop equitable research agendas and investment strategies, due consideration must be given to the voices of the most disadvantaged groups in society and the diseases which have a disproportionate impact on their lives.

Finally, some of the limitations of this study could be addressed by improved monitoring of research and funding in the field of digestive health in Europe. This study investigated the distribution of funding for digestive disease related projects within one of the largest research funding programmes in the world, however more work is needed to assess how other programmes and national funding allocations respond to need. Coordinated strategies are required to collect, organise and communicate information on existing research activities. As an example, the CardioScape project has established a database of European cardiovascular research projects and funding agencies.[32] Projects are organised using a taxonomy of research topics, permitting analysis of topic-based funding. A similar project in the field of digestive health research could potentially be initiated by building upon and further developing the taxonomy of digestive disease related research topics that have been utilised in this study. A project such as this would enable rapid analysis of under-funded areas to inform funding decisions, and support research efforts by helping to avoid duplication whilst facilitating collaborations. Over time, a well coordinated database could provide greater levels of transparency in terms of funding investments, and be utilised to evaluate the impact of strategies designed to increase research activity and funding into neglected areas.

Conclusion

This exploratory overview of research priorities, activity and funding in the field of digestive health in the European region found several areas which may benefit from additional research and investment. It is hoped that the evidence presented provides useful insight into the research landscape and can be used to develop a strong rationale for increased research support from researchers, funding bodies and policymakers. Additional exercises, such as consulting patient groups, identifying barriers to conducting research in neglected areas and improving surveillance of research activity and funding will further assist UEG in designing research agendas and advocacy strategies that are responsive to health needs and salient evidence gaps in the field of digestive health.

APPENDIX

METHODS

Methods: Research priorities and preferences of UEG national society members

The following is a copy of the survey questions completed online:

Research Priorities of National Gastroenterology Societies in Europe

Your organisation is invited to participate in a research study commissioned by United European Gastroenterology (UEG) and conducted by University of Liverpool researchers. UEG would like to gain insight from national society members regarding their research priorities, and provide members the opportunity to communicate their research priorities to UEG and other societies. We kindly request that the survey is completed once per country, and it is important that the responses to the survey represent the views of your organisation (not individual opinions).

Please take time to read the following Information Sheet (v2_29_03_2021) before continuing, available here:

https://static.onlinesurveys.ac.uk/media/account/111/survey/727518/question/information_sheet_v2_29_03_202.pdf

Please check the boxes below to indicate that you have read and understood the information in the Information Sheet (v2_29_03_2021). ✱ *Required*

Please select at least 3 answer(s).

- ☐ I have read and understood the information in the Information Sheet
- ☐ I have discussed the survey with relevant colleagues, and I am responding on behalf of my organisation
- ☐ I understand that responses to the survey, including the name of the national society, will be published in the UEG Journal

Please provide the name of the national society/societies you are answering on behalf of (if you have worked collaboratively with a society from the same country please provide both society names here) ✱ *Required*

We would like to collect information regarding your organisation's research priorities in the field of digestive health. Please submit **up to five** research priorities (these do not need to be in order of importance).

Please enter your organisation's first research priority below, by selecting from the drop-down list the research domain, the major topic which best describes the research, the disease category if applicable, and provide a concise description of the research in your own words.

Research domain ✱ *Required*

Major research topic ✱ *Required*

Disease category ✱ *Required*

Brief description ✱ *Required*

Your answer should be no more than 60 characters long.

Key for selection options:

Research domain
Research to assess burden of health problem (disease) and its determinants
Research to improve performance of existing capacities to reduce the burden
Research to develop new capacities to reduce the burden

Major research topic
Aetiology
Chemically induced health problems
Complications
Congenital
Diagnosis
Diet therapy
Drug therapy
Economics e.g. cost analysis
Embryology
Enzymology
Epidemiology
Genetics
Health care quality, access, and evaluation
Humanities e.g. history
Immunology
Information science
Metabolism
Microbiology
Mortality
Nursing
Parasitology
Pathology and physiopathology
Prevention and control
Psychology
Social sciences e.g. sociology, anthropology
Surgical procedures, operative
Therapeutics (other) e.g. radiotherapy, rehabilitation
Virology

Disease category
Diseases of oesophagus (K20-K23)
Ulcer of stomach, duodenum and jejunum (K25-K28)
Gastritis, dyspepsia and other diseases of stomach and duodenum (K29-K31)
Diseases of appendix (K35-K38)
Hernia (K40-K46)
Crohn's disease and ulcerative colitis (K50-K51)
Other noninfective gastroenteritis and colitis (K52)
Vascular disorders of intestine (K55)
Paralytic ileus and intestinal obstruction without hernia (K56)
Diverticular disease of intestine (K57)
Irritable bowel syndrome (K58)
Diseases of anus and rectum (K60-K62)
Other diseases of intestine, haemorrhoids and perianal venous thrombosis (K59, K63-K64)
Diseases of peritoneum (K65-K67)
Alcoholic liver disease (K70)
Other diseases of liver (K71-K77)
Cholelithiasis (K80)
Other diseases of gallbladder and biliary tract (K81-K83, K87.0)
Diseases of pancreas (K85-K86, K87.1)
Coeliac disease (K90.0)
Other diseases of the digestive system (K90.1-K93)
Malignant neoplasms of digestive organs (C15-C26)
Intestinal infectious diseases (A00-A09)
Viral hepatitis (B15-B19)
All diseases of the digestive system (K20-K93)
Not applicable

Add another research priority? ✱ *Required*

- Yes
- No

Research priorities of United European Gastroenterology specialist society members are presented as clustered research areas below. We would like to ascertain your organisation's views on these research areas in terms of relevancy, feasibility and potential for collaboration.

Please rank the following research areas in order of relevancy to national health policy or national goals (1 being the research area that is most relevant). ✱ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 10 answer(s).

Please don't select more than 1 answer(s) in any single column.

	1	2	3	4	5	6	7	8	9	10
Life-style/nutrition/diet/obesity	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Microbiota-host interaction/immunity	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Biomarkers/profiling/genetics	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Gut-brain interaction/enteric nervous system/neural controls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hi-tech imaging/artificial intelligence	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Precision/personalised medicine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Biobanking/surveillance	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
EU trials/epidemiological studies/networks/surveys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Medical training	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Primary prevention	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Please rank the following research areas in order of how feasible they would be to conduct (1 being the research area that would be most feasible to conduct). ✱ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 10 answer(s).

Please don't select more than 1 answer(s) in any single column.

	1	2	3	4	5	6	7	8	9	10
Life-style/nutrition/diet/obesity	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Microbiota-host interaction/immunity	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Biomarkers/profiling/genetics	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Gut-brain interaction/enteric nervous system/neural controls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hi-tech imaging/artificial intelligence	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Precision/personalised medicine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Biobanking/surveillance	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
EU trials/epidemiological studies/networks/surveys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Medical training	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Primary prevention	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Please rank the following research areas in order of their potential to strengthen collaboration between partners from different organisations, disciplines or sectors (1 being the research area with the most potential for collaboration). ✱ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 10 answer(s).

Please don't select more than 1 answer(s) in any single column.

	1	2	3	4	5	6	7	8	9	10
Life-style/nutrition/diet/obesity	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Microbiota-host interaction/immunity	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Biomarkers/profiling/genetics	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Gut-brain interaction/enteric nervous system/neural controls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hi-tech imaging/artificial intelligence	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Precision/personalised medicine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Biobanking/surveillance	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
EU trials/epidemiological studies/networks/surveys	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Medical training	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Primary prevention	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Methods: Distribution of research activity in the field of digestive health

The following search terms were used to search the MEDLINE database (via EBSCOhost) in January 2022. Each research topic and digestive disorder search term was combined with a human study search term filter[12] to refine the results to human studies, e.g. (MH "Digestive System Diseases+/ET") NOT ((MH "Animals+") NOT (MH "Humans")).

