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Fostering coherence in EU health research: Strengthening EU research for better health

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Fostering coherence in EU health research

Strengthening EU
research for better
health

STUDY

Panel for the Future of Science and Technology



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Fostering coherence in EU health research

Strengthening EU research for better health

The COVID-19 pandemic prompted reinforced investment in health research, supporting fast research and innovation for vaccine development and health care measures. The EU response highlighted strengths and weaknesses in the organisation and funding of EU research. Over time, EU investment in health research has aimed at increasing knowledge and transfer of knowledge into innovation for better health. To this end, several instruments have been developed, but their impact is hampered by fragmentation and lack of synergy between strategies at different levels. Inequalities in health and research across Member States need further measures. Policies could take inspiration from successful health research organisation and policies inside and outside of the EU, for more coherence and throughput to implementation. Health research needs strong leadership to engage in global health and to tackle the challenges of the interconnectedness of health with environmental and climate challenges, as well as durable economic development. Stakeholder involvement in a formal structure will ensure a permanent dialogue for fruitful research and development.

AUTHORS

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Executive summary

1. Introduction

The outbreak and subsequent pandemic of COVID-19 has challenged EU policies for health and has led to several new initiatives under a commitment towards a [European health union](#), strengthening EU preparedness and response during health crises. The COVID-19 experience has illustrated the key role of health research for developing the adequate public health and medical response, for treatment and management of patients and citizens.

Health research was the basis of information gathering on the presentation and course of the disease, of testing of therapies, and of the development of vaccines and new drugs. However successful the eventual outcomes may have been, COVID-19 highlighted several weaknesses in health research that appear to be systemic and inherent to the organisation and funding of health research in the EU. A common denominator in these weaknesses is fragmentation and lack of coherence. Specific examples are insufficient international collaboration to reach scale and power of clinical studies, as well as inequalities in participation in health research within the EU. Another concern is the position of the EU in comparison to the world.

The core question of the present study is therefore whether the organisation and support for health research in the EU is adequate and fit to face future challenges. These are not limited to preparedness for new epidemic disease, but include coping with chronic disease, climate and environment-related health problems, and demographic changes. We examine the structure and organisation of EU health research funding, participation across the EU, global competitiveness, and EU leadership and the barriers to translating research into better health. The results identify several mechanisms that could be addressed to increase coherence through funding synergies for scale, and through implementing coordination and leadership.

2. Methodology

We used publicly available data and documents from primary and secondary sources as well as commentaries and scientific analysis published in academic journals. Sources were the annual reports of funding bodies or national databases and documents produced by independent bodies supported by governmental funding. For data analysis and assessment of impact of strategic investment programmes we used scientometric tools.

We conducted interviews with experts in health research policies contributing views from different stakeholder perspectives. For the interview, experts were provided with the draft report as well as a set of guiding questions.

3. Results

Strategic health research funding through the EU framework programmes

The framework programmes (FPs), managed through European Commission Directorate-General for Research and Innovation (DG RTD), are the EU's largest research investment. A dedicated channel for collaborative projects in response to thematic calls is the largest instrument for health research funding, and holds approximately 10% of the total of successive FP budgets. Thematic priorities change over time, supported by analysis of funded projects in 2007-2020. Since 2013, biomedical research no longer has an important share. Clinical research for therapies saw a surge between 2012 and 2016, while research towards implementation and management subsequently becomes more prominent. Horizon Europe has novel accents, such as prevention and digital health. Since 2008, a growing portfolio of funding instruments supports public-private and public-public partnerships, although the main instrument for steering priorities remains the channel for collaborative research.

Outside the FP, the health programme supports research managed by European Commission Directorate-General for Health and Food Safety (DG SANTE). The formerly modest budget received a significant increase under the [EU4Health programme](#). The focus is on implementation research and research for policy. Notwithstanding a move towards co-direction and a common executive agency, funding remains under different DGs. Among the infrastructures in the [European Research Infrastructure Consortium](#) (ERIC), the most relevant is the [European Clinical Research Infrastructure Network](#) (ECRIN). The ECRIN ensures coordination and scaling up of clinical research capacity, but not all EU countries are active members.

This analysis shows the potential for FPs to steer funding towards priority areas on the one hand, and on the other hand, a lack of continuity that decreases coherence. Funding through different channels offers diversity but also complicates a comprehensive strategy for health research.

Inequalities between Member States in EU health research funding

The countries that formed the EU up to 2004 (referred to as the EU-15), generally have a much higher degree of participation in collaborative EU health research funding through the FPs than countries that joined the EU in 2004 (referred to as the EU-13). An analysis of the networks between countries confirms this EU-13 country position.

However, analysis of participation at the level of individual countries reveals changes over time and divergence between countries, among the EU-13 as well as the EU-15. Potential explanations point towards the impact of national health research investment and strategies, e.g. in health data and digital tools, or investment in hubs for innovation. Another indication of the importance of national strategies is participation in public-public partnerships, which is more balanced across Member States.

Participation in health research links to performance and capacity in the health care sector, given that hospitals and healthcare are the setting for clinical research and data collection. Hence, substantial differences in health care spending contribute to inequalities in research capacity. Funding through the [European Regional Development Fund](#) (ERDF) and investment in health care or research directly is part of the strategy of some EU-13 countries to increase capacity. Migration of the workforce from east and south to north within the EU for research and healthcare is intricately related to the challenges for building health research capacity and more equal participation. Voices from different countries confirm the importance of national strategies in reducing gaps in participation in health research.

Together, the data indicate that paying attention to national strategies, support for capacity building in healthcare and strengthening partnerships are options to increase inclusiveness.

Global competitiveness and leadership for EU health research funding

Considering the EU-27 as a whole and across all sectors, the EU-27 investment in research and development (R&D) ranks third worldwide, but growth of investment is much higher in the United States (US) and in China. In 2015, China overtook the EU to become the second largest R&D investor.

To assess public investment in EU health research in a global perspective, we used data from national funding agencies throughout the world. The US [National Institutes of Health](#) (NIH) stands out as the single largest funder, with EU funding more than an order of magnitude smaller and on a par with investment by of national agencies from the United Kingdom (UK), Canada, and Germany. In the absence of data on health research investment in China, we used the publication output as a surrogate. Here the gap between the EU and US is smaller, suggesting potentially more efficient EU funding. However, China comes second after the US and before the EU.

Considering the EU through its FPs as a single entity is justified because of its unique capacity for funding international cross-border collaborative research. However, only through the EU-wide

portfolio of investment, of which 90 % is with Member States, the EU comes close to the US. To leverage that capacity will require more intense coordination.

A comparison of health research governance and leadership in the US shows a weaker profile for the EU. Within the FPs, leadership with the visibility and health research credentials equivalent to the NIH director is missing. Some national funding agencies have a strong voice, but there is no joint platform or leadership for the EU as a whole.

The comparative data indicate that at world level, EU health research could be stronger and more competitive. Options include growing the EU programmes and intensified collaboration with and between Member States, and installing high-profile expert leaders for health research.

Challenges to translating research into better health

For bringing new products to market

The pipeline for new products starts with discovery research in laboratories, most often academic research with public funding. Subsequent development then lies with biotech and industry, who also sponsor the necessary clinical trials. In this pathway is a large attrition, the 'translation gap', ascribed to fragmentation of the R&I ecosystem where the different actors work in silos. This gap is more pronounced in the EU than in the US.

To reduce attrition in the pipeline between discovery and development in the private sector, two approaches are possible. In the US, a structural organisation brings academic and private actors together in large and powerful translational institutes with long-term structural funding. In the EU, a few similar initiatives exist in Member States. Another approach is incentivising translational research through project funding. This is the approach of EU funding of collaborative research with biotech and supporting academic-industry partnerships in the [Innovative Health Initiative](#) (IHI). A more long-term commitment is the [European Institute for Technology Health](#) (EIT-Health). The EU Mission Cancer continues long-term support for cancer research, and some other disease areas have long-term support, however in repeated, rather than structural, funding.

Of note, the EU also runs a highly-regarded programme supporting discovery research through the [European Research Council](#) (ERC), but without a direct health-dedicated channel, whereas the US this year launched the [Advanced Research Projects Agency for Health](#) (ARPA-H) to stimulate breakthrough transformative research.

A second reason cited for the translational gap in the EU is a regulatory system that is complex in its multitude of regulations as well as in the diversity of national implementation and rules.

Clinical studies without commercial interest.

Investigator-driven clinical studies were central to the COVID-19 response and include data gathering for outcomes of existing treatments and testing new treatment schemes with existing drugs. They bring high societal value but no commercial opportunities. For impact, clinical research needs scale and advanced study design. Co-creation, including patients, shows the way for innovative trials. However, the regulatory framework and the means for setting up cross-border international collaboration are particularly challenging to academic researchers.

Use of health data

Health data as available in medical records, national databases and dedicated registries offer a wealth of possibilities for population health monitoring and guiding public health policies, but also for discovery research driving innovation and better clinical care. Hurdles for accessing use at EU level include technological hurdles and regulatory challenges.

The data indicate the need for the EU to stimulate research that delivers for health. Means to do so are more structural and long-term support in partnerships, and support for investigator-driven clinical research. Further facilitation of the regulatory environment will benefit from close cooperation of all stakeholders, with the medical researchers and patients.

Impact on health research of regulations and initiatives for a European health union

Regulations under the EHU focus on the EU preparedness and response in times of crisis and cross-border health threats. The regulation strengthening the mandate of the European Centre for Disease Prevention and Control (ECDC) is welcomed, but many stakeholders called for an extension of monitoring beyond infectious diseases. Strengthening the mandate of the European Medicine Agency (EMA), will facilitate clinical research and navigating the regulatory framework. Nevertheless, many stakeholders feel that this could further be developed.

For the proposed regulation on the [European Health Emergency preparedness and Response Authority](#) (HERA), a major concern is that the investment in research is insufficient and not at par with investment in the US. Another concern is governance, about a lack of transparency and oversight, and a lack of expert scientific leadership and stakeholder involvement. These concerns are partially related to HERA not being an externalised agency.

Regarding the proposed regulation for a [European Health Data Space](#) (EHDS), there is consensus that the access to data has great potential benefit. However many hurdles need to be overcome for implementation to benefit health research in the key area of clinical cross-border studies. These include the diversity in regulatory implementation at national level, data harmonisation at higher level and finding the right balance between public and individual interests.

With the launch of a [pharmaceutical strategy for Europe](#), the expected better access to new treatments is welcomed. However, on health research, critical voices highlight the need for a more solid agenda of priorities set up with all stakeholders, and for engaging earlier stages of academic and translational research. [Europe's Beating Cancer plan](#) is seen as an advance for coherence in health research in this area. The one critical concern is whether it will be sufficiently inclusive for countries with poorly developed high-level healthcare. The [EU4Health programme](#) is an important financial instrument to fund the EHU actions. However, funding is also through the FPs, raising concerns about reduced funding in other areas.

Research for global health and health challenges related to climate and biodiversity, are supported by different programmes but would benefit from being included in the concept of a European health union.

In summary, the new regulations and initiatives strengthen the health research landscape. However, weaknesses remain: a lack of coordination across sectors and with stakeholders in setting the research agenda. There is opportunity for leadership towards global health.

Expert views on coherence in EU health research

The interviewees' expert opinions confirmed the analysis provided by the study and also offered additional insights and views.

Experts emphasise the importance of cross-border collaborative health research and the value of EU-wide coordination. More investment is needed, but also better investment and scientific excellence is key to ensure research translates in better health. Intensified coordination and collaboration with Member States is a way to strengthen international clinical research, with cross-sector partnerships for early translation from discovery to product. Experts emphasise the importance of stakeholder participation in governance

More attention to national policies in EU-13 countries and support for initiatives from Member States in novel co-funded actions can enhance cohesion within the EU. For coherence across research programmes within the EU, experts cite the value of a central management for health research. They predict that a critical review of programmes can identify those who deliver poorly on impact. Consequent attrition will reduce complexity.

Experts broadly support the institution of a scientific leadership via a Health Research Policy Board, provided it would have impact, guiding investment and support to health research.

4. Conclusions

The data identified several mechanisms underlying the weaknesses in health research. Below is a shortlist of actionable targets that guide the policy options:

- Low EU investment compared to the US and China.
- Limited funding for collaborative research at EU level through the FPs.
- EU-27 lack a joint health research strategy.
- Changing priorities within FPs with variable support for clinical research.
- ECRIN is not centralised at EU level and does not reach all EU Member States.
- Generally low participation of EU-13 countries, but positive impact of national policies.
- Priority setting and comprehensive strategy lack adequate guidance.
- Insufficient structural or long-term funding boosting collaboration for translation.
- Compared to the US as world leader, EU health and health research lack a leadership with strong credentials.
- Limited stakeholder participation, including the academic research community and patients/citizens in setting research agendas and developing regulations.

5. Policy options

Policy options to foster coherence aim at strengthening international cross-border collaboration and increasing participation across the EU, to increase synergies between programmes through coordination and to build stronger leadership. Regulations under the EHU were considered as **Policy option 0**, i.e. no change. We concluded from the analysis that they do not address the systemic weaknesses of EU health research.

> *Policy options 1-3 build on existing structures*

Policy option 1 – Increase the EU budget for collaborative health research

At world scale, in relation to the size of the EU, the investment in health research through Horizon Europe is small, even when considering the added EU4Health programme. Doubling the investment would substantially scale up possibilities for centrally administered impactful EU-wide actions. The budget could be managed within existing structures, but could also be connected to other options for a differently coordinated policy.

Policy option 2 – Increase health research opportunities in the ECDC and HERA

The ECDC is well-placed to identify urgent research needs and opportunities for research to guide health policies. ECDC is an agency embedded in a global network, where similar agencies have a stronger research portfolio. The mandate of the HERA response agency could be extended to proactive clinical and public health research though this would require a revision of governance to guide research.

Policy option 3 – Restructure ECRIN as a central EU body with central financing

This option will create hubs facilitating collaborative clinical studies in all EU countries with increased inclusiveness and coherence in clinical research. ECRIN has extensive experience and could lead for more impactful clinical research with data relevant across the EU. There is potential engagement and alignment with [policy for EU-wide evidence gathering Health Technology Assessment](#). The change of the statutes has budgetary implications.

> *Policy options 4-6 present design for new structures for synergies and leadership.*

Policy option 4 – An EU platform of funding agencies and optimisation of co-funding

This option is to engage Member States and their funding agencies more strongly in co-creation and co-funding. A platform of health research funders (equivalent to the former European Medical Research Council which ended in 2015), with representatives of funding bodies having both expertise and delegated power, could be a means for developing a long-term perspective and optimise co-funding, interfacing with the EU. This option would align with the call for more synergies in the [2022 Prague Declaration](#).

Policy option 5 – A European Health Research Council

A proposal from the [Horizon 2020 Scientific Panel for Health](#) comprised a Health Research Policy Board, to elaborate a comprehensive strategy and policies, and responsible for coordination and communication. A Scientific Translational Board would oversee synergies between research programmes and implement action through funding mechanisms. In 2020, a letter to the European Commission by [Members of the European Parliament and health stakeholders](#) called for more coordination in health research in reference to the proposal. Setting up a policy board can build on existing organisations and be led by a high-level expert with strong international credentials. Existing EU networks for health research can serve as example, and/or it could build up step-wise from smaller networks between EU countries in disease areas. It would require a creative legal structure to balance between autonomy and connectedness across the different European Commission Directorates, to report under the Commissioner with health in their mandate.

Policy option 6 – A European health institute

A European health institute would assume health research coordination as proposed under option 5, but also take a deeper role in health policies. It would provide permanent expertise and research for public health, advice on health strategies beyond crisis management and participate in the dialogue on global health. It could bring together regulatory aspects of health research and implementation in health care. Such an institute could be a flagship for the European health union, particularly if led by a high-level expert, and could provide support for a leading role in global health.

> Policy option 7 for leadership and strengthened advice for policy

Policy option 7 – A high-level Scientific Adviser for health

The [scientific advice mechanism](#) (SAM), provides evidence for policies by reaching out to the academies in the EU, and the Science Advice for Policy by European Academies ([SAPEA](#)). SAPEA provides advice based on expert consultation and existing knowledge. The group of high-level Scientific Advisors currently lacks a prominent medical expert, while inclusion of such a profile would provide the European Commission with direct access to a high-level expert at all times, facilitating the elaboration of scientific advice for health. Although this option may require a special call, it is not dependent on changing mandates or legal structures.