Table 2. Search terms that were used to identify publications within MEDLINE by research topic and digestive disorder

	Search term
Research topics	
Aetiology	(MH "Digestive System Diseases+/ET")
Chemically induced	(MH "Digestive System Diseases+/CI")
Complications	(MH "Digestive System Diseases+/CO")
Congenital	(MH "Digestive System Diseases+/CN")
Diagnosis/Diagnostic imaging	(MH "Digestive System Diseases+/DI") OR (MH "Digestive System Diseases+/DG")
Diet therapy	(MH "Digestive System Diseases+/DH")
Drug therapy	(MH "Digestive System Diseases+/DT")
Economics	(MH "Digestive System Diseases+/EC")
Embryology	(MH "Digestive System Diseases+/EM")
Enzymology	(MH "Digestive System Diseases+/EN")
Epidemiology	(MH "Digestive System Diseases+/EP")
Ethnology	(MH "Digestive System Diseases+/EH")
Genetics	(MH "Digestive System Diseases+/GE")
Health care quality, access, and evaluation	(MH "Digestive System Diseases+") AND (MM "Health Care Quality, Access, and Evaluation+")
History	(MH "Digestive System Diseases+/HI")
Immunology	(MH "Digestive System Diseases+/IM")
Information science	(MH "Digestive System Diseases+") AND (MM "Information Science+")
Metabolism	(MH "Digestive System Diseases+/ME")
Microbiology	(MH "Digestive System Diseases+/MI")
Mortality	(MH "Digestive System Diseases+/MO")
Nursing	(MH "Digestive System Diseases+/NU")
Parasitology	(MH "Digestive System Diseases+/PS")
Pathology/Physiopathology	(MH "Digestive System Diseases+/PA") OR (MH "Digestive System Diseases+/PP")
Prevention and control	(MH "Digestive System Diseases+/PC")
Psychology	(MH "Digestive System Diseases+/PX")
Surgery	(MH "Digestive System Diseases+/SU")
Therapy/Radiotherapy/ Rehabilitation	(MH "Digestive System Diseases+/TH") OR (MH "Digestive System Diseases+/RT") OR (MH "Digestive System Diseases+/RH")
Virology	(MH "Digestive System Diseases+/VI")

Digestive disorders	
Colon and rectum neoplasms	(MH "Colorectal Neoplasms+")
Gallbladder and biliary tract neoplasms	(MH "Biliary Tract Neoplasms+")
Liver neoplasms	(MH "Liver Neoplasms+") OR (MH "Cholangiocarcinoma+")
Oesophageal neoplasms	(MH "Esophageal Neoplasms+")
Pancreatic neoplasms	(MH "Pancreatic Neoplasms+")
Stomach neoplasms	(MH "Stomach Neoplasms")
Chronic liver diseases	(MH "Chemical and Drug Induced Liver Injury+") OR (MH "Hepatic Insufficiency+") OR (MH "Hepatitis, Chronic+") OR (MH "Liver Cirrhosis+") OR (MH "Liver Abscess") OR (MH "Liver Abscess, Pyogenic") OR (MH "Non-alcoholic Fatty Liver Disease") OR (MH "Focal Nodular Hyperplasia") OR (MH "Hepatic Infarction") OR (MH "Hepatic Veno-Occlusive Disease") OR (MH "Hepatopulmonary Syndrome") OR (MH "Hepatorenal Syndrome") OR (MH "Hypertension, Portal") OR (MH "Peliosis Hepatis") OR (MH "Liver Diseases, Alcoholic+")
Alcohol-related liver disease	(MH "Liver Diseases, Alcoholic+")
Chronic hepatitis B	(MH "Hepatitis B, Chronic")
Chronic hepatitis C	(MH "Hepatitis C, Chronic")
Non-alcoholic fatty liver disease	(MH "Non-alcoholic Fatty Liver Disease")
Appendicitis	(MH "Appendicitis")
Coeliac disease	(MH "Celiac Disease")
Dyspepsia	(MH "Dyspepsia")
Eosinophilic oesophagitis	(MH "Eosinophilic Esophagitis")
Gallbladder and biliary diseases	((MH "Cholestasis") OR (MH "Cholestasis, Extrahepatic") OR (MH "Cholangitis+") OR (MH "Common Bile Duct Diseases+") OR (MH "Cholelithiasis+") OR (MH "Gallbladder Diseases+")) NOT ((MH "Common Bile Duct Neoplasms") OR (MH "Gallbladder Neoplasms"))
Gastritis and duodenitis	(MH "Gastritis+") OR (MH "Duodenitis")
Gastroesophageal reflux disease	(MH "Gastroesophageal Reflux")
Inflammatory bowel disease	(MH "Inflammatory Bowel Diseases+")
Inguinal, femoral, and abdominal hernia	(MH "Hernia, Inguinal") OR (MH "Hernia, Femoral") OR (MH "Hernia, Abdominal")
Irritable bowel syndrome	(MH "Irritable Bowel Syndrome")
Pancreatitis	(MH "Pancreatitis+")
Paralytic ileus and intestinal obstruction	(MH "Intestinal Obstruction") OR (MH "Fecal Impaction") OR (MH "Ileus+") OR (MH "Intestinal Volvulus") OR (MH "Intussusception")
Peptic ulcer disease	(MH "Peptic Ulcer") OR (MH "Duodenal Ulcer") OR (MH "Peptic Ulcer Perforation") OR (MH "Stomach Ulcer")
Human study filter	(MH "Animals+") NOT (MH "Humans")

Methods: European Commission funding for digestive disease research within Horizon 2020

Research projects related to digestive diseases were identified by automated computer assisted searching of project abstracts using the digestive disease search terms below. Projects related to non-digestive diseases were identified using disease specific EuroSciVoc fields. Searches were performed in R with the “grep” function, ignoring text case.[33]

Table 3. Search terms that were used to identify Horizon 2020 funded projects related to digestive and other diseases

Digestive diseases	***Search terms***
Appendicitis	"appendicitis"
Chronic liver diseases	"cirrhosis| liver|hepati|hepato"
Coeliac disease	"coeliac|celiac"
Dyspepsia	"dyspepsia|indigestion"
Eosinophilic oesophagitis	"esophag"
Gallbladder and biliary diseases	"gallbladder|biliary|cholelithiasis|cholecystitis|gallstone|cholangitis|gall bladder| bile"
Gastritis and duodenitis	"gastritis|duodenitis|gastroduodenitis|pylori"
Gastroesophageal reflux disease	"esophag"
Inflammatory bowel disease	"bowel disease|crohn|colitis|enteritis|diarrh"
Inguinal, femoral, and abdominal hernia	"hernia"
Irritable bowel syndrome	"irritable bowel syndrome|irritable colon"
Pancreatitis	"pancreatitis|pancreas"
Paralytic ileus and intestinal obstruction	"ileus|paralytic|paralysis|obstruct|invagination|intussusception|volvulus|impaction|strangulation|torsion|twist|occlusion|stenosis|stricture" & "intestin|ileus|bowel|colon|rectum|rectal|fecal|faecal|gallstone"
Peptic ulcer disease	"gastric ulcer|duodenal ulcer|peptic ulcer|gastrojejunal ulcer|gastroduodenal ulcer|pylori"
Other diseases	***EuroSciVoc field search terms***
Alzheimer's disease and other dementias	"dementia|alzheimer"
Asthma	"asthma"
Diabetes mellitus	"diabetes"
Glaucoma	"glaucoma"
Idiopathic epilepsy	"epilepsy"
Multiple sclerosis	"multiple sclerosis"
Parkinson's disease	"parkinson"
Schizophrenia	"schizophrenia"
Stroke	"stroke|cerebrovascular diseases"

RESULTS

Results: Research priorities and preferences of UEG national society members

Table 4. Research priorities identified by each national society

Research domain category	*Research topic category*	*Digestive disease category*	*Description*
AEG (Asociación Española de Gastroenterología) and SEPD (Sociedad Española de Patología Digestiva)			
Develop new capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	Cost-effectiveness analysis of biologic therapies
Develop new capacities to reduce burden	Drug therapy	Irritable bowel syndrome (K58)	New drugs to treat IBS
Improve performance of existing capacities to reduce burden	Drug therapy	Malignant neoplasms of digestive organs (C15-C26)	Pancreatic cancer drug treatment
Improve performance of existing capacities to reduce burden	Drug therapy	Other diseases of liver (K71-K77)	NASH therapeutics
Improve performance of existing capacities to reduce burden	Prevention and control	Malignant neoplasms of digestive organs (C15-C26)	Colorectal cancer screening
Albanian Association of Gastro-Entero-Hepatology			
Assess burden of disease and its determinants	Health care quality, access, and evaluation	All diseases of the digestive system (K20-K93)	All GI and Hepatic Diseases
Armenian Association of Gastroenterology			
Assess burden of disease and its determinants	Epidemiology	All diseases of the digestive system (K20-K93)	Prevalence, mortality, outcomes in all GI/liver disorders
Develop new capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	Biologic therapy in IBD, clinical trials
Improve performance of existing capacities to reduce burden	Complications	Other diseases of liver (K71-K77)	Outcomes in liver cirrhosis decompensation
Improve performance of existing capacities to reduce burden	Metabolism	Other diseases of liver (K71-K77)	Epidemiology, metabolism, prevention of NAFLD
Improve performance of existing capacities to reduce burden	Prevention and control	Malignant neoplasms of digestive organs (C15-C26)	Screening programs for gastric, colorectal, liver cancer
Association of Serbian Gastroenterologists ASG			
Assess burden of disease and its determinants	Health care quality, access, and evaluation	Crohn's disease and ulcerative colitis (K50-K51)	Early diagnosis and personalised approach in therapy
Develop new capacities to reduce burden	Diagnosis	Other diseases of liver (K71-K77)	Early recognition of NAFLD
Improve performance of existing capacities to reduce burden	Prevention and control	Gastritis, dyspepsia and other diseases of stomach and duodenum (K29-K31)	Helicobacter pylori infection

Austrian Society of Gastroenterology and Hepatology			
Develop new capacities to reduce burden	Immunology	All diseases of the digestive system (K20-K93)	Microbiome, mucosal immunology, gut-liver-axis
Improve performance of existing capacities to reduce burden	Drug therapy	Other diseases of liver (K71-K77)	Disease-modifying therapies for chronic liver diseases
Improve performance of existing capacities to reduce burden	Pathology and physiopathology	Other diseases of liver (K71-K77)	Pathophysiology of chronic liver diseases
Azerbaijan Gastroenterology and Hepatology Association			
Assess burden of disease and its determinants	Epidemiology	Crohn's disease and ulcerative colitis (K50-K51)	Features of IBD in Azerbaijan
Assess burden of disease and its determinants	Epidemiology	Diseases of oesophagus (K20-K23)	The prevalence of GERD in Azerbaijan
Assess burden of disease and its determinants	Epidemiology	Viral hepatitis (B15-B19)	The prevalence of hepatitis B and D in Azerbaijan
Improve performance of existing capacities to reduce burden	Therapeutics (other) e.g. radiotherapy, rehabilitation	Other diseases of the digestive system (K90.1-K93)	Advanced endoscopic techniques in Azerbaijan
British Society of Gastroenterology			
Develop new capacities to reduce burden	Aetiology	Crohn's disease and ulcerative colitis (K50-K51)	Further the understanding of underlying causes of IBD
Develop new capacities to reduce burden	Aetiology	Irritable bowel syndrome (K58)	Improving understanding of IBS
Develop new capacities to reduce burden	Diagnosis	All diseases of the digestive system (K20-K93)	Early diagnostics/ Precision Medicine
Improve performance of existing capacities to reduce burden	Health care quality, access, and evaluation	Alcohol-related liver disease (K70)	Improving early diagnosis, treating alcohol dependence
Improve performance of existing capacities to reduce burden	Health care quality, access, and evaluation	Diseases of pancreas (K85-K86, K87.1)	Reduce significant variation in quality of care
Bulgarian Society of Gastroenterology			
Assess burden of disease and its determinants	Epidemiology	Irritable bowel syndrome (K58)	Young Gastroenterology Surveys and Research if IBS burden
Develop new capacities to reduce burden	Diagnosis	Crohn's disease and ulcerative colitis (K50-K51)	Red Flags with Fecal calprotectin as screening tools for IBD
Develop new capacities to reduce burden	Health care quality, access, and evaluation	Crohn's disease and ulcerative colitis (K50-K51)	ECCO UR-CARE initiative with creating National IBD registry
Improve performance of existing capacities to reduce burden	Therapeutics (other) e.g. radiotherapy, rehabilitation	All diseases of the digestive system (K20-K93)	Multicentral study for Quality indicators for EMR, ERCP, EUS
Improve performance of existing capacities to reduce burden	Virology	Viral hepatitis (B15-B19)	Eradicate HCV and follow-up patients for HCC after SVR

Czech Society of Gastroenterology			
Develop new capacities to reduce burden	Diagnosis	Malignant neoplasms of digestive organs (C15-C26)	Screening-Surveillance of pancreatic (biliary) malignancies
Develop new capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	Implementation of personalized treatment in IBD patients
Develop new capacities to reduce burden	Microbiology	All diseases of the digestive system (K20-K93)	Defining of a "healthy" microbiome, and its changes
Improve performance of existing capacities to reduce burden	Health care quality, access, and evaluation	All diseases of the digestive system (K20-K93)	Guidelines and quality indicators in gastroenterology
Improve performance of existing capacities to reduce burden	Information science	Malignant neoplasms of digestive organs (C15-C26)	Hi-tech endoscopic imaging and artificial intelligence
Egyptian Association for Research and Training in Hepato-Gastroenterology			
Assess burden of disease and its determinants	Drug therapy	Viral hepatitis (B15-B19)	Analyzing the large program for managing viral hepatitis
Assess burden of disease and its determinants	Epidemiology	Crohn's disease and ulcerative colitis (K50-K51)	Characteristics of IBD in Egypt
Improve performance of existing capacities to reduce burden	Drug therapy	Gastritis, dyspepsia and other diseases of stomach and duodenum (K29-K31)	H. Pylori infection
Georgian National Society of Gastroenterology and Hepatology			
Assess burden of disease and its determinants	Metabolism	Other diseases of liver (K71-K77)	Our Society is interested in scientific-clinical research
Improve performance of existing capacities to reduce burden	Diagnosis	Crohn's disease and ulcerative colitis (K50-K51)	Our Society is interested in microbiota during IBD
German Society of Gastroenterology (DGVS)			
Develop new capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	Challenge: therapy management based on biomarkers
Develop new capacities to reduce burden	Pathology and physiopathology	Diseases of pancreas (K85-K86, K87.1)	Basic research guiding novel therapies for inflamm. & cancer
Develop new capacities to reduce burden	Prevention and control	Malignant neoplasms of digestive organs (C15-C26)	Based on new immunologic / metabolic mechanisms
Develop new capacities to reduce burden	Prevention and control	Other diseases of liver (K71-K77)	Risk assessment and screening
Improve performance of existing capacities to reduce burden	Diet therapy	Irritable bowel syndrome (K58)	Neurogastroenterology from basic to clinic
Hellenic Society of Gastroenterology			
Assess burden of disease and its determinants	Drug therapy	Gastritis, dyspepsia and other diseases of stomach and duodenum (K29-K31)	H, pylori eradication schemes
Improve performance of existing capacities to reduce burden	Surgical procedures, operative	Other diseases of the digestive system (K90.1-K93)	Sedation in endoscopy

Israeli Association of Gastroenterology and Hepatology			
Assess burden of disease and its determinants	Prevention and control	Malignant neoplasms of digestive organs (C15-C26)	High burden, unmet need
Develop new capacities to reduce burden	Drug therapy	Other diseases of liver (K71-K77)	NAFLD and obesity - high impact
Improve performance of existing capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	high incidence in Israel
Improve performance of existing capacities to reduce burden	Embryology	Irritable bowel syndrome (K58)	economic burden. need to improve treatment options
Kosovo Association of Gastroenterologist			
Assess burden of disease and its determinants	Prevention and control	All diseases of the digestive system (K20-K93)	cancer prevention and screening
Lithuanian Society of Gastroenterology			
Develop new capacities to reduce burden	Genetics	Crohn's disease and ulcerative colitis (K50-K51)	Genetic variant/exome sequencing in IBD, microscopic colitis
Develop new capacities to reduce burden	Genetics	Malignant neoplasms of digestive organs (C15-C26)	Genetics of GI cancer including exome sequencing, cfDNA, etc
Develop new capacities to reduce burden	Microbiology	Crohn's disease and ulcerative colitis (K50-K51)	Metagenome analysis/microbiome modification/FMT
Develop new capacities to reduce burden	Microbiology	Malignant neoplasms of digestive organs (C15-C26)	Microbiome studies in GI studies
Macedonian Society of Gastroenterohepatology			
Develop new capacities to reduce burden	Diagnosis	All diseases of the digestive system (K20-K93)	improving diagnostic procedures
Improve performance of existing capacities to reduce burden	Drug therapy	All diseases of the digestive system (K20-K93)	access to latest medical treatments
NVGE/NVMDL (Netherlands)			
Develop new capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	Treatment strategies in inflammatory bowel disease
Develop new capacities to reduce burden	Therapeutics (other) e.g. radiotherapy, rehabilitation	Diseases of pancreas (K85-K86, K87.1)	Diagnosis and treatment of acute and chronic pancreatitis
Develop new capacities to reduce burden	Therapeutics (other) e.g. radiotherapy, rehabilitation	Malignant neoplasms of digestive organs (C15-C26)	Detection and minimal-invasive treatment of T1CRC
Improve performance of existing capacities to reduce burden	Pathology and physiopathology	Irritable bowel syndrome (K58)	Understanding and treating neurogastro-disorders
Improve performance of existing capacities to reduce burden	Prevention and control	Malignant neoplasms of digestive organs (C15-C26)	Colonic polyp detection and treatment strategies
Norwegian Gastroenterology Society			
Assess burden of disease and its determinants	Epidemiology	All diseases of the digestive system (K20-K93)	Population-based cohort studies, common digestive diseases