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AC	Associated Countries
AMED	Japan Agency for Medical Research and Development
AMR	Antimicrobial resistance
BARDA	Biomedical Advanced Research and Development Authority
BBMRI	Biomedical and Biomolecular Research Infrastructure
BMGF	Bill and Melinda Gates Foundation
CDC	United States Centers for Disease Control and Prevention
CEPI	Coalition for Epidemic Preparedness Innovations
CIHR	Canadian Institutes of Health Research
CNRS	Centre national de la recherche scientifique
CORDIS	Community Research and Development Information Service
DFG	German Research Foundation
DG CONNECT	Directorate-General for Communications Networks, Content
DG RTD	Directorate-General for Research and Innovation
DG SANTE	Directorate-General for Health and Food Safety
DZHK	German Centre for Cardiovascular Research
EATRIS	European Infrastructure for Translational Medicine
EC	European Commission
ECDC	European Centre for Disease Prevention and Control
ECRIN	European Clinical Research Infrastructure Network
EDCTP	European and Developing Countries Clinical Trial Partnership
EFPIA	European Federation of Pharmaceutical Industries and Associations
EGE	European Group on Ethics in Science and New Technologies
EIC	European Innovation Council
EIT	European Institute of Innovation and Technology
EMA	European Medicines Agency
EMBL	European Molecular Biology Laboratory
ERA	European research area
ERC	European Research Council
ERDF	European Regional Development Fund
ERIC	European Research Infrastructure Consortium
ERINHA	European Research Infrastructure on Highly Pathogenic Agents

ESIF	European Structural and Investment Funds
EU	European Union
FDA	Food and Drug Administration, US
FEAM	Federation of European Academies of Medicine
FP	framework programme
FP7	Framework Programme 7
GBP	Pound sterling
GDP	Gross domestic product
GDPR	General Data Protection Regulation
H2020	Horizon 2020
HAS	Hungarian Academy of Sciences
HERA	Health Emergency Preparedness and Response Authority
HHMI	Howard Hughes Medical Institute
HLIP	High Level Independent Panel
HTA	Health Technology Assessment
IHI	Innovative Health Initiative
IMI	Innovative Medicines Initiative
INSERM	National Institute of Health and Medical Research, France
IP	Intellectual Property
MFF	Multiannual financial framework
MRC	Medical Research Council, UK
MSCA	Marie Skłodowska-Curie Actions
NATO	North Atlantic Treaty Organisation
NHMRC	National Health and Medical Research Council, Australia
NIH	National Institutes of Health, US
NIHR	National Institute for Health and Care Research, UK
OECD	Organisation for Economic Co-operation and Development
PC	Programme Committees
SHARE	Survey of Health, Ageing and Retirement in Europe
TC	Third Countries
UK	United Kingdom
USA	United States of America
WHO	World Health Organisation

1. Introduction

1.1. COVID-19 as a health research challenge for the EU

Across the world, the COVID-19 pandemic and health crisis, with its broad impact on socio-economic life, has been a major public pre-occupation. In the EU, COVID-19 has shaken up European policies and challenged the position of the EU in a global health perspective. Assuming its global political and socio-economic responsibility, the G20, under the 2021 Italian Presidency, commissioned a [High Level Independent Panel](#) (HLIP) on Financing the Global Commons for Pandemic Preparedness and Response to analyse and make recommendations on the way forward. In its foreword, the report states *'The world does not lack the capacity to limit pandemic risks and to respond much more effectively than it has responded to Covid-19. We have the ideas, the scientific and technological resources, the corporate and civil society capabilities, and the finances needed.'* Most certainly, health research is at the centre of the scientific resources but the efficiency of EU health research to respond to current and future health needs has been questioned ([Sipido et al., 2020](#)).

COVID-19 is a case study of the challenges for health research in the EU and the starting point of this report. We showcase here major aspects of health research that were essential for the Covid -19 response, i.e. clinical research within the healthcare setting, publicly funded research that that underpins new health product development, in this case vaccines and drugs for treatment, and health data that feed into public health and health policy decision.

1.2. Clinical studies require cross-border research funding

A major line of research during COVID-19 consisted of clinical studies, collecting data on the disease and first reports into potential treatments, all performed within the health care setting. A **panoply of studies** was launched ([Fragkou et al. 2020](#)). Across the world, massive public fundraising led to a total investment of 8 Bi USD within the first year of COVID-19 ([OECD, 2021](#)). However, **less than 25 % of the investment was international collaboration**.

Some of the **results were published quickly** under the sense of urgency to acquire a much information as possible, and preprint servers provided public access before in-depth peer-review. While sharing of public health data has largely been beneficial, there have been several regrettable incidents in the area of clinical trials, with **misguided treatment choices** and political recommendations ([Watson, 2022](#)).

Several analyses have denounced the **lack of proper scale and statistical power** that cannot be remedied by post-hoc combination of results in meta-analysis ([O'Grady, 2021](#)). Interventional clinical studies of proper scale rely on recruitment in a large population and must be led by an experienced trial centre with a proper platform. Early on, the UK could build on pre-existing research platforms and strong coordination by the [National Institutes of Health and Care Research](#), NIHR, and the UK chief medical officer to launch [RECOVERY](#) trial. It evaluates several treatments in a continuously reviewed and updated design. In the EU, large-scale initiatives could only be launched through the Horizon 2020 (H2020) framework programme. An adaptive trial platform for COVID-19 therapies [EU-RESPONSE](#), provides scale and coverage of a large population. However, the project has a duration of 5 years, **missing a long-term commitment for funding**. Since the launch of EU-RESPONSE, other programmes have been funded, notably the [VACCELERATE](#) programme that provides a pan-European platform for clinical trial design and conduct for vaccine development trials. The programme was funded under H2020 with a time window of January 2021 through January 2024. The EU infrastructure [European Clinical Research Infrastructures Network](#) (ECRIN) supports coordination of COVID-19 clinical research across Member States. Nevertheless, a recent

reflection on the lessons learned for clinical research during Covid-19, emphasised again the need for better structural support ([Goossens et al., 2022](#)).

1.3. Vaccine development built on existing knowledge

The threat of 'disease X' resulting from animal-to-human virus mutation and the need for anti-viral agents and vaccines, spurred into being the [Coalition for Epidemic Preparedness Innovations \(CEPI\)](#), to lay the ground for vaccine research, from basic discovery to production strategies. While these structures provided a backbone for vaccine development, the necessary knowledge on the new virus was lacking and fast response was essential. Therefore, development of a novel COVID-19 vaccine by industry explored application of existing technologies used for other viral diseases. But, the urge for a COVID-19 vaccine also spurred development of mRNA-based vaccines, a strategy that had not been used so far. The story of the development of these new types of vaccines ([Veugelers & Zachmann, 2020](#)) is a strong example of the contributions of **publicly-funded discovery research which transcends the typical disciplinary boundaries**, as well as the importance of **support for translation and innovation**. As recently highlighted ([Morens, Taubenberger and Fauci, 2022](#)), we will need renewed and continued research for innovative vaccines and strategies.

1.4. Drugs for COVID-19 - a long-term endeavour

Different from bacterial diseases, small molecule drug therapies for viral diseases are few. The largest class of antiviral agents developed, with increasing therapeutic success, has been targeting HIV, with more than 40 drugs developed, of which more than two dozen now on the market. Successful drug development followed with a substantial time lag the discovery and characterisation of the virus ([De Clercq and Li, 2016](#)). For Covid-19, several parallel lines of research were started, building on lessons from the past while implementing the latest technology. Nevertheless, and to some extent not unexpectedly, **progress in this area remains slow** and the actual virus-eradication is still elusive. Remdesivir, a broad-spectrum antiviral originally developed and used to treat hepatitis C, is now [recognised as a COVID-19 medicine by the WHO](#).

Further search for antiviral drugs remains an active field of research, where world-wide, public funding including by the EU, and not-for-profit funding such as by the [Bill and Melinda Gates Foundation](#), BMGF, have a major role in the first discovery stages of research and early development. This investment is **essential to feed the pipeline leading to new products** where private funding and industry take over.

1.5. Public health policies need data and expert coordination

Key to guidance for public health policies are health data and within the EU, each Member State has its public health monitoring system. However, for COVID-19 a global coordination was needed. One of the important mechanisms for coordination in the EU is the European Centre for Disease Prevention and Control, [ECDC](#). Nevertheless, **early in the pandemic ECDC could not assume this role** as needed ([Jordana & Triviño-Salazar, 2020](#)). A lack of agility and decisiveness of the organisation related to limited resources and mandate, because of the distribution of competences among Member States and national priorities. In addition, ECDC had not had a major role in addressing public health crises of this magnitude so far ([Gontariuk et al., 2021](#)). Eventually the Centers for Disease Control and Prevention, [CDC](#), in the US, [ECDC](#), in Europe and the [World Health Organisation](#), WHO, joined force to oversee the extent of public health risks and measures to address them. Within the EU, Peter Piot, a world leader in infectious diseases, was appointed [special adviser to the President of the European Commission](#) to **assist the European Commission in management of the pandemic**.

1.6. Fostering coherence of EU health research after COVID-19

Health research for the COVID-19 response has taught the importance of deep existing knowledge, agility to acquire new data and translate knowledge into public health measures and health care. COVID-19 has shown the need for cross-border collaboration in acquiring robust data, the importance of cooperation and inclusiveness, under leadership to engage for global health.

Against these needs, **COVID-19 highlighted several weaknesses** that appear to be systemic and inherent to the structure and organisation of public funding of health research in the EU. These include **insufficient international collaboration** to reach scale and power of clinical studies, as well as **inequalities in participation** in health research within the EU. Addressing the global health crisis requires **engagement of the EU with the world** with **coordination and leadership** in health and health research for the EU. The ecosystem to **translate discoveries to new treatments has several hurdles**.

Therefore, in this study **we examine the current structure and organisation** of the public funding for EU health research **to identify mechanisms** that underlie these weaknesses and ways forward. In a first chapter, we critically examine EU funding schemes for international collaboration and strategic investment for health research under the framework programmes (FPs). In the next chapter, we examine inequalities in Member States participation and underlying reasons. We then look at the position of the EU as a public funder for health research in the world, the competitiveness and impact of EU investment and Member States, and strategies for health research within and outside the EU. We compare leadership for health research in the EU and the world. Next, we look at the challenges within the EU for bringing discoveries forward towards novel drugs and treatment. We then discuss the plans for the European health union and how these would, or not, address the weakness in health research. We report on interviews with high-level experts on the way forward to address the structural weaknesses identified. The identified mechanisms are the starting point for proposed solutions through policy options.

2. Methodology

2.1. Analysis of investments and expenditures

We used publicly accessible databases and reports from primary and secondary sources. Primary sources were the annual reports of funding bodies or national databases where available. A secondary neutral information source were documents produced by independent bodies supported by governmental funding, the [WHO](#), and the Organisation for Economic Co-operation and Development, [OECD](#), with contractual agreements and/or direct access to national databases. A third source were data collected in commissioned reports elaborated by professional consulting organisations and/or in academic analyses published as scientific reports.

2.2. Analysis of health research policies and strategic funding

We used publicly available documents from funding bodies, as well as commentaries and scientific analysis published in academic journals. For the multiannual FPs of the European Union, we used publicly available and applied informatics tools for content analysis. The impact of strategic investment programmes was assessed with scientometric tools.

2.2.1. Data sources

We searched for health research projects funded by FP7, the FP from 2007-2013, and H2020, the FP from 2014-2020, and their respective publications, in the [Community Research and Development Information Service \(CORDIS\)](#), which is the European Commission's primary source of results from the projects funded by the EU's framework programmes for research and innovation. We found in the CORDIS database 1008 and 1216 health research projects funded respectively by FP7 and H2020. In addition, we carried out a search of the publications derived from the health research projects funded by FP7 and H2020 in the CORDIS database. The CORDIS database lists 35,514 publications related to FP7-health projects and 12,013 publications related to H2020-health projects. Subsequently, we performed a search of the publications listed in the CORDIS database in the Web of Science (WoS), a paid-access platform owned by Clarivate. KU Leuven has institutional access for members of the institution under a paid license. We found 28,948 and 8,369 papers related to health research projects funded by FP7 and H2020, respectively.

2.2.2. Data analysis

The methodology used for the quantitative analysis of the content of the projects financed by the FPs and of the derived scientific literature was previously used to analyse global funding for biotechnology research ([Fajardo-Ortiz et al. 2022](#)). The content of the projects (title and abstract) was analyzed using [KH Coder](#) version 3, a free software for quantitative content analysis or text mining. KH Coder generated co-occurrence networks and multidimensional scaling maps to visualise the content organisation of health research projects funded by the FP7 and H2020. We coded the terms with the highest frequency in the title and abstract of the projects using descriptions for types of health research and of diseases, based on expert input by the authors of the study. This coding was supported by the structure of the content observed in the co-occurrence maps and multidimensional scaling. We also use term association networks generated by KH Coder to analyze the relationship between the coded terms and refine the coding. The similarity in the distribution of the categories was analysed by KH Coder using the Jaccard index, representing the relationship between sub-disciplines and groups of diseases through a cluster analysis. Using KH Coder, we analysed the distribution of the different categories corresponding to the branches of health research and disease groups among the projects grouped by financing scheme. We also used

[VOSviewer](#) to analyse the content of the papers found in the WoS. VOSviewer generated term co-occurrence maps for both FP7 and H2020.

2.3. Interviews with experts on how to increase coherence in European Union funding for health research

2.3.1. Format of the interviews

The format of the interviews, informed consent procedure, data collection and data handling were in line with the General Data Protection Regulation, [GDPR](#), and approved by the [Social and Societal Ethics Committee of KU Leuven](#). Interviews were conducted by the main author and at least one collaborator. Guiding questions regarding challenges and solutions were complemented with free comments. Interviews were recorded and offline analysed to prepare a summary of main answers and reflections. The resulting document was sent to the experts for approval. The approved summaries of the interviews were integrated and structured according to the thematic questions. The approved abstracts were used in conjunction with the evidence collected in the scientific literature and in the databases to support the elaboration of the policy options.

2.3.2. Profile of the experts

The interviews were conducted with a group of twelve experts with extensive knowledge of the organisation and funding of health research in the EU. The experts predominantly reside and work in countries of the European Union, with one expert residing in Norway. The experts come from different regions within the EU, both from Member States with long and more recent membership (Belgium, Denmark, France, Germany, Italy, Portugal and Spain; Hungary, Lithuania and Poland respectively). Eight of the experts are or have been actively involved in health research, while four experts are active in social sciences research such as economics, public administration and health administration. All experts have held leading roles and positions of trust in academic or governmental organisations at the national level, at EU level or global scale. Several experts have also held leadership roles in non-governmental organisations and/or professional associations.

2.3.3. Dynamics of the interviews

The experts were provided with the draft report and with a list of guiding statements and questions. The interviews were conducted by video call and were aimed at gathering observations, ideas and proposals regarding how to increase the coherence of health research in the EU. The experts were informed in advance about the content, purpose and nature of the interview. The interviews were conducted in an open and flexible format, allowing the experts to decide what questions or topics related to the study they wished to elaborate on more in depth. The interviewing researcher limited himself to facilitating the conversation by guiding the interviewee through the topic and asking for more detail on some points according to the profile of the expert interviewed.

2.3.4. Guiding questions

Experts were presented with the following questions and some potential responses as topics for discussion:

- How can international collaboration be increased to enhance coherence within EU for strategically oriented health research?
- Are current measures sufficient to increase participation in health research of EU-13 countries (and some EU-15 countries) and address inequalities within EU?
- What measures could be taken to create more coherence between EU programs?
- What leadership is needed to increase coherence of policies for health research to address societal needs?

3. Strategies for EU health research funding

3.1. Changing priorities for health research funding between FP7 and H2020

The FPs are the largest research investment of the EU and are under the administration of DG RTD. FPs have thematic lines for strategic investment, one of them being health. For health, **each FP sets priorities with specific aims**. Under **FP7**, health research was shaped by overarching policies aiming for smart, sustainable and inclusive growth through better health and health systems, innovation through partnerships and implementation of ERA. Under the Cooperation scheme, both small, medium and large integrating projects were supported.

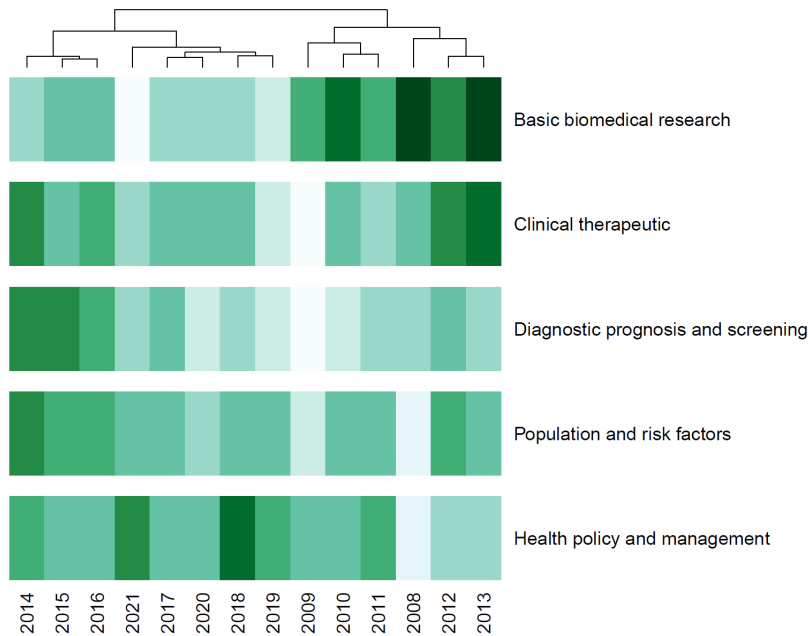
The theme **Health had three axes**, (1) biotechnology and technology development (2) translational research to better health care, and (3) optimisation of health care delivery. The FP6 approach with narrow topics was abandoned in favour of more **broad topics**. The **allocated budget was €6 billion**. Targets were infectious disease, brain disease and ageing, and the burden of chronic diseases including cancer. Project funding through competitive calls was complemented with targeted actions such as the Human Brain project as a flagship funding starting in 2008. **In 2011, support for clinical trials was reinforced**.

The launch of the [Innovative Medicines Initiative](#) public-private partnerships (2008) was an important **novel instrument for health research**. Industry support in kind and matched funding by the EC to academic partners supported large collaborative research projects within a strategic research agenda, that was strongly directed towards innovation in health care. Diagnostics and treatment in major chronic diseases and infectious disease, aligned with the Health theme, while more specific programmes aimed for novel pathways for drug discovery and clinical trials.

In **Horizon 2020** health was identified as one of the [societal challenges, SC1](#), with a **budget of €7.5 billion**. Programming put more emphasis towards improving health through **innovation and implementation**, with new instruments **targeting SMEs** and launch of the [EIT Health](#), as one of 'knowledge and innovation community' (KIC) of the European Institute of Innovation and Technology (EIT). Under Horizon 2020, major disease areas remained in scope, but were also addressed in **new public-public partnerships**, led by Member States. The [Joint Programming Initiatives](#) address antimicrobial resistance, neurodegenerative disease, and included a large action around rare diseases.

In order to determine the impact of the changing emphasis and priorities, we analysed and compared the content of the **abstracts of funded projects** under the major health programmes in FP7 and Horizon 2020. The analysis of terms with two-dimensional clustering in categories is shown in Figure 1. In the years **2008 through 2013, biomedical research** is highly prominent. **Clinical studies** are most prominent in **2012, 2013, 2014**, corresponding with the strategic decision. However, clinical studies **decline in the years 2015-2020**, in favour of implementation and **health care-oriented funding in 2018-2019**.

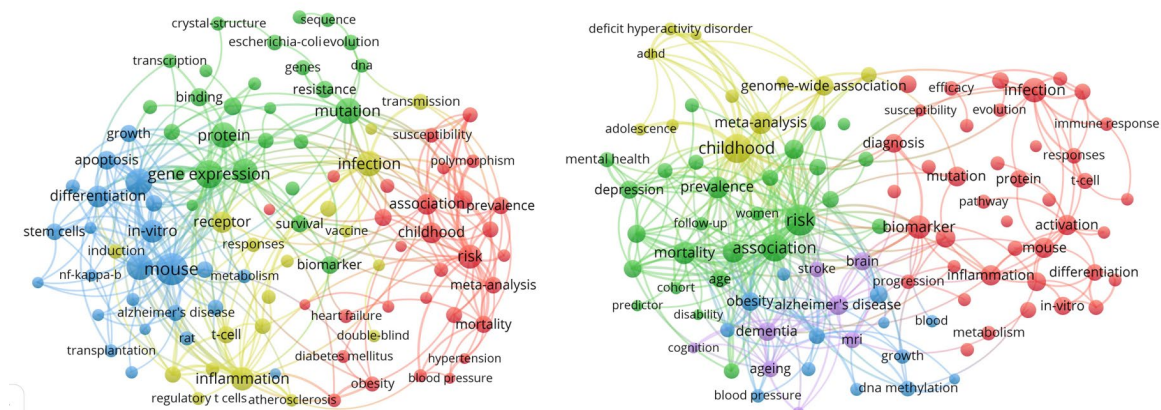
Figure 1 – Domains of health research projects in FP7 and H2020



Data source: [CORDIS database](#)

A term **analysis of publications connected to FP7 and H2020** (Figure 2), shows that many manuscripts resulting from FP7 funding have a bio-mechanistic component relating to cell therapy and drug development (large green, blue and yellow clusters), corresponding to the project abstracts of basic biomedical sciences, and clinical studies (red cluster), corresponding to the 2012-2014 strategy. Reports from **H2020 still include some mechanistic studies** in inflammation, related to studies in infectious diseases and cancer (red & blue cluster). They also include a **more prominent output in population studies of risk factors** for chronic diseases (green cluster). Altogether, although differences are noted, they are less noticeable than expected from the shifts in project abstracts (Figure 2). These results suggest that the **output in publications is possibly not fully concordant** with the objectives of the projects.

Figure 2– Topics in publications funded by FP7 (left) and H2020 (right)



Sources: [CORDIS database](#) and [Web of Science](#).

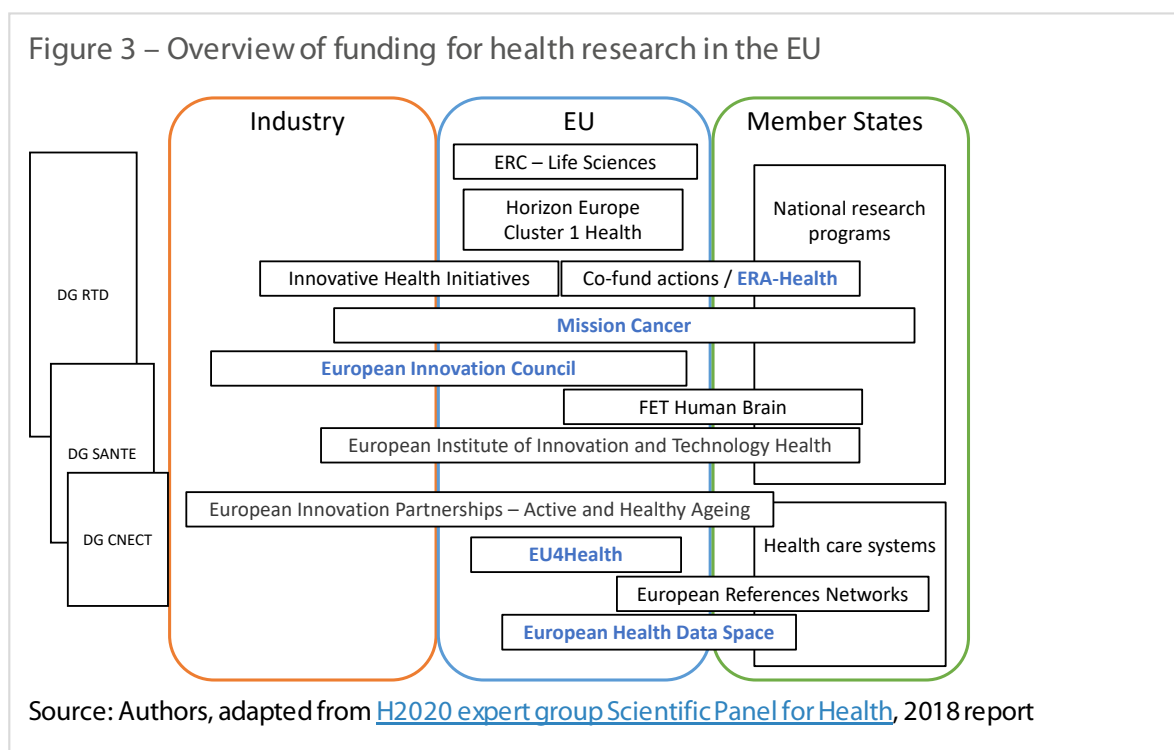
Taken together, this analysis indicates that **the implementation of FP7 and Horizon 2020 is to a large extent successful in funding different types of projects according to strategic decisions.** With changing emphasis in policies, there is a shift in the type of investment towards more application and implementation, but support for **clinical therapeutic studies lack continuity** in the main pillar, though these may have moved to the IMI programme.

3.2. Opportunities and complexity within Horizon Europe

Although [Horizon Europe](#) was announced as '[Evolution, not revolution](#)' there are shifts in emphasis and organisation. The €95.5 billion programme brings forward societal challenges, yet economic return remains at the forefront. Among the challenges, **climate change has been put forward as priority area for investment** with [over 35 % of Horizon Europe budget to climate objectives](#).

For health research, Horizon Europe provides a dedicated programme under societal challenges, [Cluster 1 Health](#) with a **budget of €8.25 billion**. Important **novel accents are on prevention and health promotion, and the deployment of digital tools**. The programme also intends to strengthen the health care industry and the IMI partnership has evolved into the IHI, [Innovative Health Initiatives](#), including a more diverse industry. Of the selected missions, one is the **Mission Cancer**, and thus an important action within health research.

As illustrated, in Figure 3, under Horizon Europe the number of **instruments for health research has increased, and, also has complexity** (blue= new under Horizon Europe).



Novel elements have improved the potential for cross-border health research with the **co-fund programme ERA-Health**, which is **predominantly financed by Member States**. **Cross-sector collaboration** is enhanced through the already mentioned IHI and the European Innovation Council (EIC). The development of a [European Health Data Space](#) is a regulation proposed under the public health agenda of the EU, and is outside of the FP.

An important change in management is **more coordination with the Health programme** (see under 3.3.) and co-administration of health research between DG RTD and DG SANTE.

3.3. Research in the Health Programme

The EU competence on health and health care is much more limited than for research, but EU engagement in health is firmly anchored in the **EU commitment to protect and act in the face of common challenges**, and to support Member States. Over the years, the [actions for health have grown](#), with increasing awareness of the benefits of cooperation. Under the 2007 EU strategy “Together for Health”, the health programme had a budget of €350 million for public health actions. In 2014-2020, a budget of €498 million was allocated to the Health for Growth Programme, under care of DG SANTE.

Research includes **data collection and analysis for public health and health care systems improvement, to guide policies at EU level and support for Member States** in the area of health. **Some actions for health are connected to research carried out under the FPs.** An example of connected actions is the establishment of the [European Reference Networks](#) for rare diseases and conditions in 2017, and the subsequent establishment of the [European Joint Programme on Rare Diseases](#) in 2019 to support research related to rare disease. While an area of success in international collaboration, it also underscores the fragmentation across programmes and their administration.

In response to the COVID-19 pandemic the [EU4Health programme](#) was launched which boosted the Health programme under DG SANTE to €5.3 billion, as part of the actions towards a [European health union](#).

3.4. EU infrastructures in support of health research

[The European Research Infrastructure Consortium](#) (ERIC) is a specific legal form that facilitates the establishment and operation of research Infrastructures with European interest. There are thirteen [Biological and Medical Sciences Research Infrastructures](#) of which six with more direct health research connection as listed in Table 1.

Table 1 – Governance of key EU infrastructures for health research

European Research Infrastructure Consortium	Governance
European Research Infrastructure on Highly Pathogenic Agents (ERINHA)	Executive Board; Director General; Independent Advisory Board
European Infrastructure for Translational Medicine (EATRIS)	Executive Board; Board of National Directors; Scientific Advisory Board
European Research Infrastructure for Imaging in Biological & Biomedical Sciences (Euro-Biolmaging)	Joint management by hub in Finland (Turku), EMBL for biological imaging and hub in Italy (Torino) for biomedical imaging, overseen by the Euro-Biolmaging Board; Scientific Advisory Board; Industry Board Advisory Panel
European Clinical Research Infrastructure Network (ECRIN)	Steering Committee; Network Committee (scientific representatives); Advisory Board
Biobanking and BioMolecular resources Research Infrastructure (BBMRI-ERIC)	Management Committee, Steering Committee, Finance Committee, Stakeholder Forum (European patients' organisations, civil society, industry, and academia); Scientific and Ethical Advisory Board
Survey of Health, Ageing and Retirement in Europe (SHARE)	Management Board; Scientific Monitoring Board

The **core governance** is by an assembly of members, with **representatives of the national governments**, and a management board/committee. However, the regulatory framework of the ERICs allows adaptation to the specific needs of each infrastructure. For example, Euro-BioImaging works as a network managed by a hub in Finland. Under different names, all have a **scientific advisory board**. Interestingly, the governance of Eurobioimaging includes an **Industry Board Advisory Panel**. Some, like BBMRI-ERIC includes in its governance a **Stakeholder Forum** that serves as its main interface for European patients, civil society, industry, and academia.

The infrastructures are designed and implemented under the [European Strategy Forum on Research Infrastructures](#) (ESFRI), where Member States and the European Commission are represented. Financial support for the infrastructures is through membership contributions, resulting in **variable participation of Member States**.

3.5. Summary and conclusions

The major single dedicated investment in health research in the FPs is the section for collaborative research. As a fraction of the total investment in the framework programmes, it is around 10% of the total budget, with little change over the years, if anything a decrease. This health research budget is an important tool to steer funding of strategic priorities.

Noted changes in priorities are first the loss of biomedical research from the collaborative projects. Second, there was a surge of funding for clinical research that was not visibly maintained. Thirdly, new initiatives have brought opportunities for health research through public-private partnerships that primarily aim to promote the transfer from discoveries into new product. While strategically important, this increasing diversity of funding, in the absence of a larger budget, may negatively impact on collaborative and clinical research.

Partially addressing this concern, Horizon Europe promises strengthening of the public-public partnerships, with Member States in collaborative networks and infrastructures. Since most of the funding comes from Member States this is an effective increase of investment in collaborative research. However, as Member States will be the main funders from national budgets, participation may not be open or accessible to all.

In conclusion, EU funding through the FPs is a powerful means to steer health research. The complexity of funding through the array of instruments offers flexibility yet is also of potential concern, especially with regard to maintaining a comprehensive strategy for health research and inclusiveness. Future policies should address the scope and budget for funding for collaborative research, coherence and synergies between instruments and the mechanisms to guide strategic priorities.

4. Inequalities between Member States in EU health research funding

4.1. EU membership duration and economy as determinants

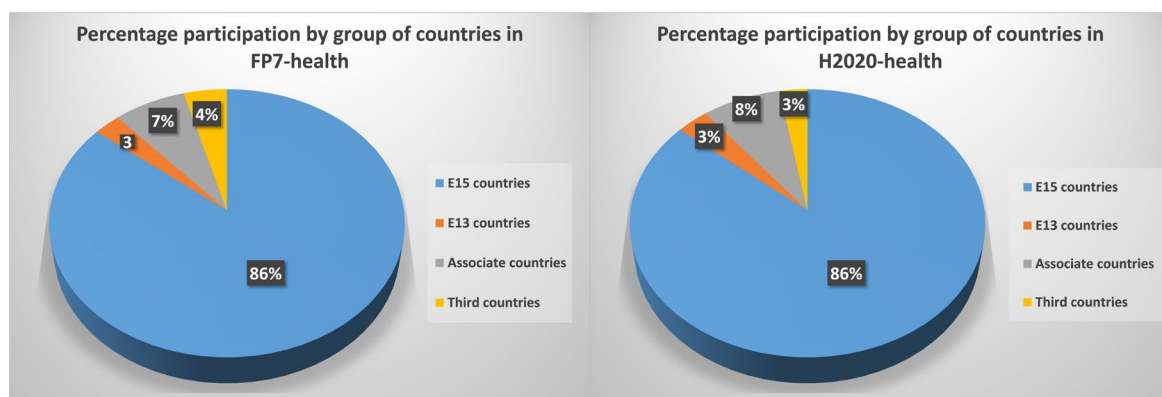
We consider EU Member States in two groups as the primary object of this analysis. The first group is made up of the thirteen **countries (EU-13) that joined the European Union in or after 2004**: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia. The second group is made up of those **countries that were part of the EU before 2004 (EU-15)**: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom. In the course of this analysis, we also refer to some of the **European countries that were affected by the economic crisis of 2008** and implemented strong budget reductions. In this chapter, we document inequalities over time and at country level, to identify mechanisms and targets to increase coherence in participation across the EU.

4.2. Unequal participation of the group of EU-13 countries

The **gap between the EU-13 and EU-15 countries is huge** as 96.9% of total health research grants from the Framework Programmes were assigned to EU-15 countries between 2007 and 2016 ([Kao et al., 2019](#)). A comparably large gap was seen in an analysis for 2014-2020 ([Gallo et al., 2020](#)). However, the aforementioned analysis does not separate the information between the FP7 and H2020 frameworks, to know if there has been a **reduction or an increase** in inequality in participation given the change in research priorities (Chapter 3).

To address this question, we compared the percentage of total funding received by EU-13 and EU-15 countries, associated countries (AC) and third countries (TC) in FP7 and H2020, using the data on health research financing in the [CORDIS database](#). From the pie charts in Figure 4, it is **not possible to notice a major change in the participation of EU-13 countries as a group**.