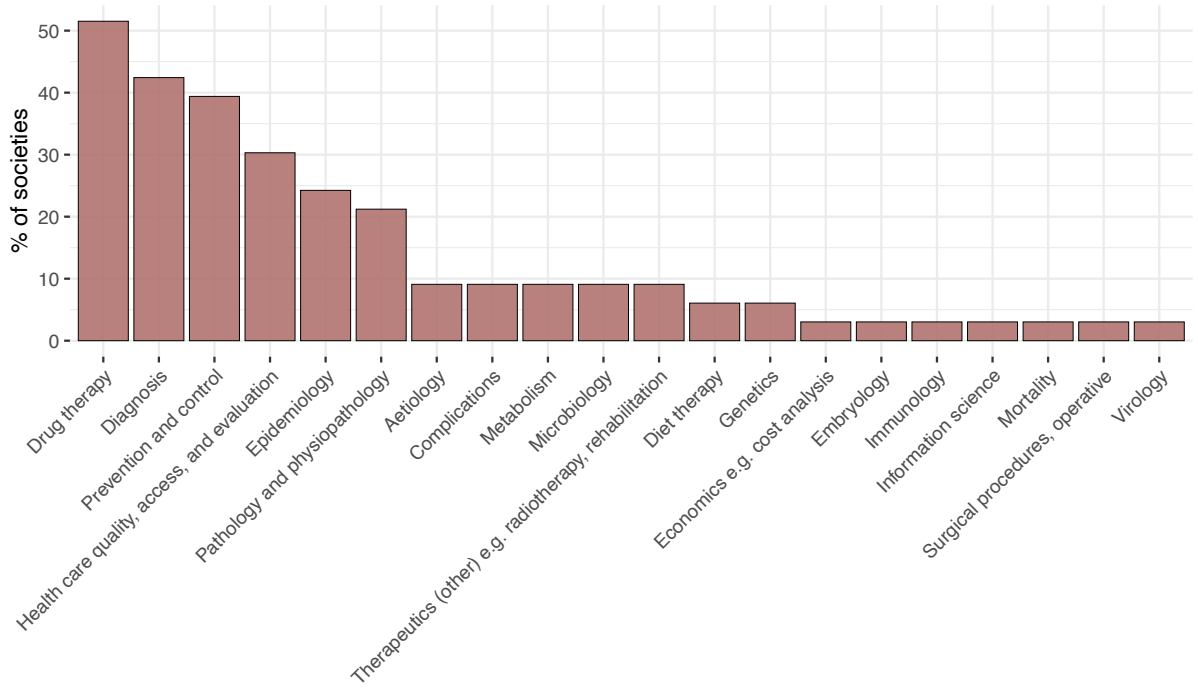
Assess burden of disease and its determinants	Epidemiology	Crohn's disease and ulcerative colitis (K50-K51)	Prospective population-based IBD cohort
Develop new capacities to reduce burden	Diagnosis	Other diseases of gallbladder and biliary tract (K81-K83, K87.0)	Primary sclerosing cholangitis, cholangiocarcinoma
Develop new capacities to reduce burden	Health care quality, access, and evaluation	Irritable bowel syndrome (K58)	Patient and healthcare education
Improve performance of existing capacities to reduce burden	Metabolism	Not applicable	Metabolic implications of bariatric therapy
Polish Society of Gastroenterology			
Improve performance of existing capacities to reduce burden	Diagnosis	All diseases of the digestive system (K20-K93)	The conducted research concerns endoscopy in the prevention
Portuguese Society of Gastroenterology			
Assess burden of disease and its determinants	Epidemiology	Diseases of pancreas (K85-K86, K87.1)	Pancreatic cancer is increasing
Assess burden of disease and its determinants	Mortality	Viral hepatitis (B15-B19)	Screening of HCV and HBV
Improve performance of existing capacities to reduce burden	Diagnosis	Malignant neoplasms of digestive organs (C15-C26)	The burden of digestive cancers, has been one top priority
Romanian Society of Gastroenterology and Hepatology			
Assess burden of disease and its determinants	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	personalized medicine, artificial intelligence
Assess burden of disease and its determinants	Health care quality, access, and evaluation	All diseases of the digestive system (K20-K93)	artificial intelligence, primary prevention-screening
Assess burden of disease and its determinants	Health care quality, access, and evaluation	Other diseases of the digestive system (K90.1-K93)	neurogastroenterology, microbiotics, fecal transplantation
Develop new capacities to reduce burden	Prevention and control	Diseases of pancreas (K85-K86, K87.1)	diagnosis/genetics/prevention and control
Improve performance of existing capacities to reduce burden	Genetics	Malignant neoplasms of digestive organs (C15-C26)	biomarkers/genomics/ personalized medicine /prevention /control
SAHGEED (Algeria)			
Assess burden of disease and its determinants	Aetiology	Other diseases of liver (K71-K77)	Budd Chiari Syndrome , Aetiological workup
Assess burden of disease and its determinants	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	Anti TNF alpha therapy with biosimilars
Assess burden of disease and its determinants	Drug therapy	Other diseases of liver (K71-K77)	Efficacy of generics in Hep C
SIGE/AIGO (Italy)			
Assess burden of disease and its determinants	Economics e.g. cost analysis	All diseases of the digestive system (K20-K93)	Digestive diseases are under diagnosed and underweighted
Develop new capacities to reduce burden	Drug therapy	Other diseases of liver (K71-K77)	NAFLD/NASH is expected to become the main liver disorder

Develop new capacities to reduce burden	Pathology and physiopathology	Irritable bowel syndrome (K58)	IBS has a huge burden in European healthcare systems
Develop new capacities to reduce burden	Prevention and control	Malignant neoplasms of digestive organs (C15-C26)	Digestive cancers are increasing in incidence
Improve performance of existing capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	IBD is increasing, especially in young people
SMMAD (Morocco)			
Improve performance of existing capacities to reduce burden	Epidemiology	Viral hepatitis (B15-B19)	Hepatitis b and c
SNFGE (France)			
Develop new capacities to reduce burden	Pathology and physiopathology	Diseases of pancreas (K85-K86, K87.1)	Pancreatic cancer; biomarkers; risk factors
Develop new capacities to reduce burden	Pathology and physiopathology	Malignant neoplasms of digestive organs (C15-C26)	Liver cancer: Biomarkers, Molecular tools, Genetic, Immunology
Develop new capacities to reduce burden	Pathology and physiopathology	Other diseases of liver (K71-K77)	Non alcoholic steatohepatitis - Non invasive diagnosis
Improve performance of existing capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	Therapeutic strategies including microbiota products
Improve performance of existing capacities to reduce burden	Prevention and control	Malignant neoplasms of digestive organs (C15-C26)	colon cancer screening
Slovenská Gastroenterologická Spoločnosť			
Develop new capacities to reduce burden	Aetiology	Crohn's disease and ulcerative colitis (K50-K51)	Still an unmet need necessary for a breakthrough in therapy
Develop new capacities to reduce burden	Aetiology	Diseases of pancreas (K85-K86, K87.1)	unmet need in improving the incidence and burden of disease
Develop new capacities to reduce burden	Diagnosis	Malignant neoplasms of digestive organs (C15-C26)	major unmet need to reduce the burden
Develop new capacities to reduce burden	Prevention and control	Alcohol-related liver disease (K70)	major cause of premature death in the country
Improve performance of existing capacities to reduce burden	Health care quality, access, and evaluation	Malignant neoplasms of digestive organs (C15-C26)	major cause of death, and still ineffective health-care
Suomen Gastroenterologiayhdistys			
Improve performance of existing capacities to reduce burden	Diagnosis	Diseases of pancreas (K85-K86, K87.1)	Diagnosis, follow-up and treatment of pancreatic disorders
Improve performance of existing capacities to reduce burden	Diagnosis	Other diseases of liver (K71-K77)	Diagnosis, follow-up and treatment of autoimmune liver disease
Swedish Society of Gastroenterology			
Assess burden of disease and its determinants	Diagnosis	All diseases of the digestive system (K20-K93)	-
Assess burden of disease and its determinants	Health care quality, access, and evaluation	All diseases of the digestive system (K20-K93)	-

Develop new capacities to reduce burden	Prevention and control	Other diseases of liver (K71-K77)	-
Improve performance of existing capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	-
Improve performance of existing capacities to reduce burden	Health care quality, access, and evaluation	Crohn's disease and ulcerative colitis (K50-K51)	-
Swiss society of Gastroenterology			
Improve performance of existing capacities to reduce burden	Health care quality, access, and evaluation	Not applicable	expert opinion statements, structure of training
Turkish Society of Gastroenterology			
Assess burden of disease and its determinants	Epidemiology	Crohn's disease and ulcerative colitis (K50-K51)	Epidemiological study National IBD prevalence and incidence
Assess burden of disease and its determinants	Pathology and physiopathology	Diseases of pancreas (K85-K86, K87.1)	Pancreatic steatosis and metabolic syndrome
Develop new capacities to reduce burden	Diagnosis	Diseases of oesophagus (K20-K23)	HRM, different catheters, normal and cut off values
Develop new capacities to reduce burden	Diagnosis	Malignant neoplasms of digestive organs (C15-C26)	Colorectal carcinoma screening programmes
Improve performance of existing capacities to reduce burden	Complications	Diseases of pancreas (K85-K86, K87.1)	Acute pancreatitis: epidemiology, clinic and management
Ukrainian Gastroenterological Association			
Improve performance of existing capacities to reduce burden	Diet therapy	All diseases of the digestive system (K20-K93)	Nutrition should have more impact in prevention/ treatment
Improve performance of existing capacities to reduce burden	Drug therapy	Irritable bowel syndrome (K58)	IBS dominated in practice and hasn't effective treatment
Improve performance of existing capacities to reduce burden	Drug therapy	Other diseases of liver (K71-K77)	High prevalence of NAFLD and limited treatment's options
Improve performance of existing capacities to reduce burden	Microbiology	Crohn's disease and ulcerative colitis (K50-K51)	Microbiome - one of most important targets for interventions
Improve performance of existing capacities to reduce burden	Prevention and control	All diseases of the digestive system (K20-K93)	Absence of prevention strategy in European gastroenterology
VVGE and SRBGE (Belgium)			
Develop new capacities to reduce burden	Diagnosis	Other diseases of liver (K71-K77)	Development and implementation of precision medicine
Develop new capacities to reduce burden	Drug therapy	Crohn's disease and ulcerative colitis (K50-K51)	new treatments, nutrition and extraintestinal manifestations
Develop new capacities to reduce burden	Drug therapy	Malignant neoplasms of digestive organs (C15-C26)	Personalised treatments in digestive oncology
Develop new capacities to reduce burden	Pathology and physiopathology	Irritable bowel syndrome (K58)	Development of neurogastroenterology
Improve performance of existing capacities to reduce burden	Complications	Other diseases of liver (K71-K77)	improving outcome in NASH, liver transplantation, ...

Figure 17.

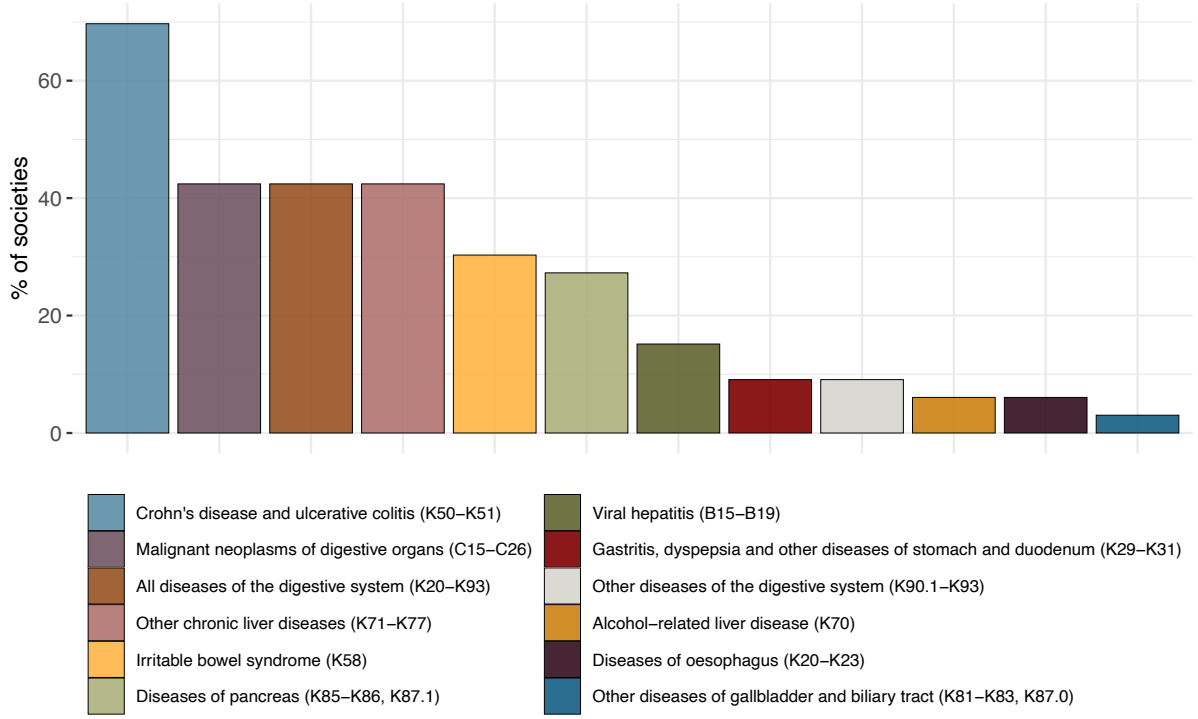
Proportion of societies that prioritised each major research topic



Source: authors' compilation using survey data from UEG national society members.

Figure 18.

Proportion of societies that prioritised each disease category



Source: authors' compilation using survey data from UEG national society members.

Results: Distribution of research activity in the field of digestive health

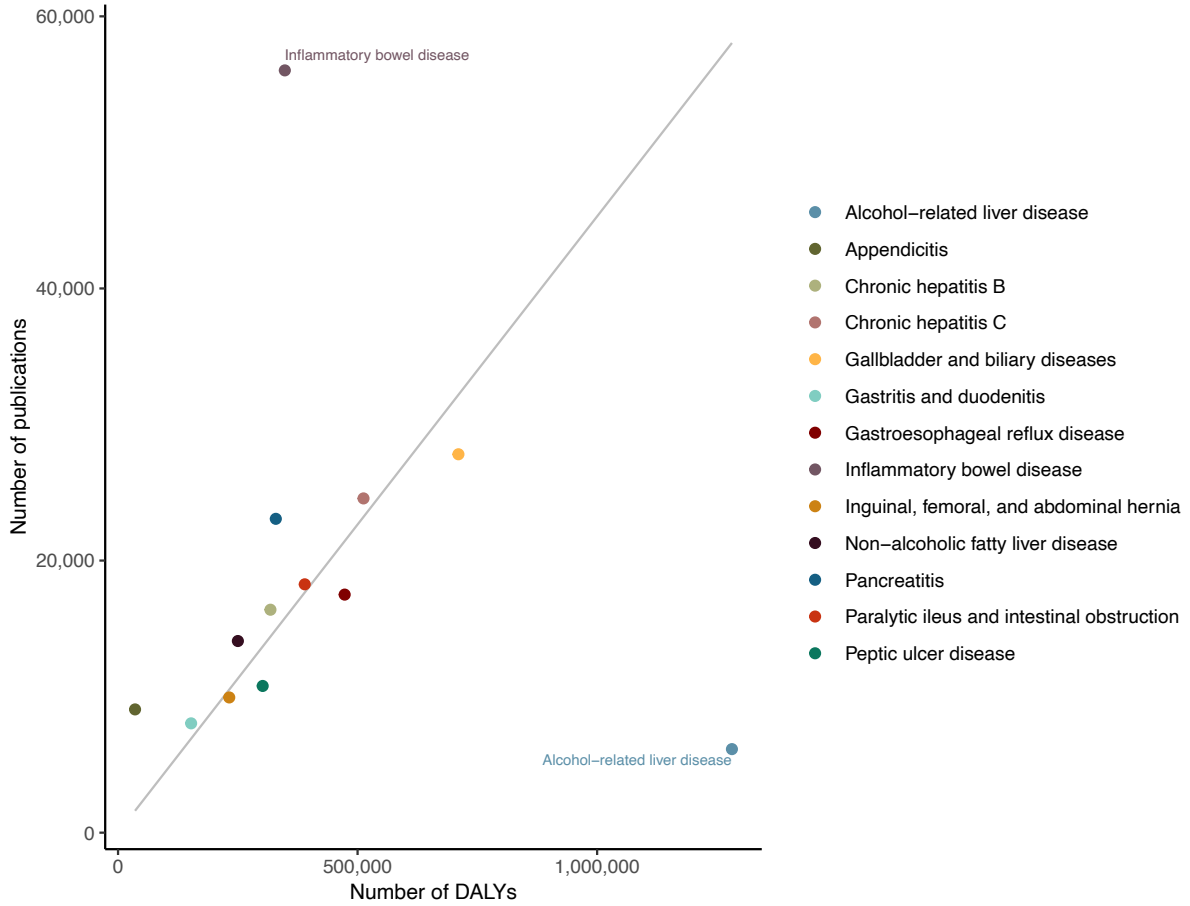
Table 5. MEDLINE database search results showing number of digestive disorder related academic journal publications by research topic and disorder

	Hits from 2000, in academic journals	*Hits from 2000, in academic journals, with human study filter*
Research topic		
Aetiology	140632	130525
Chemically induced	35869	20408
Complications	143706	139643
Congenital	2612	2508
Diagnosis/Diagnostic imaging	254727	249559
Diet therapy	6188	5640
Drug therapy	173530	156951
Economics	6155	6094
Embryology	569	433
Enzymology	18295	14845
Epidemiology	100697	97295
Ethnology	5555	5551
Genetics	124335	115297
Health care quality, access, and evaluation	43616	43408
History	1799	1789
Immunology	53190	44144
Information science	21005	20416
Metabolism	121552	98175
Microbiology	35259	31113
Mortality	65149	64092
Nursing	2228	2228
Parasitology	10095	6035
Pathology/Physiopathology	336772	300784
Prevention and control	52775	39761
Psychology	12238	12089
Surgery	196805	194020
Therapy/Radiotherapy/Rehabilitation	124987	120382
Virology	40159	38262
Digestive disorders		
Colon and rectum neoplasms	153938	148401
Gallbladder and biliary tract neoplasms	19460	19242
Liver neoplasms	121193	113060
Oesophageal neoplasms	35139	34772
Pancreatic neoplasms	56941	54637
Stomach neoplasms	60216	59245
Chronic liver diseases	142134	123125

Alcohol-related liver disease	7284	6141
Chronic hepatitis B	16565	16386
Chronic hepatitis C	24637	24567
Non-alcoholic fatty liver disease	17238	14086
Appendicitis	9085	9059
Coeliac disease	11542	11469
Dyspepsia	4820	4710
Eosinophilic oesophagitis	2004	1985
Gallbladder and biliary diseases	29865	27812
Gastritis and duodenitis	8908	8035
Gastroesophageal reflux disease	17856	17498
Inflammatory bowel disease	59091	56027
Inguinal, femoral, and abdominal hernia	10205	9938
Irritable bowel syndrome	8115	7731
Pancreatitis	26458	23067
Paralytic ileus and intestinal obstruction	19203	18254
Peptic ulcer disease	13728	10783

Figure 19.

Relationship between the number of digestive disease related academic journal publications and disease burden in the European Union (measured as Disability–Adjusted Life Years)



Source: authors' compilation using data extracted from MEDLINE and GBD 2019 databases.
The grey line represents the number of publications that would be expected if publication output was proportional to disease burden.