Figure 4 – Participation of the EU15, EU13, associated and third party countries in health research in FP7 and H2020



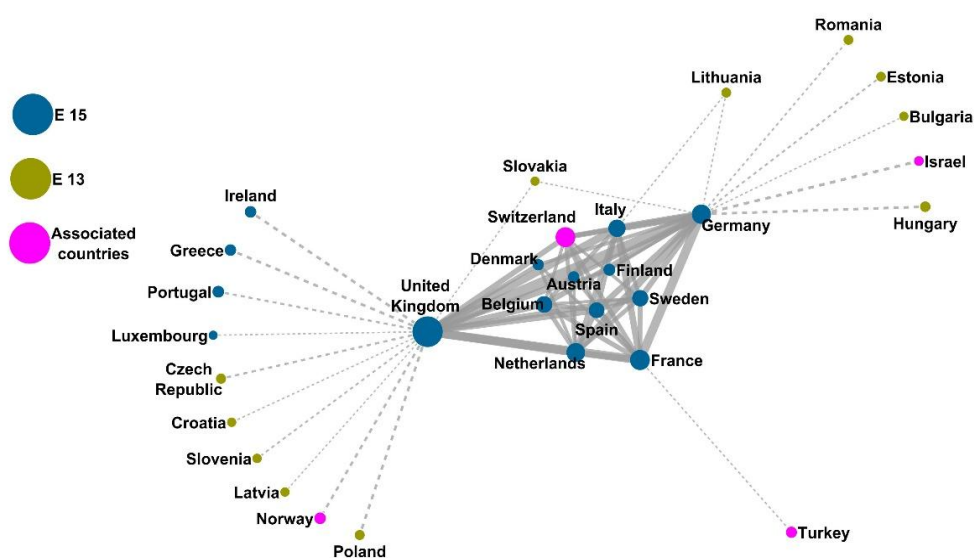
Sources: [CORDIS database](#).

4.3. EU-13 participation in networks in FP7 and Horizon 2020

A complementary perspective on the participation of Member States in the framework programmes comes from the **analysis of collaborative networks** and the evolution in between FP7 and H2020. For this purpose, we built network models derived from collaborative projects as registered in the [CORDIS database](#). For the purpose of this analysis, the network renders only of the EU countries plus the associated countries. In the rendering, the size of the node of a country, is a function of its central position and thickness of the connecting lines between countries reflects the number of common projects.

In the data for **FP7** (Figure 5), we can see that the **central nucleus of highly interconnected countries is made up of the main economies of the EU-15 group plus Switzerland**. On the periphery are all the countries of the EU-13 group, in addition to those countries that were hit hard by the 2008 crisis, such as Ireland, Greece and Portugal (Figure xx). United Kingdom followed by Germany was the main connection with these countries in peripheral positions.

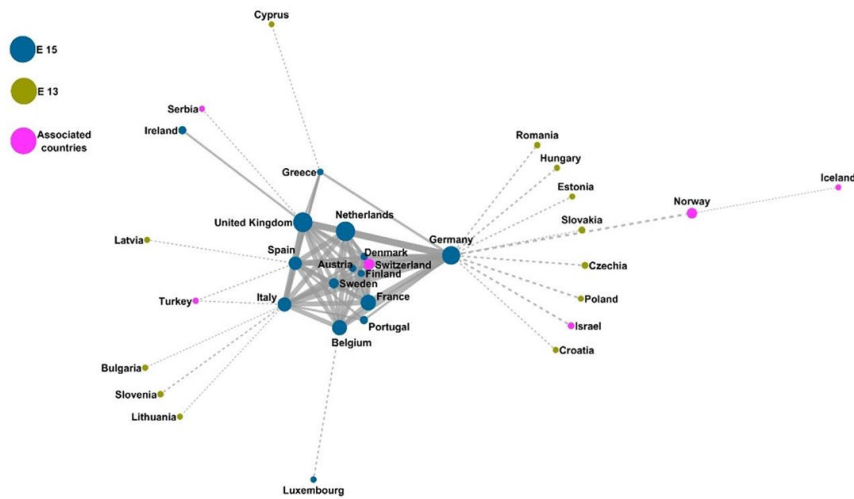
Figure 5 – The FP7 collaboration network in health research



Source: [CORDIS Database](#).

For **H2020** (Figure 6), the central nucleus remains formed by the main economies of the EU-15 group plus Switzerland. However, compared to FP7, **Greece, Portugal and Ireland now form part of the central core** of countries and Germany becomes the country with the greatest connectivity and main contact with the EU countries. Despite a greater participation, all the countries of the EU-13 group remain in peripheral positions.

Figure 6 – The H2020 collaboration network in health research



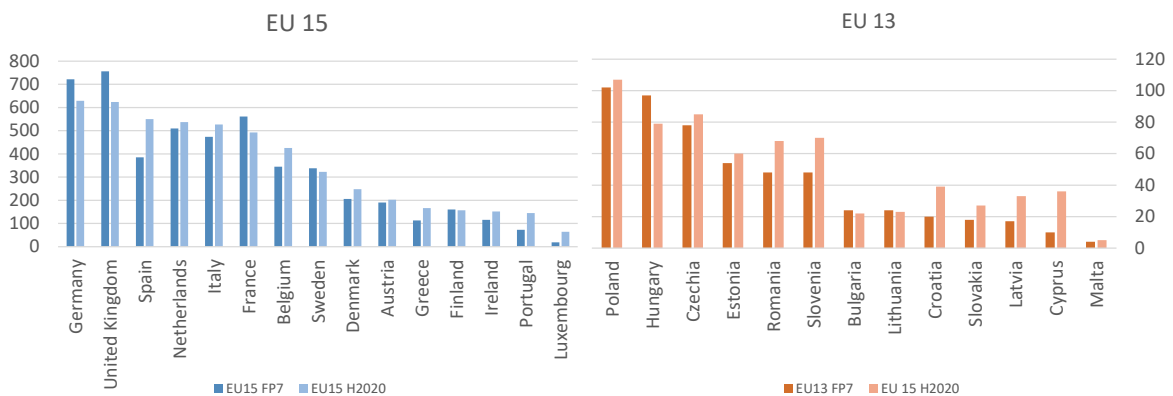
Data source: [CORDIS database](#).

These data suggest there may have been changes at individual country level prompting further analysis.

4.4. Substantial shifts between FP7 and H2020 for individual EU Member States

We thus calculated the FP7 and H2020 health research participation by country. First, looking at the number of projects (Figure 7), the size of countries and their economy influence the ranking. Nevertheless, among the EU-15 countries, the large economies, **Germany, the United Kingdom and France, saw a reduction in the number of projects** between FP7 and H2020. In contrast, some of the countries affected by the 2008 crisis, **Portugal, Ireland, Greece and Spain significantly increased their participation**. Of note as well, Luxembourg, went from 19 projects supported by FP7 to 64 in H2020, one of the largest increases. Among the EU-13 countries, Croatia, Slovakia, Latvia, Cyprus, Malta, Romania and Slovenia increased their participation, with an **exceptional growth in**

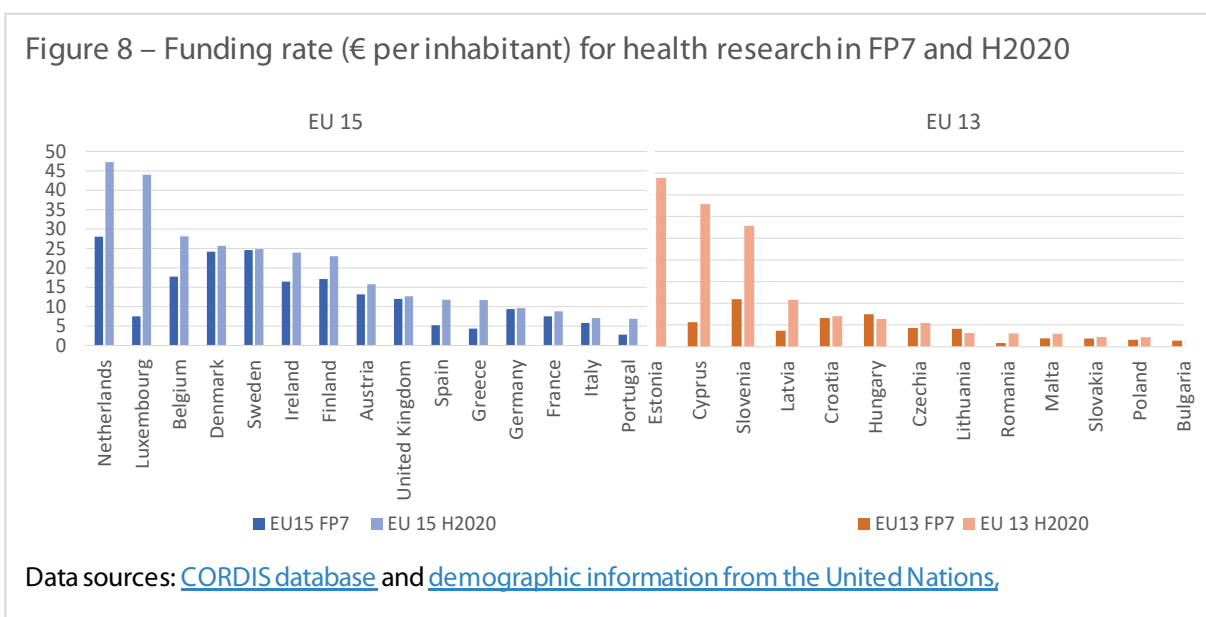
Figure 7 – Number of health research projects per Member State in FP7 and H2020



Data source: [CORDIS database](#) – note: range and scale for EU13 and EU15 data are different.

Cyprus, which went from 10 projects in FP7 to 36 in H2020. Estonia, Czechia, Poland remained stable but Hungary, Lithuania and Bulgaria had fewer projects funded in H2020 than in FP7.

To correct for the size of countries, we examined funding per capita, illustrated in Figure 8.



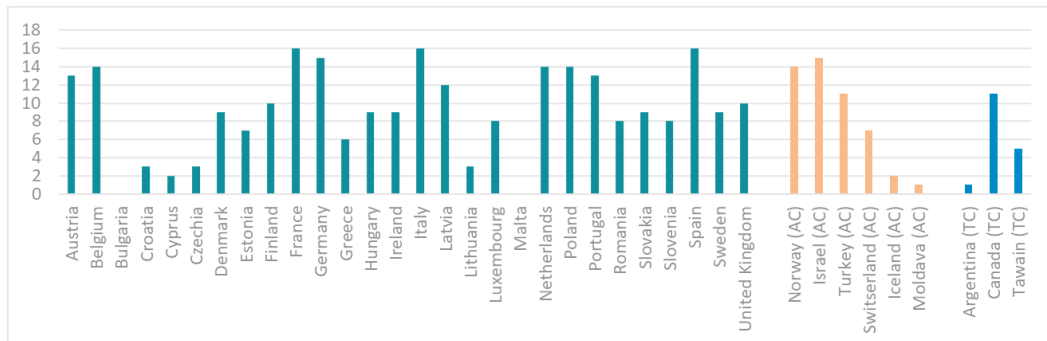
In this perspective, **except for Hungary and Lithuania among the EU-13, all Member States the countries of the European Union saw an increase in the financing rate for health research per inhabitant** though with big differences. Among the EU-15 countries, **Luxembourg practically increased its funding six-fold**, and the Netherlands and Belgium also significantly increased their participation, while large EU economies such as Germany and France remained stable. Among the EU-13 countries, **Estonia saw the largest growth and Cyprus almost six-folded its health research funding** between FP7 and H2020 while Slovenia doubled its participation, and **Latvia and Romania tripled their financing**. Bulgaria, Poland, and Slovakia had a modest growth while Lithuania and Hungary decreased their participation. Also, a number of the EU countries affected by the 2008 crisis, namely Greece, Portugal and Spain doubled their funding.

For the two largest increases, some **potential explanations** can be found. The increase in Luxembourg's participation between FP7 and H2020 can be explained in part by a greater participation of the Luxembourg Institute of Health and the University of Luxembourg. These institutions have engaged in large-scale projects on [systems medicine](#) and [digital health](#), topics that aligned with H2020 priorities. The research connected to the emergence of start-up companies such as [Information Technology for Translational Medicine](#). In the case of Estonia, the increase in participation is linked to a strategy for excellence but also alignment with research on development of [digital health](#) as part of the country's vision and leadership role in the EU.

4.5. A different profile for participation in public-public partnerships

In the public-public partnerships, national funding agencies of Member States engage for individual strategic programs. In this configuration, national priorities define participation. Figure 9 illustrates participation in H2020 partnerships, including [EJP CoFund](#), [ERA-NET](#), ERA-NET Cofund, ERA-NET plus, and [Joint Programming Initiative](#) (JPI). Although EU 15 countries still have the largest number of participation, the distribution is more balanced.

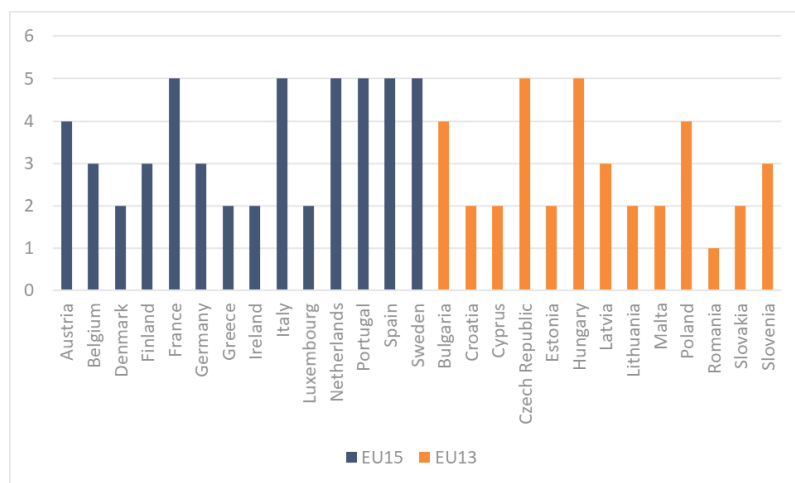
Figure 9 – Country participation in ERA networks under health in H2020



Data source: [ERA-LEARN](#).

A similar trend is seen for participation in the infrastructures (Figure 10), with a more balanced presence of all Member States.

Figure 10 – EU13 and EU15 participation in health-related ERIC

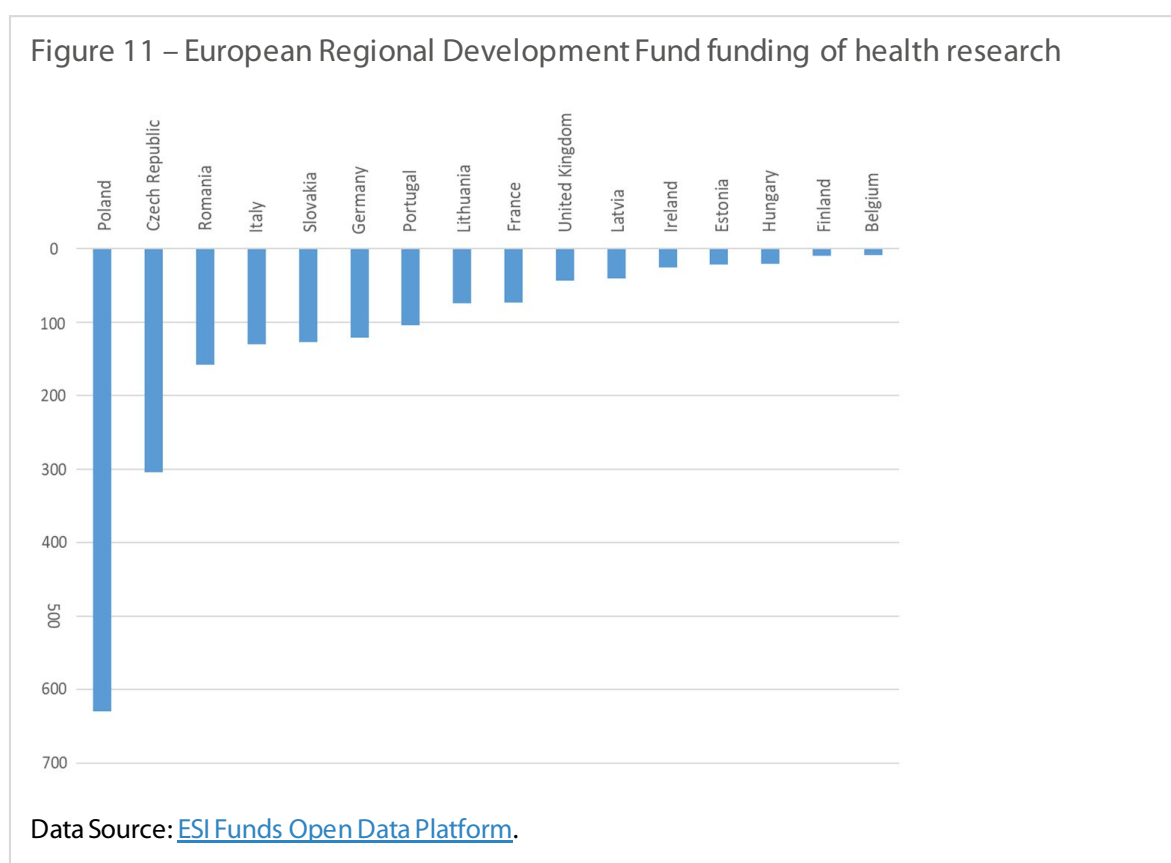


Sources: [ERINHA](#), [EATRIS](#), [Euro-Biolmaging](#), [ECRIN](#), [BBMRI-ERIC](#), and [SHARE](#).