Results: European Commission funding for digestive disease research within Horizon 2020

Table 6. Horizon 2020 funded digestive disease related research projects categorised by disease

Project title	*European Commission funding (Euros)*	*Digestive disease category*	*Digestive disease sub-category*
GALAXY: Gut-and-liver axis in alcoholic liver fibrosis	6305654	Chronic liver diseases	Alcohol-related liver disease
3D Liver Organoids: Modelling Host Hepatitis B Virus Interaction	172800	Chronic liver diseases	Chronic hepatitis B
HBV GenetIc and Proteomic Screen	185076	Chronic liver diseases	Chronic hepatitis B
IL-2 gene therapy for chronic hepatitis B virus infection	150000	Chronic liver diseases	Chronic hepatitis B
Immune profiling to guide host-directed interventions to cure HBV infections	9983029	Chronic liver diseases	Chronic hepatitis B
Investigating the structural role of the Hepatitis B virus core protein C-terminal domain in assembly and maturation using solid-state NMR	143603.35	Chronic liver diseases	Chronic hepatitis B
THERVACB: A Therapeutic Vaccine to Cure Hepatitis B	10425686.25	Chronic liver diseases	Chronic hepatitis B
Crosstalk of Metabolism and Inflammation	1701011	Chronic liver diseases	Chronic hepatitis B and Chronic hepatitis C
Innate immune responses to human hepatotropic viral infections	1498312	Chronic liver diseases	Chronic hepatitis B and Chronic hepatitis C
Cell circuits as targets and biomarkers for liver disease and cancer prevention	2305000	Chronic liver diseases	Chronic hepatitis C
A novel pharmaceutical treatment for nonalcoholic fatty liver disease	150000	Chronic liver diseases	Non-alcoholic fatty liver disease
A potent Micro-RNA therapeutic for nonalcoholic fatty liver disease (NAFLD)	149800	Chronic liver diseases	Non-alcoholic fatty liver disease
A scientifically proven, safe, naturally derived drug for the effective treatment of liver damage - an innovative solution for a significant unmet medical need	50000	Chronic liver diseases	Non-alcoholic fatty liver disease
Bile acid, immune-metabolism, lipid and glucose homeostasis	2500000	Chronic liver diseases	Non-alcoholic fatty liver disease
Bioenergetic Remodeling in the Pathophysiology and Treatment of Non-Alcoholic Fatty Liver Disease	3202195.68	Chronic liver diseases	Non-alcoholic fatty liver disease
Cellular and molecular mechanisms of metabolic immune activation triggering non-alcoholic steatohepatitis (NASH) and HCC	1995860	Chronic liver diseases	Non-alcoholic fatty liver disease
Clinical evaluation of carbons of controlled porosity as a new therapeutic for the treatment of liver cirrhosis and non-alcoholic fatty liver disease.	5913079.75	Chronic liver diseases	Non-alcoholic fatty liver disease

creTRAP for in situ Characterization of Fibrosis-Promoting Pathways in Non-alcoholic Fatty Liver Disease	212194.8	Chronic liver diseases	Non-alcoholic fatty liver disease
Decisions in metabolic inflammation of the liver: Adhesive interactions involved in leukocyte retention and resolution of inflammation in metabolic-inflammatory liver disease	1953250	Chronic liver diseases	Non-alcoholic fatty liver disease
Discovery and characterization of food bioactive compounds modulating the Pentose Phosphate Pathway against non-alcoholic fatty liver disease.	172932.48	Chronic liver diseases	Non-alcoholic fatty liver disease
Elucidating Dendritic Cell Heterogeneity and Functions in Metabolic Associated Fatty Liver Disease	166320	Chronic liver diseases	Non-alcoholic fatty liver disease
Elucidating Pathways of Steatohepatitis	5985521	Chronic liver diseases	Non-alcoholic fatty liver disease
Epigenetic Regulation of Inflammation in NAFLD	157845.6	Chronic liver diseases	Non-alcoholic fatty liver disease
EU Training Network in understanding the molecular regulation and the role of endo-lysosomal processes in cardio-metabolic diseases	4074589.44	Chronic liver diseases	Non-alcoholic fatty liver disease
Exercise as a regulator of hepatic NAD metabolism and MItochondrial function in Non-Alcoholic fatty liver disease	146591.1	Chronic liver diseases	Non-alcoholic fatty liver disease
Fatty liver Nano-/Antibody Therapy - (FAITH)	150000	Chronic liver diseases	Non-alcoholic fatty liver disease
How cellular suicide programmes control phase transitions in fatty liver disease and liver cancer	1997840	Chronic liver diseases	Non-alcoholic fatty liver disease
Liver Investigation: Testing Marker Utility in Steatohepatitis	15797881	Chronic liver diseases	Non-alcoholic fatty liver disease
Maternal Enteric Microbiota for Offspring's Repertoire development and Illness Susceptibility	187419.6	Chronic liver diseases	Non-alcoholic fatty liver disease
Mechanisms of cellular fatty acid homeostasis	265059	Chronic liver diseases	Non-alcoholic fatty liver disease
Methyl Donating artificial organelles to support liver cells in Non-alcoholic fatty liver disease	219312	Chronic liver diseases	Non-alcoholic fatty liver disease
Mimicking liver disease and regeneration in vitro for drug development and liver transplantation	2413449	Chronic liver diseases	Non-alcoholic fatty liver disease
mitoFOIE GRAS: Non-invasive Profiling of Mitochondrial Function in Non-Alcoholic Fatty Liver Disease	454500	Chronic liver diseases	Non-alcoholic fatty liver disease
Non Invasive Diagnostic Test Service For “Non Alcoholic Fatty Liver Disease” Management	50000	Chronic liver diseases	Non-alcoholic fatty liver disease
Revealing the contribution of liver macrophage populations to NASH in insulin resistance	1999781	Chronic liver diseases	Non-alcoholic fatty liver disease
Study the functions of the hepatic sympathetic nerve and the receptor Adrb3 in liver-mediated adaptive thermogenesis.	203149.44	Chronic liver diseases	Non-alcoholic fatty liver disease
The Role of OSTα/β as a Bile Acid and Drug Transporter in Obesity-Associated Chronic Liver Disease, Nonalcoholic Fatty Liver Disease	179325.6	Chronic liver diseases	Non-alcoholic fatty liver disease

Unmasking insulin resistance triggering mechanisms using microphysiological two-organ systems as in vitro disease models of metabolic syndrome and non-alcoholic fatty liver disease	162806.4	Chronic liver diseases	Non-alcoholic fatty liver disease
Unravelling the heterogeneity and functions of hepatic myeloid cells in Non-Alcoholic Fatty Liver Disease	1500000	Chronic liver diseases	Non-alcoholic fatty liver disease
Using Bariatric Surgery to Discover Weight-Loss Independent Mechanisms Leading to the Reversal of Fatty Liver Disease	1499354	Chronic liver diseases	Non-alcoholic fatty liver disease
Validation and Molecular Characterization of Novel Glucagon-Thyroid Hormone Conjugates for the Efficient Management of Dyslipidemia and Fatty Liver Disease	171460.8	Chronic liver diseases	Non-alcoholic fatty liver disease
Validation of a novel class of cyclophilin inhibitors for the treatment of non-alcoholic steatohepatitis	150000	Chronic liver diseases	Non-alcoholic fatty liver disease
Beating Goliath: Generation of Novel, Integrated and Internationally Harmonised Approaches for Testing Metabolism Disrupting Compounds	6761833.75	Chronic liver diseases	
Characterization of Key Epigenetic Targets in Hepatic Fibrosis and Hepatocellular Carcinoma Development. Generation of New Antifibrotic and Antitumoral Drugs.	170121.6	Chronic liver diseases	
Controlled Organoids transplantation as enabler for regenerative medicine translation	6301156.25	Chronic liver diseases	
Decompensated Cirrhosis: Identification of New Combinatorial Therapies Based on Systems Approaches	6000000	Chronic liver diseases	
Development of a cell-based system for high-throughput screening of antifibrotics	195454.8	Chronic liver diseases	
Development of DIALIVE, a novel Liver Dialysis Device for the treatment of patients with Acute on Chronic Liver Failure (ACLF)	6478737.5	Chronic liver diseases	
Diagnosis and Exclusion of Drug-Induced Liver Injury by using Patient Blood Samples (DILITEST)	50000	Chronic liver diseases	
Engineering the 3D Niche to enHANCE functionality of hepatocytes derived from human iPSCs	183454.8	Chronic liver diseases	
Ex vivo Re-vascularization in Porcine Liver Bioengineering - A Critical First Step Towards Effective Transplantation of Bioengineered Livers	158121.6	Chronic liver diseases	
Hepatocytes-Like Microreactors for Liver Tissue Engineering	1992289	Chronic liver diseases	
Integrated Tissue Slice Culture and NMR Metabolomics – A Novel Approach Towards Systemic Understanding of Liver Function and Disease	3138432.5	Chronic liver diseases	
Live, In vivo Visualisation of liver Regeneration in Zebrafish After Photoablation of hepatocytes	200194.8	Chronic liver diseases	
MICROBiome-based biomarkers to PREDICT decompensation of liver cirrhosis and treatment response	15000000	Chronic liver diseases	
Mucus-Penetrating Microbiota: Characterization, Mechanism and Therapeutic in Metabolic Disease	1850000	Chronic liver diseases	
Non-Invasive Quantitative Magnetic Resonance for Obese Children – the Paediatric LiverMultiScan Test	50000	Chronic liver diseases	
Non-invasive rapid assessment of chronic liver disease using Magnetic Resonance Imaging with LiverMultiScan	3460486.5	Chronic liver diseases	
Novel Treatment of Acute On Chronic Liver Failure Using Synergistic Action of G-CSF and TAK-242	5999999	Chronic liver diseases	
Pannexin1 nanobodies for the clinical treatment of liver disease	150000	Chronic liver diseases	
Production of next generation modulators of pannexins and connexins as novel therapeutics in the treatment of inflammatory cardiovascular, hepatic and joint diseases	3503628.75	Chronic liver diseases	
Regeneration and zonation by ZEB2 of Liver Endothelium	160800	Chronic liver diseases	
Screening for liver fibrosis - population-based study across European countries	5996481.25	Chronic liver diseases	