4.6. Use of structural funds for health research

Another distinction at country level is in the use of [European Structural and Investment Funds](#) (ESIF), in particular the [European Regional Development Fund](#) (ERDF). The goal of the ERDF is to “strengthen economic, social and territorial cohesion in the European Union by correcting imbalances between its regions.”. For the period 2007-2013 the [Cohesion Policy](#) that guides the operation of the ERDF emphasised the need to stimulate and enhance Research and Innovation capacities, while for the 2014-2020 period, research and innovation were among the [four thematic priorities of the ERDF](#). Therefore, different [guiding](#), [technical](#) and [policy](#) documents from EU institutions have advanced the development of synergies between different sources of financing to strengthen the scientific and technological development and increase participation in future framework programmes of countries lagging behind.

The information available in the open data portal of ESIF allowed dissecting the investment in health research (Figure 11). The data show that **those EU-13 countries that had a low participation in the FP7 and H2020 framework programmes make greater use of ERDF** than EU-15 countries. The amounts are comparable to those received through the framework programmes, with Poland being a major beneficiary.



The **prominent position of Poland** in the use of ERDF to finance R&I in the area of medical and health research, is in line with a recent report for the period 2014-2020 ([Dubas-Jakóbczyk & Koziel 2022](#)). The importance of these funds for Poland is evidenced by considering that about a third of the capital investment in health in Poland comes from this source of financing, mostly invested in **hospital infrastructure** (Dubas-Jakóbczyk & Koziel 2022).

4.7. Academic and healthcare workforce migration contributes to the gap

The impact of research funding on the mobility of the scientific workforce is complex but highly relevant in the discussion of inequalities. The ability of countries to circulate, attract and retain their intellectual capital is essential for their economic development ([Kerr et al., 2016](#)) which in turn contributes to infrastructures and capacity to attract funding. Two major factors have contributed to migration of health research workforce, i.e. the 2004 EU enlargement and the 2008 financial crisis.

One of the main transformations of the European research constellation was the EU enlargement in 2004 with the inclusion of 12 new member countries. The new opportunities for **mobility towards countries with a higher research intensity** and capacity led researchers away from the newly incorporated Member States. This migration not only led to a loss of workforce in these countries, but also actually resulted in a reduced intensity of previous international collaborations ([Doria Arrieta et al., 2017](#)). The most internationally oriented researchers leaving their country could explain this **loss of previous cross-border collaboration**.

The **2007-2008 financial crisis** also profoundly affected migration of the intellectual labor force. An analysis of the loss and gain of workers with tertiary education in 30 European countries found that e.g. **Greece, Ireland, and Spain**, which had a balance in the mobility of their workforce before the 2000-2008 crisis, had a net loss of graduates in the post-crisis years ([Zhang & Lucey 2019](#)). **Portugal** and to a certain extent Spain had a **lower capacity to retain researchers**, compared to Finland and the Netherlands ([Santos Horta & Heitor 2016](#)).

The loss of workforce in Portugal occurred after a **substantial increase** in the hiring of researchers and research staff between 2005 and 2008. Government initiatives to align its research and innovation policy in accordance with the EU goals had led to mobilizing public resources and reaching a goal of 7.2 researchers per 1,000 active inhabitants in 2008 ([Hasanefendic, 2017](#)). However, with the commitments made with the Troika (the European Commission, the European Central Bank and the International Monetary Fund) to apply cuts to public spending and a new government elected in 2011 focused on macroeconomic stabilisation, Portuguese scientific development ceased to be a priority in the post-crisis years.

The mechanisms behind the loss of workforce in Greece show many similarities. Due to budget cuts stemming from the 2008 crisis, the number of Greek academics abroad increased from 120,000 in 2010 to an estimated 150,000 in 2013 ([Trachana, 2013](#)). The reasons for emigration were primarily better career prospects and advanced research possibilities, against scarcity of attractive jobs in Greece.

The medical and healthcare force also **migrates towards rich EU countries**. As an example, the Greek austerity policy generated a paradoxical imbalance in the health sector in terms of supply and demand for the medical workforce ([Ifanti et al, 2014](#)). The lack of job opportunities and the search for a specialty has displaced Greek doctors to Germany, the United Kingdom and the Scandinavian countries given the high demand in those countries for medical personnel (Ifanti et al, 2014).

4.8. Strategies to close the gap: three cases

Both the EU-13 countries and the EU countries most affected by the 2008 crisis developed strategies to close the research and innovation gap, **aiming for excellence and investment** as in these collected views.

Greece. Costas Fotakis, former alternate Minister for Research and Innovation, talked in an interview ([Maragkou, 2015](#)), about the importance of **collaboration** with leading European research organisations, and the advantage of having two **leading institutions** in Greece:

"FORTH and the Centre for Research and Technology Hellas are among the top 20 European centres regarding competitiveness through participation in FP7, while the National Centre for Scientific Research, Demokritos, is in the top 50."

As well, the former Greek minister spoke of the need to **simplify and adjust the legal and administrative frameworks** to the needs of research and innovation (Maragkou, 2015):

"...it is crucial that we pursue not only scientific but also entrepreneurial quality; towards this latter point we need to improve the legal and financial frame for research and innovation, which is most likely the weakest part of the chain. Our priorities include the establishment of rules adapted to the specific needs of research work."

Fotakis also mentioned how **Structural Funds** could be used to **support poles of excellence and reverse the brain drain** that affects Greece (Maragkou, 2015):

"Through the EU Structural Funds, we have planned targeted calls for supporting researchers at the pre- and postdoctoral levels, as well as reinforcing poles of excellence, which could be attractive to talented young scientists and also well-established researchers."

Estonia. In an interview for Nature ([Schiermeier, 2019](#)), the Estonian scientists Jüri Allik and Martin Zobel and Jaak Aaviksoo, former rector of the Tallinn University of Technology, narrate how the scientific development of Estonia is linked to a profound **Western-oriented reform**, motivated by the desire to consolidate its independence. Despite the progress made, science and innovation in Estonia are deeply dependent on EU resources with almost half of the research budget coming from **EU funds** (Schiermeier, 2019).

Hungary. Similar to the case of Estonia, the modernisation of the Hungarian research and innovation system was mainly aimed at displacing the academic structures of the communist regimes and replacing them with a **western model of science**. In an interview for Nature ([Schiermeier, 2011](#)), József Pálincás, then president of the Hungarian Academy of Sciences (HAS), spoke enthusiastically about the reforms that were taking place.

"Many of our present institutes have a mundane office air about them when they should be inspiring academic hubs... Without more pronounced teamwork and competition we will lose our foothold in the world's scientific community."

The reform was intended to transform the HAS into a network of interdisciplinary research centres similar to the Max Planck Society (Schiermeier, 2011). This reform was accompanied by a historic increase in **government funding for science and innovation**. More recently, Pálincás, president of the National Research, Development and Innovation Office (2015-2018), instituted a public funding system for research based on academic merit, which according to Pálincás "creates a lot of tension in the community, but without such serious selection science won't work well" ([Abbott, 2017](#)).

However, the modernisation process of science and innovation in Hungary is vulnerable to political tensions in the country. In 2019, the Ministry of Innovation and Technology sought to use the 17 billion forint (US\$60.2 million) destined to pay the running costs of the HAS to finance specific calls ([Abbott, 2019](#)). The president of HAS commented (Abbott, 2019):

"This was unacceptable... we would be competing for our own running costs — we wouldn't be able to propose spectacular science, and spectacular science is what we need to be doing."

4.9. Summary and conclusions

Our results do not show a substantial progress between FP7 and Horizon 2020 in terms of a growth in the participation of the group of EU-13 countries in the collaborative research projects. However, important shifts are visible at Member States level. Some countries increased their participation while others did not. Interestingly, in the ERA networks and research infrastructures, profiles of participation are more balanced than those in the networks funded at EU-level.

Regarding underlying mechanisms, the data point to the major role of individual Member States policies, as also expressed in some collected views. Inequality in participation in the health research programmes among EU-13 countries is related to [long-term structural processes](#), but also to elements specific to health research. One is the strong link to the healthcare and its workforce migration, where several countries lose skilled workers.

Future investments into the health care system through [EU4Health](#) and [NextGenerationEU](#), could contribute to increasing the participation of EU-13 countries in clinical research. For research, the planned ERA Health and Member State collaboration could strengthen national research capacity. This will however not succeed without local structural measures. Another element is choices in research priorities and alignment with the EU strategies in health and research with emphasis on clinical implementation and digital health, which are example areas for the growth in the participation of the countries of the EU-13 group.

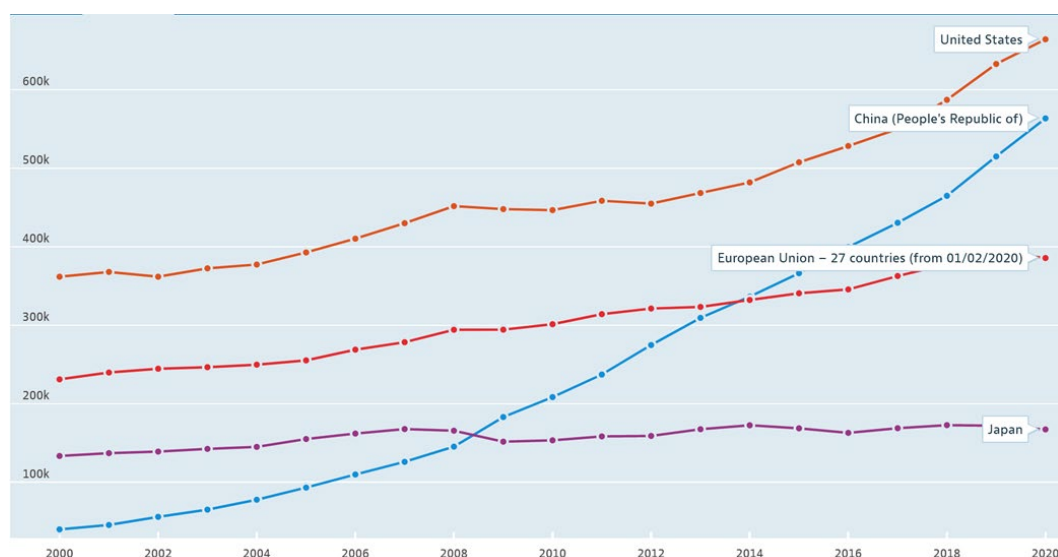
Increased and better use of the ERDF to finance medical and health research could help to decrease the gap in participation across the EU. A more inclusive participation will thus foremost depend on national policies but will be supported by access to EU funds that strengthen local research infrastructure and capacity, and by enhanced partnerships between Member States.

5. EU health research funding - global competitiveness and leadership

5.1. Growth of R&D investment in the EU is slow

Public investment in health research by governments is part of a larger investment and total expenditure in R&D. As a starting point, Figure 12 shows the importance of the EU, but also the **predominance of the US and fast growth in China**.

Figure 12 – R&D expenditure in the top world economies (million USD)



Source: [OECD \(2022\), Gross domestic spending on R&D \(indicator\)](#).

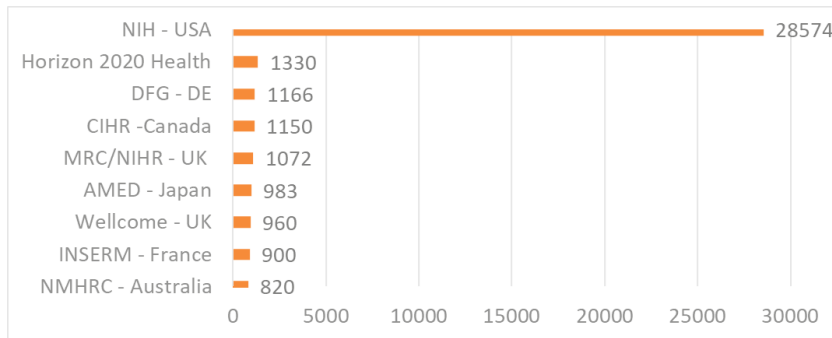
5.2. EU funding among top 10 of world-wide public investment in health research

We next analyse the position of the EU as a public funder for health research through the framework programmes, in a comparison with other well-defined public and charitable funding bodies for health research.

A 2016 study identified the top funders of health research in the public and philanthropic sector, who together represent 40 % of total expenditure ([Viergever & Hendriks, 2016](#)). These included the [National Institutes of Health](#), NIH, the European Commission, the [UK Medical Research Council](#), [Inserm](#) in France, the [Canadian Institute for Health Research](#), CIHR, the [Wellcome](#) foundation, the [Australian National Health and Medical Research Council](#), NHMRC, the [Howard Hughes Medical Institute](#), HHMI, and health research in the [German Science Foundation](#), DFG. We directly accessed the latest available data on public websites of these major funders for 2019 to extract health research investment (Figure 13).

These data confirm, unsurprisingly, the **predominance of the NIH as single governmental funding body for health research in the world**. The data also show that as a funder, the EU framework programmes are on a par with several other national funders in EU Member States.

Figure 13 – Reported spending on health research in 2019 (million EUR)

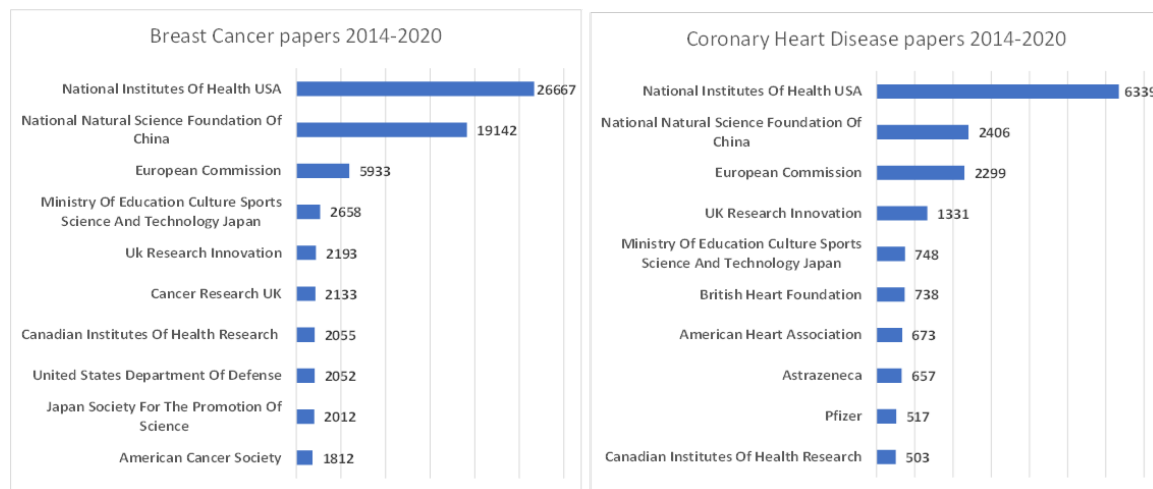


Source: Authors, extracted from public annual reports.

Extrapolating to health research funding by country, introduces the **complexity** as well as **concentration** of some of the major funding. E.g. in Germany, DFG funding is complemented by funding at state level. In the US, the NIH funds are complemented by disease-oriented charitable funding, as well as by foundational investment, e.g. HHMI, the [Bill & Melinda Gates Foundation](#), BMGF, and others. In the UK, the Wellcome foundation, even if a global funder, largely spends within the UK and complements MRC/NIHR funding for health research, probably putting the UK in the second position for health research funding by country.

We further analysed the **impact of the EU health research funding** to that of other major funders by **comparing publication output**, in the areas of breast cancer and coronary heart disease, as indexed in the Web of Science, and identified their ten main sources of funding, including from China (Figure 14). The graph confirms the **lead of the NIH, but also of China**. On the other hand, the **impact of EU funding appears larger than expected from the investment**. Funding as shown in Figure 13 suggests 1: 25 ratio to NIH, whereas publication output (Figure 14) is a 1:3. This could be specific to the disease areas, but another hypothesis is that EU funding is targeting high impact research. Of note, these disease areas are also funded by impactful charitable and scientific organisations.

Figure 14 – Main sources of funding by number of publications

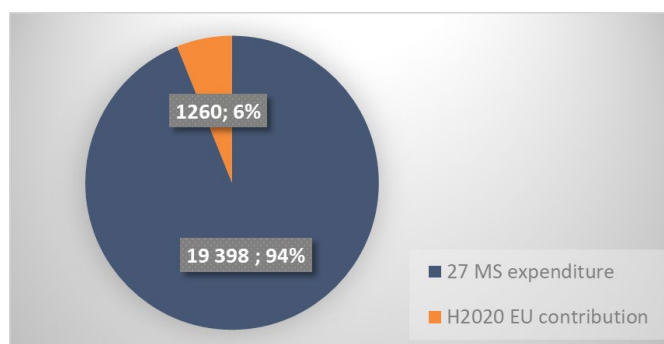


Source: [Web of Science](#) extracted by the authors.

5.3. Impact of EU is through the ecosystem with Member States

At a world scale, the impact of the EU comes from the entire health research investment, i.e. EU funding and Member State investments. Compared to public funding of research by Member States, **EU funding constitutes only a fraction of the total expenditure within the EU**, estimated at 10-15 % depending on the field. The data for 2020 shown in Figure 15 are probably distorted by increased national spending related to COVID-19 but underscore the large Member States contributions to health research.

Figure 15 – Public expenditure of the Member States vs EU contribution to the financing of health R&D in 2020 (million EUR; % of total)



Sources: [Eurostat. Government expenditure on health](#), and [Horizon 2020 Dashboard](#). Extracted by the authors.

When we add the public spending of the Member States on health research to the contribution of H2020, the 2020 funding for health research reaches €20 billion, an amount close to but still substantially below NIH investment.

5.4. Impact of EU health research through funding of cross-border collaborations

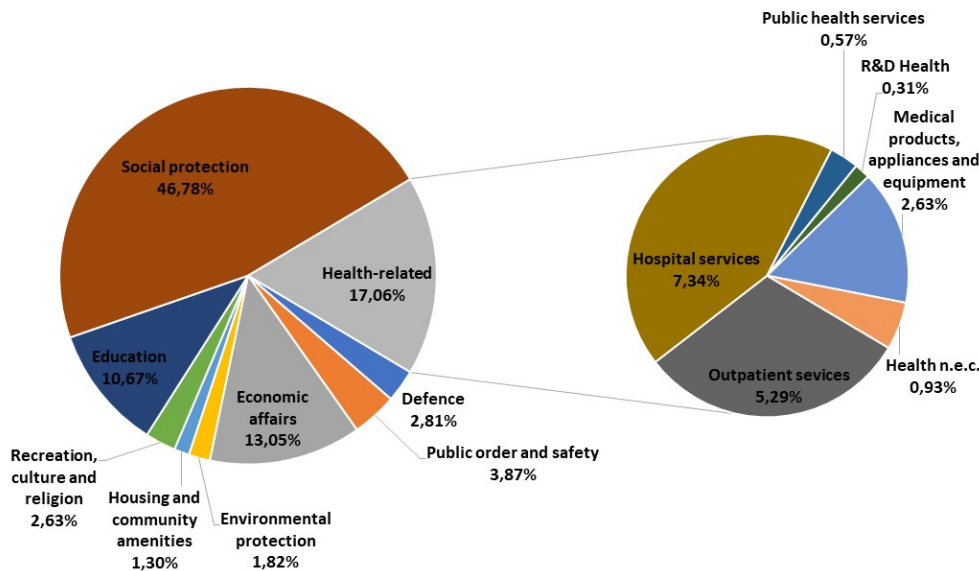
In contrast to the limited financial share of EU framework programmes to total funding (Figure.), the **EU is the major funder of cross-border collaborative research**. Member States funding is mostly entirely spent within the countries. Member States engage in bi and multi-lateral agreements but only few agencies fund costs of international collaboration in another country. The impact of international collaborations can be measured in analysis of publications, and in the contribution of international clinical research to establishing value, through efficacy and safety, of new treatments. For the latter, **public funding is essential to support clinical research that is of no commercial interest**. The European Medicine Agency puts the number of **studies without industry sponsor at 40 % and even higher during Covid-19**.

5.5. Research in EU Member States is linked to healthcare

Much of the health care innovation, whether evaluating **new treatments** or introducing new products in diagnostics and care, relies on **research and development inside regular health care activities and structures**. As well, regular health care is the setting for **clinical discovery research**, interactive translation and use of **real world data** is a research tool. Therefore, there is a continuous interaction between research and practice, as well as with public health. The provision of health care is in most countries one of the major public expenditures, far exceeding the investment in health research but also intricately linked to the research activities ([Bouillon et al, 2015](#)).

Recent data from Eurostat include **health research spending by Member State governments inside the total spending on health services** (Figure 16) and confirm that **research expenditure is but a fraction of the health cost**. Of note, these figures as total national spending indicate that **analysis of single agencies, are incomplete** to estimate the total expenditure.

Figure 16 – Average expenditure in the EU27 in health research as % of total government spending in 2020



Sources: [Eurostat. Government expenditure on health.](#)

Health expenditure and health research investment run largely parallel, reflecting foremost the global distribution of wealth, but there are **important links between investment in health care and research capacity**. A **competent workforce**, good infrastructures, better **data availability**, are settings that **support clinical research, promote international collaboration** and further boost national performance. As an example, the **investments in health care in China** in the last fifteen years are now translating in larger participation in clinical research and are attracting attention from the [pharmaceutical industry](#) as well. More recently, [Chinese investment](#) in digital technologies and access to large amounts of health data will contribute to this trend.

5.6. Weak coordination and leadership for EU health research

5.6.1. Leadership for health research within the EU

The European Commission is responsible for strategic planning and execution of the health research programmes funded under the regulations of Horizon Europe. To this end, the Directorate-General staff works with the **Programme Committees (PC) with representatives from MS**. Together they develop the strategic planning, the work programmes and implementation. Different sections of Horizon Europe have dedicated PCs, e.g. for ERC, EIC, Research Infrastructures, and there is a PC for strategic overview and coherence, including missions. There is one [PC configuration for funding through the cluster Health](#). Within these PCs, Member States may delegate representatives that are closest to the topic e.g. in health, and Member States can also include experts in their attending representatives. Of interest in the search for coherence, the PCs for Health include **EC staff from different DGs** relevant for health research, i.e. from SANTE and CONNECT. Co-administration of the

research programmes by DG RTD, DG SANTE and DG CONNECT has also led to the implementation of the Health and Digital Executive Agency, [Health and Digital Executive Agency, HaDEA](#).

DG RTD organises consultations about the annual work programmes and [R&I days](#) that are open to all. However, **under Horizon Europe there is no formal scientific or stakeholder board or leadership for the cluster Health**. High-rank DG RTD staff represent the EU funding programme in external meetings.

In contrast, **public-private partnerships** have dedicated **boards and executive directors**, to set out strategies and monitoring of the programme outputs and directions. As an example, the [Innovative Health Initiatives Joint Undertaking](#) has an Executive Director and a Governing Board, consisting of EC and industry members, further supported by the **Science & Innovation Panel**. Together and with stakeholder consultation, they develop a Strategic Research and Innovation Agenda.

A novel **public-public partnership** under Horizon Europe is the **ERA - Health**, a public-public partnership. The proposal identified several key areas. The governance will be jointly by EC and Member States, and funders that could be part of the ERA. At this time, investigator-initiated clinical research will be a focus for the first two years to be subsequently evaluated. For **future governance, a Strategic Advisory Board is to be installed**.

As part of the FPs, ERC has a special place, with a governing body in the [ERC Scientific Council and President](#), **formal representative of ERC**. However, within ERC funding is based on excellence, and not guided by strategic priorities for health.

Among the [Chief Scientific Advisors to the European Commission](#), a **profile in health research is absent**, even if the group has a strong link to the academies with a special link to [Federation of European Academies of Medicine, FEAM](#), for scientific advice.

5.6.2. EU leadership in global perspective

The EU health research programmes have a proper governance structure according to the regulation with strong involvement of Member States. However, to ensure strategic impact, **leadership with experience and credentials are major assets**. One of the **strengths in the US** is the long-term commitment to a **scientific profile of the leadership** of the major agencies for health and health research, i.e. the [NIH](#), the [Food and Drug Administration](#) (FDA) and the [CDC](#). In the EU, the agencies **EMA** and **ECDC have a scientific leadership** in addition to the executive director and board. These EU agencies find their **partners in the global dialogue** with their equivalent in the US (FDA, CDC) and other countries.

For the health research programmes under **Horizon Europe, an equivalent leadership with the visibility and credentials as for NIH is missing**. Several conspiring reasons can be named. Within the EU, there is no formal coordination between the EU funding programmes and the Member States funding agencies notwithstanding contacts within programme committees. An **independent platform for health research coordination** between Member States with representatives for health research at national level, was part of the [former European Science Foundation](#) but is **no longer active**. At global level, the European Commission takes part in meetings with NIH through the DG RTD staff, and large funding agencies of Member States participate in their own capacity. Of note, even at **global level coordination of health research remains weak or lacks transparency**, as [noted in 2011 by Viergever](#). Although the [WHO launched a platform](#), the information is not up to date.

5.7. Summary and conclusions

In terms of investment, the EU holds an important portfolio of health research funding through its framework programmes, putting it at par with other leading national funding agencies, but not the US or China. However, considering the size of investment of the EU together with Member States a much larger role could be assumed in world competitiveness, where China is growing at a fast rate, though this may require intensified coordination.

Major impact of EU investment in health research lies in its support to EU-wide cross-border collaboration where Member States have limited possibilities. Ways forward are to strengthen EU-wide collaborations in health research with appropriate budgets and coordination. Options are strengthening within the framework programmes or under a dedicated health research structure.

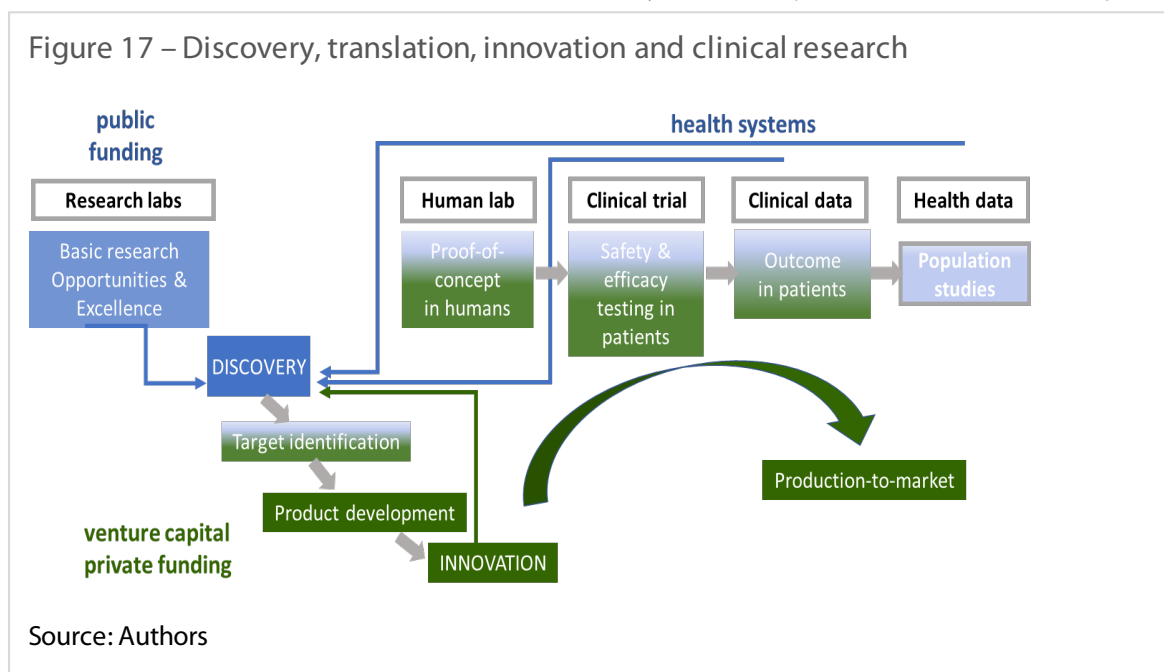
A second important element is the embedding of health research within the healthcare system, with mutual interactions and benefits for investment. In many Member States, research and health care are silos under different Ministries, and at EU level as well, cross-agency collaboration is in its infancy. Yet for progress in health, a closer coordination could be pursued, where the EU could take guidance through example programmes such as in rare diseases, and cancer. Another possibility lies in the future European health union, which could strengthen the health and research interaction.

Thirdly, looking within the EU as well as at the EU as partner in a global health research perspective, health research would benefit from a strong, visible leadership and science-guided stakeholder input into the strategies. Member States could rebuild a platform for coordination and support a leadership structure with the EU for global interactions.

6. Challenges for translating research into better health

6.1. The pipeline from discovery to innovative products

This section give a brief review of the pathways for drug development. It is an area where **public funding has a major role in the early stages of discovery and preclinical research**. For product development, private actors, biotech and later industry, have a major role, as illustrated in Figure 17.



To bring products to the market, evidence for safety and efficacy requires clinical trials, which rely again heavily on the **access to excellent clinical research facilities, supported by public funding**.

6.1.1. The translational gap

An analysis of the translation of biology discoveries into treatments in the European context found that the EU *“has lagged in its translational performance versus the US”* (Barker & Scannell 2015). One reason put forward was that in the EU the *“current translational thinking is based too much on the push model of innovation, with a linear progress from genomics to target to drug to approved treatment.”* This has led to the so-called European paradox consisting of the extraordinary capacity of the EU to generate scientific knowledge in biomedicine and its relative inability to transform that scientific knowledge into innovations (Aarden, Marelli & Blasimme, 2021). Among the causes of the European paradox would be a fragmentation of the R&I ecosystem where the different actors are seen to work in silos (Aarden, Marelli & Blasimme, 2021).

To address this fragmentation a first approach is a **structural organisation**. Within the **US**, this approach has generated several large **dedicated institutes with long-term structural funding**, such as the [Harvard Catalyst](#) for or the [Duke Clinical and Translational Science Institute](#). In these institutes, academia, clinical researchers and supportive research facilities are brought together and work closely to biotech. NIH has itself launched the [National Center for Advancing Translational Sciences](#), NCATS. Among the **EU Member States**, an example of a dedicated institute is the [Luxemburg Institute of Health](#) which has a major focus on translation.

A second and complementary approach is **incentivising translational research in temporary alliances for specific medical needs**. This is the approach taken by funders, supporting projects of variable scope and duration, including the EU, but with variable commitment. In Germany, **long-**

term structural funding supports the [German Centers for Health Research](#), with a major emphasis on translational research from T0 to T4. Under **EU support**, an example of success of translational research in **mixed approach of structural organisation and dedicated funding** in the EU is the International Rare Diseases Research Consortium, which is a global consortium with multiple funders, including the EU, and which focuses on drug development ([Lochmüller, 2017](#)). Whereas the goal of 200 new therapies was reached early, new drug development is **still in need** of acceleration ([Hivert et al, 2021](#)). A positive outlook is the development of new drugs for cystic fibrosis, moving from products that act on the symptoms of the disease to new therapies aimed at cause of the disease ([Ponzano et al, 2018](#)). This development requires greater collaboration between patient organisations, academia and industry.

At present, **collaborative health research in Horizon Europe emphasises late stages of translation**, with discovery research referred to the ERC program. ERC itself seeks translation in its proof of concept programme and seeks links to the EIC. In the US, the NIH has launched a funding stream for translational research in addition to its NCATS, and modelled on the success of DARPA: ARPA-H ([Thorp, 2022](#)). There are **no dedicated EU health research institutes** with a similar inclusive design to cover the pipeline from discovery to patients as seen in the US or at Member States level, but the **EU supports structures for networking in public-private partnerships**, like the [EIT Health](#), with a long life-time. These also focus the later stage of translation and product development. According to its most recent [work programme](#), [EU Mission Cancer](#) will closely involve citizens in its preparation, implementation and follow-up along with the participation of academics, entrepreneurs, social partners and public administrators as co-designers, co-developers and co-implementers, thereby implementing a [quadruple helix social innovation model](#) to increase impact.

6.1.2. Regulatory challenges for innovative medicines and devices

The **regulatory environment** is crucial to facilitate product development for eventual market access. Major efforts have been made in the EU to ensure quality for medical products, be it diagnostics, drugs, biologicals or devices, through regulations and directives, many still under development. The impact of these regulations needs monitoring to ensure that not only the EU provides optimal quality but also remains competitive, especially in the area of innovative biologicals and devices.