Simvastatin And Rifaximin as New Therapy For Patients With Decompensated Cirrhosis	5998800	Chronic liver diseases	
Targeted strategies for prevention and treatment of fibrosis-associated liver cancer	2430000	Chronic liver diseases	
Targeting ubiquitin processing in cancer and fibrosis: novel probes for the Ubiquitin Carboxy-Terminal Hydrolases	224933.76	Chronic liver diseases	
The HepaRG-Bio-Artificial Liver: Feasibility of commercialization and expansion of business plan	50000	Chronic liver diseases	
The N-IF mouse – a new and unique fibrosis model for preclinical efficacy studies	50000	Chronic liver diseases	
Tracking the Dynamics of Human Metabolism using Spectroscopy-Integrated Liver-on-Chip Microdevices	2118175	Chronic liver diseases	
Treatment of liver disease and cancer prevention	150000	Chronic liver diseases	
Understanding the Biology of Human Enteroendocrine Cells	2733150	Chronic liver diseases	
Development of New therapies against cholangiopathies	2499111	Chronic liver diseases and Gallbladder and biliary diseases	
Perivascular cells at the crossroads of inflammation, regeneration and fibrosis	1976100	Chronic liver diseases and Inflammatory bowel disease	
A Revolutionary, Safe and Cost-effective Industrial Process for Gluten Detoxification in Cereals	1265192	Coeliac disease	
A study for the technical and business feasibility of a fast-acting consumer test to detect gluten and other contaminants in food.	50000	Coeliac disease	
Human Exposomic Determinants of Immune Mediated Diseases	11992338.74	Coeliac disease	
Improving Gluten-Free Flours Functionality by MW Treatments; A Tool for High Quality of Gluten-Free Bakery (Physical, Sensorial and Nutritional)	170121.6	Coeliac disease	
Leveraging a novel platform technology to develop a first-in-class immunotherapy for Celiac Disease	50000	Coeliac disease	
Smart Technologies for personAlised Nutrition and Consumer Engagement	6393914	Coeliac disease	
Therapeutic potential of recombinant antibodies to neutralize immunogenic peptides in celiac disease	160932.48	Coeliac disease	
Using a blood cell-based approach to determine gluten responsiveness and to bring a novel, less invasive assay on the market to diagnose celiac disease.	130062.5	Coeliac disease	
The Role of Mucins and Mucus in the Diseases Cystic Fibrosis, Celiac Disease, and Ulcerative Colitis	2500000	Coeliac disease and Inflammatory bowel disease	
A novel drug candidate for the treatment of Eosinophilic Esophagitis - an innovative solution for a significant unmet medical need	50000	Eosinophilic oesophagitis	
Characterization of the Human Gallbladder Microbiome	187866	Gallbladder and biliary diseases	
Recurrent disease in the liver transplant: window to identify and stop gut signals driving autoimmunity	1500000	Gallbladder and biliary diseases	
The first multiple stent delivery system for the treatment of biliary, pancreatic and urologic strictures and stenosis	50000	Gallbladder and biliary diseases	
A minimally invasive, outpatient treatment for Gastroesophageal Reflux Disease (GERD), resulting in permanent relief from both GERD symptoms and life-long drug dependency	50000	Gastroesophageal reflux disease	
A novel ulcerative colitis treatment - A phase III ready feasibility study	50000	Inflammatory bowel disease	

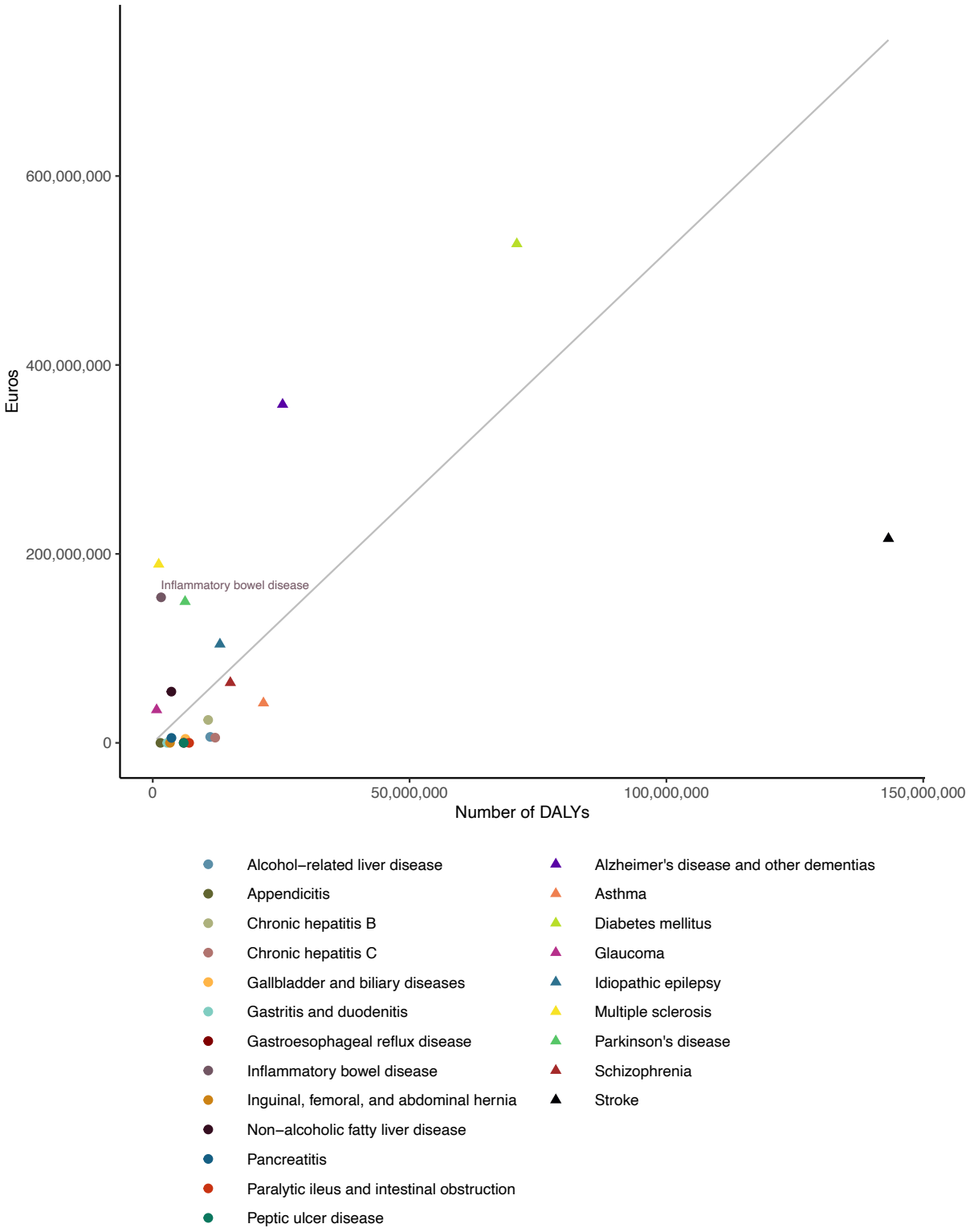
A powerful and efficient tissue regeneration method for reducing the anastomotic leakage rate in gastrointestinal surgery	2140775	Inflammatory bowel disease	
A Systems medicine approach to chronic inflammatory disease	14456236.25	Inflammatory bowel disease	
ALGAE4IBD –From Nature To Bedside- Algae Based Bio Compound For Prevention And Treatment Of Inflammation, Pain And IBD	7499517.25	Inflammatory bowel disease	
At the host-bacteria interface: Modulation of the intestinal microbiota and its metabolic activity by Card9 signalling in health and Inflammatory Bowel Diseases	185076	Inflammatory bowel disease	
Autonomous multimodal implantable endoscopic capsule for the gastrointestinal tract	3992860	Inflammatory bowel disease	
Better control and treatment of immune-mediated diseases by exploring the universe of microenvironment imposed tissue signatures and their correlates in liquid biopsies	15500000	Inflammatory bowel disease	
Bio-Inspired Tools for Glycoscience	1986356	Inflammatory bowel disease	
BIOlogical therapy CYCLEs towards tailored, needs-driven, safer and cost-effective management of Crohn's disease	5962096.88	Inflammatory bowel disease	
Cell-cell interactions critical to ILC3 function in the human gut	173857.2	Inflammatory bowel disease	
Cellular cartography of the intestine in health and inflammation	187572.48	Inflammatory bowel disease	
Characterizing Microbe-specific Immune Responses in the pathogenesis of Autoimmunity	173857.2	Inflammatory bowel disease	
Circular DNA in diagnosis and disease models	3998822.5	Inflammatory bowel disease	
Decision On Optimal Combinatorial Therapies in IMIDS Using Systems Approaches	6260050	Inflammatory bowel disease	
Defining the role of FBXW7 in intestinal epithelium regeneration	207312	Inflammatory bowel disease	
Disruptive fluorescent technologies for inflammatory bowel diseases	150000	Inflammatory bowel disease	
Dissecting the molecular mechanisms underlying YAP activation in intestinal tissue repair	207312	Inflammatory bowel disease	
Elucidating the role of liver resident Kupffer cells in the regulation of the immune responses to intestinal antigens	160800	Inflammatory bowel disease	
Enhancing Ultrasound and PHOtoacoustics for Recognition of Intestinal Abnormalities	2314315.13	Inflammatory bowel disease	
EUbOPEN: Enabling and Unlocking biology in the OPEN	27935000	Inflammatory bowel disease	
Exploiting the pathophysiology of the gut towards innovative oral peptide delivery strategies	1488937.5	Inflammatory bowel disease	
Extracellular vesicle production and engineering by turbulence for fistula therapy in thermoreversible hydrogels	1496094	Inflammatory bowel disease	
Fecal miRNAs, new mediators of host-microbiota interaction in Inflammatory Bowel Disease	196707.84	Inflammatory bowel disease	
Foetal Intestinal Stem Cells in Biology and Health	2000000	Inflammatory bowel disease	
Function of long non-coding RNA in Crohn Disease Ulcer Pathogenesis	1500000	Inflammatory bowel disease	
Functional characterization of specialized metabolites from gut microbiomes	174806.4	Inflammatory bowel disease	
Functional role of Epithelial–to–Mesenchymal Transition in the pathogenesis of Inflammatory Bowel Disease	171473.28	Inflammatory bowel disease	
GAIA-Health: microbiome suite for personalized medicine	50000	Inflammatory bowel disease	