In the regulatory challenges, special attention goes to **advanced medicinal products** (AMP) that could transform medicine yet run against regulatory hurdles. A survey of advanced therapy medicinal products in clinical trials during 2010-2015 found that the number of clinical trials of advanced therapies is slowly increasing in the EU through of projects carried out mainly by small and medium-sized companies, academia and hospitals ([Boráň et al, 2017](#)). More recently, the [Alliance for Regenerative Medicine](#) (ARM), the [European Federation of Pharmaceutical Industries](#) (EFPIA) and the [Associations and European Association for Bioindustries](#) (EuropaBio) made a call for more effective regulation of clinical trials with advanced therapy medicinal products pointing out the difficulty for multicenter clinical trials given the **discrepant regulations between Member States** ([AMR et al 2021](#)). One of the most widely discussed AMP is CRISPR genome editing technologies. A [2022 STOA](#) study reviewed legal aspects of genome editing of the human germline, given that such **genetic modifications** are inheritable. Another recent study has documented the legal restrictions in various countries, identifying two large blocks ([Nestor & Wilson, 2022](#)). On the one hand, in several EU Member States, Australia, Brazil and Canada germline genomic editing is prohibited, while in China, the UK it is possible though within a strict regulatory and institutional framework. The [European Group on Ethics in Science and New Technologies](#) points out the **lack of robust structures of inclusive governance** that allow the participation of geopolitical actors, scientific disciplines, stakeholders extending to the wider public in this debate.

While the institution of a new [pharmaceutical strategy for Europe](#) aims to facilitate medicines development, whether all hurdles will be removed is uncertain. The proposal also highlights the role of academic researchers to promote and develop repurposing of off-patent medicines for new therapeutic uses. With examples from the area of rare diseases, health care professionals have highlighted the hurdles for academic research with insufficient resources and difficulties navigating the regulatory complexities ([van den Berg et al, 2021](#)).

6.2. Clinical studies without commercial interest

The linear model of clinical and translational medicine for product development does not fit all needs and opportunities for better health. **Many research questions and consequent changes in treatment and health policies, are not of commercial interest** and do not require new products. Examples are testing an existing drug for a different purpose, as for Covid-19, adapting the duration and dosage of treatment, or the combination of medications with surgical interventions. These studies **start from medical needs and clinical observations**, they are **initiated by the medical professional and research community** and have large public interest, but no commercial interest. Such studies, referred to as Investigator-initiated clinical studies, IICS, are hampered by a regulatory web aimed at regulating and promoting the processes of innovation of the pharmaceutical industry according to a recent analysis ([Lacombe et al, 2020](#)). The study points out a series of **regulatory obstacles** that limit non-commercial academic clinical research (Lacombe et al, 2020). These include the **high costs** of procedures and insurance of the required patients required of academic research at a level comparable to that required of the pharmaceutical industry, the **regulatory fragmentation between the Member States**, and the obligation to comply with the **requirements of at least four European directorates-general**.

In line with these observations, a study on the regulatory fragmentation of health research in the European Union concludes that "*the **current risk-based system of health research regulation is insufficiently responsive to the ultimate objective of realizing social value from human health research***" ([Frowde, Dove & Laurie, 2022](#)) This analysis proposes a processual approach to promote on-going evaluation of the guiding principles, rules, and regulatory instruments (Frowde, Dove & Laurie, 2022). In practical terms, the proposal implies that regulators might implement feedback loops of continuous cycles of learning, adaptation, and training to improve the efficiency of regulation.

Earlier this year, the European Commission, the Heads of Medicines Agencies and the European Medicines Agency launched [an initiative](#) to speed up clinical trials in the EU. The initiative recognises that "*about 40 % of clinical trials are sponsored by academia, often small and nearly all mono-national with a recent shift to more academic trials being done during the COVID-19 pandemic*" and proposes to strengthen clinical trials that deliver decisional for public health crises and pandemics and promoting larger, multinational trials specifically in the academic setting.

On the other hand, the [European Clinical Research Infrastructure Network](#) (ECRIN) promotes the performance of multinational academic and independent clinical trials by offering researchers support to overcome the aforementioned barriers in "*the preparation of applications for funding, protocol evaluation, trial management, quality assurance and more.*" However, **not all EU countries participate in ECRIN**.

6.3. Use of health data in research and innovation

Health data as available in medical records, national databases and dedicated registries offer a wealth of possibilities for **population health monitoring** and **guiding public health policies**, but also for **discovery research driving innovation and better clinical care**.

Hurdles for accessing the data and use at EU level include **technological hurdles** and **regulatory challenges**. The regulatory environment for health data in the EU is complex and part of the larger regulation of personal data under the [General Data Protection Regulation](#), GDPR. Despite being a regulation, there is lack of uniformity across the EU when collecting data. On the technological side, [a June 2021 STOA study](#) explored policy options to create a EU health data centre, and set out how harmonisation of data structure and access could build a public-health-relevant data ecosystems and institutionally link with Member State level actors. This study connects to the proposal for a European Health Data Space launched by the European Commission in 2022. One of the main purposes of the initiative is to "allow researchers, innovators, policymakers and regulators at EU and Member State level to access relevant electronic health data to promote better diagnosis, treatment and well-being of natural persons, and lead to better and well-informed policies." Another objective of the European Health Data Space is increasing the availability of data for AI innovation and implementation ([Kiseleva & De Hert 2021](#)). However, the current ethical and legal requirements are not fully developed, and the proposal will require additional work before finalization (Kiseleva & De Hert 2021).

Although the establishment of a comprehensive EHDS will take time, **subsets of data are used in many projects for R&I**, e.g. from diagnostic procedures. Big data technologies is the ability to detect patterns and to turn high volumes of data into actionable knowledge for precision medicine and decision making. However, the application of big data in health care and research requires a huge investment effort in technological infrastructure and a high level of intersectoral coordination ([Pastorino et al, 2019](#)). The study identifies at least 11 projects for the application of big data technologies in the area of public health and 8 in oncology that have been supported by the European Commission through its Framework Programmes (Pastorino et al, 2019).

Among the Member States, there are **several national initiatives** to promote the application of big data technologies, such as the French Health Data Hub initiative (a top-down approach focused on a shared computational infrastructure) and the German Medical Informatics Initiatives ([Cuggia & Combes, 2019](#)). Estonia for its part is an example of how the convergence of ambitious government policies for the implementation of a biobanking initiative in conjunction with public support for the use of medical data, has boosted the development of precision medicine in Estonia ([Prins et al, 2021](#)).

6.4. Summary & conclusions

As illustrated during Covid-19, several domains of health research are essential for preparedness and tackling future health challenges, i.e. translational research and product development, clinical research for assessing new products and therapies without commercial interest, and use of data for health monitoring. In each, there is a need to reduce bottlenecks.

First, in the pipeline from discovery to innovative products, the EU lags behind in its support for translational research and long-term commitment. Long-term funding in areas of need could build on the existing model for rare diseases, or of translational research centres in Member States. The regulatory environment must keep the EU an attractive place for research and innovation, and must serve patients' needs.

Second, clinical research to benefit patients and society but without commercial interest should be facilitated. It is necessary to develop a coherent, procedural and adaptive European regulatory system in perpetual communication with stakeholders and aimed at satisfying the needs of patients.

Third, access to and responsible use of health data is a work in progress, where presently different initiatives run in parallel, led by different actors, and in need of coordination and leadership.

7. Will the future European health union address health research?

7.1. Aims of the European health union

Although health, in particularly healthcare, is not an EU competence under the current treaty, many aspects of public health, medicine development and protection of citizens provide a legal basis for pro-active measures towards health policies. Following Covid-19, the President of the European Commission thus launched the initiative for building a [European health union](#) (EHU). Concrete measures focus on the **preparedness and response role of the EU** in times of crisis to cross-border health threats. The EHU has already implemented two regulations, i.e. [strengthening of the mandates of ECDC](#) and [of EMA](#), and two more proposals for regulations are under discussion, the [European Health Emergency preparedness and Response Authority](#) (HERA) and the [European Health Data Space](#) (EHDS). Initiatives for a [Pharmaceutical Strategy for Europe](#) and [Europe's Beating Cancer Plan](#) are also being developed. The [EU4Health Programme](#) is an important, but not the only, financial instrument to fund the initiatives.

The EU4Health [2022 work programme](#) budget reflects the EHU aims. Of the €835 million budgeted in the 2022 program, the largest amount is intended for preparation for tackling health emergencies, supporting HERA and tackling antimicrobial resistance (AMR). The second general strand of the 2022 budget, is cancer, financing all aspects from health promotion and cancer prevention to the development of new treatments, the reduction of inequities and the quality of care for patients' lives.

Building the EHU is at an early stage. [Nabbe & Brand \(2021\)](#) formulate possible scenarios regarding the evolution of the EHU which included a move towards supranational actions and increased efficiency, but also the risk of no change or even increased fragmentation of the EU.

A study from the Bruegel think tank provides a detailed analysis of the potential advantages and challenges of a greater integration of the protection of the health of the population of the European Union ([Bucher, 2022](#)). The **study concludes that the EU should deepen the EHU approach, including for health research**. It should improve health security, take advantage of economies of scale in research and knowledge at EU beyond infectious diseases for non-communicable diseases, including surveillance systems. The scientific knowledge that supports sectoral legislation, and monitor health inequalities, including those related to access and quality of care, could be better coordinated and consolidated.

7.2. Will the initiatives strengthen the coherence of health research in the EU?

The strengthening of existing instruments, the amplification of the Health programme and the creation of HERA are primarily intended to increase cooperation and effectiveness in addressing cross-border health threats and infectious disease in particular. They align with the commitment of the EU for better health for its citizens. Since research and science underpin better health, it is important to examine how these instruments answer the needs and challenges for future health research set out above, which extend beyond preparedness for health crises, and to highlight where more is needed.

7.2.1. Strengthening of ECDC & EMA

The regulation for ECDC is welcomed, but many **stakeholders called for an extension** of monitoring beyond infectious diseases, which would greatly support research and innovation. The

second regulation for EMA is also welcomed as it would facilitate clinical research and navigation of the regulatory framework. Nevertheless, a number of stakeholders feel that this could further be developed, e.g. articulated by the [European Patients Forum](#).

FEAM, in [its statement on the reinforcement of the mandate of the ECDC](#), suggests new ways of articulating the functions of the ECDC with scientific research in health. In particular, the FEAM recommends, on the one hand, recognizing and promoting the importance of informal scientific networks which also help with data exchange, especially during health emergencies. Reformulate the proposal for an ad-hoc advisory committee in such a way that it offers an impartial response to the need for a clear and multidisciplinary scientific orientation

7.2.2. Health Emergency Preparedness and Response Authority

The HERA has the mission to "*improve preparedness and response to serious cross-border threats in the area of medical countermeasures*". It takes example from the US [Biomedical Advanced Research and Development Agency](#) to increase capacity and readiness.

HERA's potential impact on the landscape of healthcare and biomedical research has resonated with both academia and industry. The Federation of European Academies of Medicine (FEAM) and Wellcome Trust [pointed out](#) that the creation of HERA "*is an opportunity to harmonise the European research and development landscape for pandemic preparedness and rapid response capacity*" and ask for more coordination with the existing research programmes.

Despite the optimism, a study from the Institute for Advanced Studies in Vienna warns that in order to mount a better and more coordinated response to the next pandemic, HERA will need to **reach out beyond the EU and broaden its focus** ([Reiss, 2022](#)). HERA will have to connect to international organisations and non-EU national agencies, and develop adaptive strategies to a broad spectrum of threats, including AMR and health consequences of climate change.

[Anderson, Forman & Mossialos \(2021\)](#) for their part, points out that one of the main challenges of the HERA will be to develop an approach to funding **research and development that stimulates innovation** for health technologies, including vaccines, medicines, and diagnostics. However, the same authors warn that **research funding may be insufficient compared to US initiatives** like Biomedical Advanced Research and Development Authority (BARDA) whose budget was €1.4 billion in 2021 ([Anderson, Forman & Mossialos, 2021](#)).

Rather than an externalized agency like ECDC or EMA, which could audit and make recommendations to national institutions regarding emergency preparedness, HERA will be a unit within the Commission. Although an Advisory Board is foreseen, **scientific leadership and external participation are less prominent**. The [European Parliament has expressed concern](#) about having less oversight with the current institutional arrangement of HERA.

7.2.1. The European Health Data Space

In 2022 the European Commission submitted a [proposal for the regulation of the EHDS](#). One of the main purposes of the initiative is to "*allow researchers, innovators, policymakers and regulators at EU and Member State level to access relevant electronic health data to promote better diagnosis, treatment and well-being of natural persons, and lead to better and well-informed policies.*"

A study by the [European Alliance for Personalised Medicine](#) (EAPM) cites a number of prerequisites for success. Important are the possibility for free data movement and to perceive the true potential of health data as an investment, pragmatically building a framework to achieve the maximum possible benefit for patients and for public health ([Horgan et al, 2022](#)).

On the other hand, a study that compares the main data sharing rules of four Member States (Germany, Greece, Latvia and Sweden) on the basis of the respective provision of the GDPR indicates

that **regulatory diversity is detrimental to the exchange of health data at the EU level, and unclear and vague terms of the GDPR lead to poor harmonization** ([Molnar-Gabor, 2021](#)). The EHDS framework considers the development of a code of conduct for the primary and secondary use of health data as a means of harmonizing national regulations. However, a code of conduct cannot by itself overcome the lack of harmonization in legal provisions of Member States, although it can serve to clarify essential terms.

The [BioMed Alliance](#), [EFPIA](#), and the [Guild](#), have expressed their concerns regarding the legal uncertainties that affect researchers related to GDPR and have proposed the clarification and harmonisation of the legal framework of the European Health Data Space. [Shabani \(2022\)](#) has pointed out the pending legal challenges for the use of personal data in health research. These include the balance between the public interest in health research and the specific rights of individuals. Another challenge is to define the primacy of public interest in academic and industrial research. Although the concept of data altruism has been introduced in the legislation, it has not been sufficiently developed from ethics and social sciences.

7.2.2. A novel pharmaceutical strategy

A new [pharmaceutical strategy for Europe](#) aims to ensure the quality, availability and safety of medicines while **strengthening the European pharmaceutical industry**. This new strategy will seek to establish interdisciplinary collaborations that would also include the **participation of patients, regulatory bodies, and providers/payers of health services**. However, in their analysis, [Garattini, Natsis & Banzi \(2021\)](#) point out the necessary changes to the way in which health research is organised and regulated. These include shared agendas across all stakeholders, a critical review of Intellectual Property rights and sharing, and engaging academic clinical research.

While celebrating the initiative, the [Biomedical Alliance](#) emphasises the **need for complementary actions**. These are (1) long-term strategic planning to strengthen biomedical and clinical research accompanied by a visionary leadership for health and health research, and (2) to promote and finance clinical trials led by academics with public resources. The latter type of research makes it possible to address health problems that would otherwise remain outside the interest of the market.

The FEAM agrees with the Biomed Alliance on the **need to strengthen research and development in biomedicine** as an essential component of the new pharmaceutical strategy for Europe. In addition, the [FEAM emphasises a set of actions necessary to solve the problem of unmet health needs](#). FEAM proposes, among other actions: 1. Establish a European Health Research Council to coordinate the health research agenda. 2. Engage with all stakeholders, and with patients, to meet societal needs for scientific and technological knowledge in health and 3. Provide public funding for clinical research in areas that lack sufficient economy-driven innovation to respond to the health needs of society.

For its part, the [Guild points out](#) that the Pharmaceutical Strategy for Europe represents "an opportunity to develop a European Framework for Multinational Clinical Studies." To this end, the Guild suggests, among other actions, 1) a platform where a researcher can express an interest in joining multinational clinical studies, 2) invest resources in financing multinational clinical studies through Horizon Europe.

7.2.3. Europe's Beating Cancer Plan

[Europe's Beating Cancer Plan](#) is a €4 billion commitment (including €1.25 billion from the EU4Health programme). The plan includes [three flagship projects](#) that will increase the coherence of cancer research in the EU. The [Knowledge Centre on Cancer](#) will provide data and resources to feed into policies, coordinated by the [Joint Research Centre](#). The European Cancer Imaging Initiative will develop an EU 'atlas' of cancer-related images, widely accessible and deriving strength from the

latest technology in machine learning and artificial intelligence. An EU network of recognised National Comprehensive Cancer Centres in every Member State will facilitate training, research and clinical trials across the EU.

The [European Association for Bioindustries](#) points out that the **lack of regulatory coherence can limit the success** of the plan and calls to remove obstacles for clinical trials in the EU, in particular with regard to advanced products that contain genetically modified organisms.