Genome-wide CRISPR/Cas9 screen in intestinal organoids for identification and molecular characterization of therapeutic targets to enhance tissue regeneration	207312	Inflammatory bowel disease	
Gut microbiota-dependent tryptophan metabolism: role in disease pathogenesis and therapeutic target	1495525	Inflammatory bowel disease	
Harnessing Targeted Nanotheranostics to Reprogram Activated Leukocytes in Inflammatory Bowel Disease	2703125	Inflammatory bowel disease	
High-throughput and reproducible development of intestinal organoids by microfluidics encapsulation in synthetic niches for intestinal bowel disease research	257561.28	Inflammatory bowel disease	
Highly efficient and eco-innovative probiotic food supplement for antibiotic-associated disorders prevention	50000	Inflammatory bowel disease	
Identification and characterization of enteric nervous system stem cells	212933.76	Inflammatory bowel disease	
Identification of promoters and enhancers specific for inflammatory bowel disease and its subtypes	212194.8	Inflammatory bowel disease	
Identifying microbiotal triggers of inflammatory bowel disease through the lens of the immune system	2304375	Inflammatory bowel disease	
Impact of maternal Adrenomedullin on the Microbiome and Gut health: insights into preventing chronic intestinal disorders	184590.72	Inflammatory bowel disease	
Innovative technology solutions to explore effects of the microbiome on intestine and brain pathophysiology	1992578	Inflammatory bowel disease	
Investigating the regulation of iron homeostasis by erythroferrone and therapeutic applications	1499235	Inflammatory bowel disease	
Investigation of the role and mechanism of action of NOD2-mediated isoform selective PI3K signalling in gut immunity and inflammation	195454.8	Inflammatory bowel disease	
Mapping and modulating integrin mediated interactions	162806.4	Inflammatory bowel disease	
Microbial therapy against gut inflammation	147815.04	Inflammatory bowel disease	
Microbiota and immune responses at weaning predict the susceptibility to chronic inflammatory diseases in adulthood	1555650	Inflammatory bowel disease	
Modulation of intestinal barrier function and inflammation via butyrate-promoting dietary fibre	203852.16	Inflammatory bowel disease	
Molecular, morphological, and functional requirements for gastrointestinal serotonin release	207312	Inflammatory bowel disease	
Mucobiome-Mediated Immune Pathways in Inflammatory Bowel Diseases	166320	Inflammatory bowel disease	
Multifunctional polymeric film-based drug delivery system for oral anti-TNF-alpha-based inflammatory bowel disease therapy	172800	Inflammatory bowel disease	
Nanoengineered magnetoresponsive diagnosis and personalized treatment of pediatric inflammatory bowel disease	2000000	Inflammatory bowel disease	
Neuroimmune activation as a novel therapeutic approach for IBD	150000	Inflammatory bowel disease	
New siRNA Nanotherapy for Inflammatory Bowel Diseases, targeting Janus kinases	5999178.75	Inflammatory bowel disease	
Novel diagnostic and therapeutic approach to inflammatory bowel disease based on functional characterization of patients: the CrUCCial index	2494500	Inflammatory bowel disease	
Novel smart glyco-nanomaterials as targeted therapeutics.	195454.8	Inflammatory bowel disease	
Novel Target for Treatment of Chronic Inflammatory Diseases	2219688.63	Inflammatory bowel disease	
Obsidian Anastomotic SafeGuard – A powerful and efficient tissue sealant method for reducing the anastomotic leak rate in colorectal surgery	50000	Inflammatory bowel disease	
Paediatric Inflammatory Bowel Diseases Network for Safety, Efficacy, Treatment and Quality improvement of care	5996000	Inflammatory bowel disease	

PermeAbility - A non-invasive, side-effect-free diagnostic kit for intestinal disorders	50000	Inflammatory bowel disease	
PI3K delta role in dendritic cell antigen processing and presentation to control gut tolerance	212933.76	Inflammatory bowel disease	
Point of Care Diagnostic Test for the Differential Diagnosis of Inflammatory Bowel Disease	50000	Inflammatory bowel disease	
Quantitative T cell Immunology and Immunotherapy	3923652.96	Inflammatory bowel disease	
Regulation of lipid-mediated immunity in the intestine	195454.8	Inflammatory bowel disease	
Reprogramming of IELs at the intestinal epithelial barrier during virus infection	147463.68	Inflammatory bowel disease	
Scale-up of an Advanced Manufacturing process to produce a Pharmaceutical product Application (SAMPA).	1600000	Inflammatory bowel disease	
Single-cell analysis of intestinal lymphocytes reveals targets for treatment of inflammatory bowel disease	1500000	Inflammatory bowel disease	
Spatio-Temporal Regulation of Inflammation and Tissue Regeneration: Studying the immune system - tissue - microbiota communication to develop targeted therapies for immune-mediated diseases and cancer	1999687	Inflammatory bowel disease	
Super-resolution genomic mapping for the microbiome	149875	Inflammatory bowel disease	
The game changing drug in Crohn’s Disease : a unique standard of care for a healthy long-term remission	2501528.75	Inflammatory bowel disease	
The microbial degradation and utilization of mucin by Bacteroides in ulcerative colitis	247059	Inflammatory bowel disease	
The next generation epigenetic medicine for inflammation	1294785	Inflammatory bowel disease	
The role of microbial Oxylipins in the MIcrobe-hosT dialogue	196590.72	Inflammatory bowel disease	
Therapeutic antibody drug monitoring using bioluminescent sensors proteins and a smartphone	149750	Inflammatory bowel disease	
Transferring Activomics into the Clinical Setting	50000	Inflammatory bowel disease	
Uncovering Enteric GLIA-MACrophage communication in the intestinal homeostasis and inflammation	160800	Inflammatory bowel disease	
Novel therapeutic approaches to improve gastrointestinal wound healing	1487396	Inflammatory bowel disease and Irritable bowel syndrome	
Advanced manufacturing process to obtain a partially Bio-Resorbable Adhesive/Non-Adhesive Triple Layer Mesh for intra-peritoneal Hernia Containment	50000	Inguinal, femoral, and abdominal hernia	
Evidence-based probiotic for Chronic Fatigue Syndrome	50000	Irritable bowel syndrome	
Fermentation And behaviour of carbohydrates in the colon	183454.8	Irritable bowel syndrome	
Deciphering type 2 innate lymphoid cell/epithelial progenitor cell crosstalk in pancreas regeneration and neoplasia	224933.76	Pancreatitis	
Human Cell Atlas of the Pancreas	4962494.75	Pancreatitis	
The first effective remedy for acute pancreatitis disease	50000	Pancreatitis	

Figure 20.

Relationship between European Commission funding for Horizon 2020 research projects and global disease burden (measured as Disability–Adjusted Life Years)



Source: authors' compilation using data extracted from CORDIS and GBD 2019 databases.
The grey line represents the level of funding that would be expected if funding was proportional to disease burden.

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