For its part, the [European Cancer Patient Coalition](#) identifies in the initiative the possibility of increasing the **coherence of health research in favour of patients** and compares the Cancer Plan to the success of the European Reference Networks. It sees the planned cross-border cooperation as a **means to address inequalities**. In contrast, a comparative analysis between public policies in Romania and France for the prevention of breast cancer identifies **major hurdles** ([Motoi & Niță, 2021](#)). For Romania to participate and benefit, a shift from emphasis on tertiary care to prevention and primary care is necessary, as well as a public commitment to increase health expenditure ([Motoi & Niță, 2021](#)). This could signal a more general issue for EU-13 countries' participation.

7.3. EU leadership for Global and One health

Health is deeply embedded into the Sustainable Development Goals and is strongly interconnected with other challenges such as climate and environment and education. Citizens have been [advocating](#) for climate as well as for health as research priorities, recognising the intense relationships and need for a comprehensive approach. A well-recognised example is the impact of air quality on health with cardiovascular disease as one of the major hazards ([Lelieveld et al 2019](#)). Whereas air quality has been studied across different regions in the world in its multiple presentations, the problem transcends the regional level. Health is a global challenge, disease is not limited to borders and air quality is but one of many environmental and socio-economic drivers for health. Climate change impact on animal habitat and health, is linked to emerging infectious disease, and many other examples abound, consolidated in the concept of One Health ([Zinsstag et al, 2018](#)).

The European Commission's [communication](#) on the global approach to research and innovation of 2021 includes the **commitment for health research**. One set of measures are a response to the COVID-19 crisis and include expanding access to the [COVID-19 Data Platform](#), a partnership of the European Commission, Member States and research organisations, and access to [COVID-19 Tools Accelerator](#), a global partnership and WHO initiative, for development of diagnostics and care. The second is the continued support to the longer-running programmes such as [European and Developing Countries Clinical Trial Partnership](#) (EDCTP) and disease-centred collaborations. In this proposal, the EU asserts itself with values and expectations, including the economic perspectives. This has raised **concerns that the global research cooperation should remain sufficiently open** to drive health, for all ([Vallin et al 2021](#)). Resonating in this comment is the need for stakeholder engagement, including the academic community, but also citizens worldwide. The need for tackling global health entails there is strong **leadership at EU level**, as could be constructed in a European health union ([Kickbusch & De Ruijter, 2021](#)).

An analysis of documents and interviews by Bergner concluded that the **role of the EU as leader in global health is evolving** ([Bergner, 2021](#)). The EU has several assets to assume this role but **important barriers are a lack of capacity and coordination** with Member States.

7.4. Summary & conclusions

Expectations for impact generated by the commitment towards a European health union are high and several plans are still at an early stage.

The new regulations for strengthening ECD and EMA, and for HERA and the EHDS are welcomed but critical voices underscore that the plans are insufficient with regard to budget for research, to stakeholder involvement in strategic planning and leadership. There is optimism about the Beating Cancer plan as a comprehensive approach, though also concerns about the inequalities which it is not addressing. Overall however, health research plans remains restricted to a somewhat narrow focus of infectious disease and cancer. Many stakeholders find this insufficient to address the future health challenges. For all intended activities, regulatory hurdles require further action.

While a future EHU enhances the potential for the EU to strengthen its profile and assume a leading role in global health, this aspect is not fully developed.

Taken together, whereas building a EHU is an exciting and necessary step forward, for health research the regulations and initiatives are not yet addressing the weaknesses identified in previous chapters. Building a EHU is an opportunity to assume a leading role in developing global health, and complex challenges for One Health, provided proper leadership.

8. Expert views on coherence in EU health research

8.1. An interactive and dynamic interview process

A series of questions as outlined in the Methodology section, guided the interview, and the interviewees also had had the opportunity to read the working version of the study ahead of the interview. The interviewees each had specific expertise and expanded more broadly on one of other of the topics. The content of the interviews is rendered here in generalized responses underscored with statements taken from the individual interview's summaries.

8.2. Summary of responses

8.2.1. Strengthening cross-border collaborations and coherence of health research in the EU

- Experts saw benefit for a **central mechanism for cross-border collaborative health research** in the EU for a number of reasons: *"a centralised administration at European level of international collaborations in health research is a desirable goal from the economic point of view, since resource management is optimised."* In the face of global health challenges, experts point out the need to join forces *"at EU level, strengthening partnerships both public-public and those that combine public and private resources to respond to technical-scientific challenges facing the EU."*

- All experts emphasise the **importance of excellence**. Several experts mention how EU programmes of ERC and MSCA have proven to be successful producing *"transformative research results of importance for the global society – with innovation and global leadership."* They also point out the need to strengthen EU funding for health research after the loss of global leadership post-Brexit suggesting that *"the only alternative to regain global leadership in health research would be to mobilise more resources at the EU level."*

- Despite the potential benefits of a centralised administration of funds for international health research collaborations in the EU, several experts express their **concern for increased centralised financing of international collaborations at EU level**. In particular, several emphasise the possible resistance of local actors in the Member States as *"an increase in the centralization of funding for health research in the EU could be seen by both national governments and regional authorities as a reduction in their own resources to fund research."* Moreover, *"these national agencies perceive strategic funding for research at the current European level as too politicised and as a possible risk to the funding of basic research."*

In general, the experts favour the **intensification and better coordination of international collaborations between the Member States** in order to solve common challenges in the field of health research, but they offer a nuanced vision on how to achieve this goal:

- A financing strategy for health research focused on unmet strategic needs:
- Mechanisms to evaluate and guarantee the scientific excellence of international collaborations with EU funding:

It is necessary to have clear tools for the measurement and evaluation of international collaborations. In particular, it is important to promote collaborations based on excellence and complementarity and not as a mechanism for obtaining greater financial resources for research groups. Of concern are potential for ghost partnerships or continuation of ongoing research without true collaboration, while collaboration should lead to added value.

- The participation of a plurality of stakeholders in the governance of international collaborations in health research:

An alternative is to further encourage and unite international collaborations involving the pharmaceutical and health services industry, patient organisations and even philanthropic foundations in the institution of international health research consortia.

- A staggered process where the health research financing entities of the member states retain a preponderant role:

An intermediate step based on the establishment and implementation of multinational treaties for the co-financing of health... In this intermediate scheme, the national agencies will retain control of their resources but would be obliged to allocate a percentage to finance European health research networks. Those countries that do not have sufficient economic resources to participate in these co-financing schemes would receive resources from the EU so that the criteria for participation in these health research networks would not be based on the economic capacity of the countries but on the scientific excellence of research groups.

8.2.2. Addressing inequalities in participation across the EU

Some of the experts interviewed proposed specific mechanisms to increase the participation of the countries of the EU-13 group in EU health research. The opinions of the experts interviewed regarding how to increase the participation can be **grouped under opinions that favour a strategy at the EU level** and those that **consider that reforms and implementation of strategies have to come from the EU-13 countries**.

Options at EU level. An option at EU level would be the use of the European structural and investment funds (ESIF) to strengthen the research infrastructure of the EU-13 countries "*as long as the use of these resources is optimised by supporting inter-institutional networks of research made up of the most competent groups.*" Another proposed alternative would be to strengthen the "*European Reference Networks and allow their participation in the FPs in such a way that the clinical workforce of EU-13 countries can get involved in health research.*"

Regarding the actions that would have to be carried out from the **Member States** of the EU-13 group, the experts mention the following:

- The implementation of long-term policies that include the development of research capacities through the identification and promotion of pockets of excellence and the needs and priorities of the countries themselves.
- A unit or platform that provides information on available research resources and possibilities for collaboration.
- Support for bottom-up initiatives from Member States forming research networks through co-funding at EU level.
- Mechanisms that guarantee "*the quality of health research no matter where it is carried out and the free flow of scientific knowledge in such a way that countries with little participation in FPs also benefit.*"

8.2.3. Increasing coherence and synergies between funding mechanisms

The experts interviewed identified some of the main negative consequences derived from the lack of coherence between the funding mechanisms for health research in the EU and formulated a set of measures necessary to strengthen the harmonization of European funding for health research.

Among the **main negative consequences of the lack of coherence** in the financing of health research, the interviewed experts identified the following:

- *A duplication of research funding between the framework programmes (even within the different calls of the health cluster in Horizon Europe), HERA and calls from the different DGs.*
- *The resources are not used efficiently as multiple funding sources may end up supporting the same projects or similar investigations.*
- *Limited possibility that the research financed by the framework programmes can be used for the elaboration and implementation of health policies because of the lower quality and extent of research.*
- *Insufficient connection between policies for health research and building useful scientific evidence for the development of health policies.*

Among **proposals to increase the coherence** of funding for health research, the interviewed experts identified the following:

- *A centralised administration of health financing at a European level comparable to that of the United States articulating health care and research.*
- *A mandate for the recently created Health Emergency Preparedness and Response Authority (HERA) with a sufficient degree of autonomy and solid scientific leadership that allows it to provide effective solutions to pandemics and health crises that may come in the future.*
- *An information system that allows knowing with certainty which research projects and topics are being conducted by which groups, from which source of financing they receive support, and what the promised and delivered results are.*
- *The establishment of mission-oriented type research programmes based on the organised initiative of the clinical and scientific communities.*
- *To assign the responsibility and the necessary resources to the European scientific societies so that they coordinate and give coherence to the joint research efforts.*
- *The general directorates and the agencies responsible for the governance of the FPs should focus on the final results of the investigation and not on the processes in order to deliver useful research products for the protection and health care of European citizens.*

8.2.4. EU leadership in health research

In general, the experts interviewed agree that the institution of scientific leadership at the EU level is a necessary component to give greater coherence to health research funding efforts and consolidate the EU's leadership on the global stage. The experts interviewed put forward a series of specific proposals aimed at building leadership at the EU level in the area of health research.

A first set of proposals is related to the **extension of the responsibilities of existing bodies at the level of the Member States and the EU:**

- *All of the departments and agencies involved with health policies should have a strong health research mandate with the capacity to influence health research financing and scientific leadership capable of identifying knowledge needs.*
- *To extend the mandate of the European Center for Disease Prevention and Control to surveillance not only of contagious but also of chronic diseases to have the capacity to identify the priority health needs of the population and implement strategic funding for health research.*

A second group of proposals is related to **the institution of a novel mechanisms for guidance and leadership within the EU in a Health Research Policy Board.**

- *A leadership that manages European health policies either under the figure of a deputy commissioner.*
- *The creation of a Health Research Policy Board, capable of articulating the different visions, objectives and work styles of the different stakeholders and actors, and that includes in these the participation of patients in a process of co-creation of a European agenda research.*
- *A Health Research Policy Board must come with a sufficient budget to generate impact and to attract strong leadership with excellent credentials.*

A third group of proposals is related to the need **to empower and establish a permanent dialogue with various actors and sectors of European society involved in improving the health conditions of the population**

- *Facilitate participation in the organisational decision-making process of organisations and key stakeholders that give voice to the scientific and medical communities, scientific journals and academic societies along with universities, hospitals, funders and public institutions.*
- *Empower scientific leadership in the area of health research in the EU not only to facilitate common thinking around thematic research priorities, but also to ensure coordination in terms of research infrastructure, and to monitor the results of the European programmes that support health research.*
- *Co-creation of the research agenda between Member States and the European Commission. This co-creation being understood not as a consultation process on ideas already pre-established centrally, but building a joint agenda from the beginning based on the needs and proposals of the states.*

8.2.5. Summary and conclusions

All experts agreed on the importance to strengthen cross-border collaborative translational and clinical research in the EU. They find that the EU is well-placed for coordination, but emphasise that the primary guidance should be scientific excellence to ensure research translated in better health. More investment at EU level is important but opinions on way to achieve it vary, with many citing reluctance of national agencies to increase funding in a centralised EU budget. Ways forward are to intensify coordination and collaboration between Member States, guided by a strategy that includes addressing unmet medical needs as well as excellence principles. Cross-sector partnerships are a win-win, and can take the form of consortia including patients and citizens. Stakeholder participation in governance is essential.

Although there is agreement on the desirability to increase quality and capacity of the research and health systems of the EU-13 countries, the predominant view is that countries need to take the necessary initiatives, with some suggestions made. Importantly, such initiatives deserve more support.

Experts cite the dire consequences of lack of coherence between different health research programmes, such as duplication of efforts and lack of translation into health policies. Several options were expressed to increase the coherence of health research in the EU. These included a central administration across programmes, supported by an improved information system and use of the strength of European scientific and professional societies in health.

Experts feel very strongly the need for better leadership. Broad support is given to the institution of a scientific leadership via a Health Research Policy Board, provided it would have impact in guiding investment and support to health research. Such a Board is also seen as a means to establish the important permanent dialogue with all actors and stakeholders in health research to set up a health research agenda.

9. Conclusions

We examined the **possible mechanisms underlying the structural weaknesses of EU health research** identified in the wake of the response to COVID-19. These weaknesses and lack of coherence are: insufficient international collaboration to reach scale and power of clinical studies; inequalities in participation in health research within the EU; weak coordination and leadership in health and health research affecting the global position of the EU; and hurdles in the ecosystem to translate discoveries to new treatments.

(1) With regard to insufficient **international collaboration for clinical research**, we identified the following elements.

- EU funding through the framework programmes is the major source to fund collaborative research but has a limited budget, with the majority of funding in Member States. However, there is a near absence of investment in international collaboration within the national funding systems.
- EU funding has changing priorities within the framework programmes, with variable support for clinical research. While funds were mobilised for COVID-19, this was at the expense of funding in previously defined areas.
- There are concerns that the approach through short-term project funding is less efficient for long-term impact and preparedness.
- Diversity of funding offers flexibility, but at the expense of complexity.
- The major infrastructure for clinical studies, ECRIN, is not centralised at EU level and does not reach all EU Member States.

(2) With regard to **inequalities in participation** in health research, we identified the following elements.

- Despite a lower participation of EU-13 countries, individual Member State policies can increase participation.
- Use of Structural Funds for strengthening health and research infrastructures are EU policies that can reduce inequalities.
- Member State engagement in public-public-partnerships facilitates participation.

(3) With regard to **global position, coordination and leadership** in health and health research under EU, we identified the following elements.

- As a funding body through the framework programmes, the EU is among the top-10 funders of health research in the world, but well behind the US and China.
- Together with Member States, this position improves, but there is no organised research strategy platform and among Member States, dialogues exist but not a formal joint strategy.
- EU agencies like ECDC and EMA, as well as public-private partnerships and externally managed infrastructures, have dedicated scientifically expert leadership and stakeholder boards, these are absent for the internally managed EU health research funding.
- In the absence of such leadership and stakeholder participation, the priority setting and comprehensive strategy lack proper guidance to address health needs.
- The group of Chief Scientific Advisors for EU policies lacks an expert on health and health research.
- Compared to the US as world leader, EU health and health research lacks a leadership with strong credentials to engage in global dialogue.

(4) With regard to the ecosystem to **translate discoveries to new treatments**, we identified the following elements.

- With the exception of a number of special programmes, there is **no structural or long-term funding boosting the collaboration** between different actors necessary to advance the translation of knowledge into new products.
- The impactful model of wider stakeholder participation including government/funders, the academic research community and patients/citizens is not implemented at all levels.
- The regulatory framework for clinical studies is directed towards product development and **not sufficiently supportive for studies that are of public but not commercial** interest.
- Use of health data holds major promise but implementation is complicated and regulatory development in need of **coordination with stakeholders**.

While these weaknesses in the system became very apparent during the COVID-19 pandemic, they are of equal concern for addressing the major health challenges for EU citizens, such as chronic diseases, ageing and climate-related health needs. Analysis of the **changes proposed**, including those already implemented, as part of the road towards a **European health union**, indicates they are **insufficient** to address these systemic weaknesses.

Based on the analysis and interviews with key opinion leaders in health research, we can conclude that addressing the underlying mechanisms will **require changes in the administration of EU funding, in the interactions with Member States and establishing a coordination and leadership to strengthen the EU** position for global health.

Consequent policy options explore ways to strengthen the existing structures or more radical changes in the funding structure and leadership. Positive examples to inspire policies are: the European Reference Networks for EU-wide synergies with a strong articulation between research, innovation and product development, and the leadership in disease areas; successful organisation of research in the US; Member State examples of creating synergies.

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The COVID-19 pandemic prompted reinforced investment in health research, to support rapid research and innovation for vaccine development and health care measures. The European Union response highlighted strengths and weaknesses in EU research organisation and funding. Over time, EU investment in health research has been aimed at increasing knowledge and transfer of knowledge into innovation, for better health. To this end, several instruments have been developed, but the impact of these efforts is hampered by fragmentation and a lack of synergy between strategies at different levels. Inequalities in health and research across Member States need further measures. Policies can take inspiration from successful health research organisation and policies inside and outside the EU, for more coherence and throughput to implementation. Health research needs strong leadership to engage in global health and to tackle the challenges of the interconnectedness of health with environmental and climate challenges, and durable economic development. Stakeholder involvement in a formal structure will secure permanent dialogue for fruitful research and development.

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