

A Survey on Monitoring Innovation and Societal Impact of EU-funded Biomedical Research

Executive Summary



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This Executive Summary describes a study conducted by the JRC's EU Reference Laboratory for alternatives to animal testing (*EURL ECVAM*) to monitor the innovation and societal impact generated by EU-funded projects in the fields of Alzheimer's disease and other dementias, breast cancer and prostate cancer. The study is based on a survey addressed to current and former participants of EU-funded research projects and is analysed in a JRC Technical Report (Pistollato, F. *et al.*, *A Survey on Monitoring Innovation and Societal Impact of EU-funded biomedical Research*, EUR 30712 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-39456-3 doi:10.2760/644131, JRC125539).

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Alzheimer's disease, breast cancer and prostate cancer are among the most prevalent non-communicable diseases in Europe and worldwide (Box 1). Dementia, including Alzheimer's disease, represents the seventh leading cause of death¹, with about 10 million people affected in Europe².

Breast cancer and prostate cancer were respectively the first and the third most commonly diagnosed type of cancer in 2020 in Europe³.

Over the past 20 years, the European Union (EU) has made considerable investments in biomedical research, including the fields of Alzheimer's disease (AD), breast cancer (BC) and prostate cancer (PC).

This has supported a large portfolio of different studies which have enhanced our understanding

of these diseases, including basic research on disease mechanisms, diagnostics, drug development, drug repurposing, clinical trials, prevention and telemedicine, among others.

Nevertheless, translation of research findings into effective treatments or concrete prevention strategies is limited, and the failure rate in drug development remains exceptionally high.

The aim of this study was to understand what makes a project truly innovative and how scientific breakthroughs can eventually translate into tangible impact on public health.

The results can serve as an evidence base to inform future research and funding strategies, both specific to these disease areas and also more generally in the biomedical domain.

1 <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>

2 <https://www.euro.who.int/en/health-topics/noncommunicable-diseases/mental-health/areas-of-work/dementia>

3 <https://ec.europa.eu/jrc/en/news/2020-cancer-incidence-and-mortality-eu-27-countries>

Box 1. Non-communicable diseases

Non-communicable diseases are diseases that are not transmissible directly from one person to another. They may be chronic or acute and are mostly non-infectious. For example, these conditions include cancer, neurodegenerative disease, cardiovascular disease, diabetes and chronic lung disease. Many of these conditions can be largely prevented by reducing common risk factors such as tobacco use, excessive consumption of alcohol, physical inactivity and unhealthy diets.

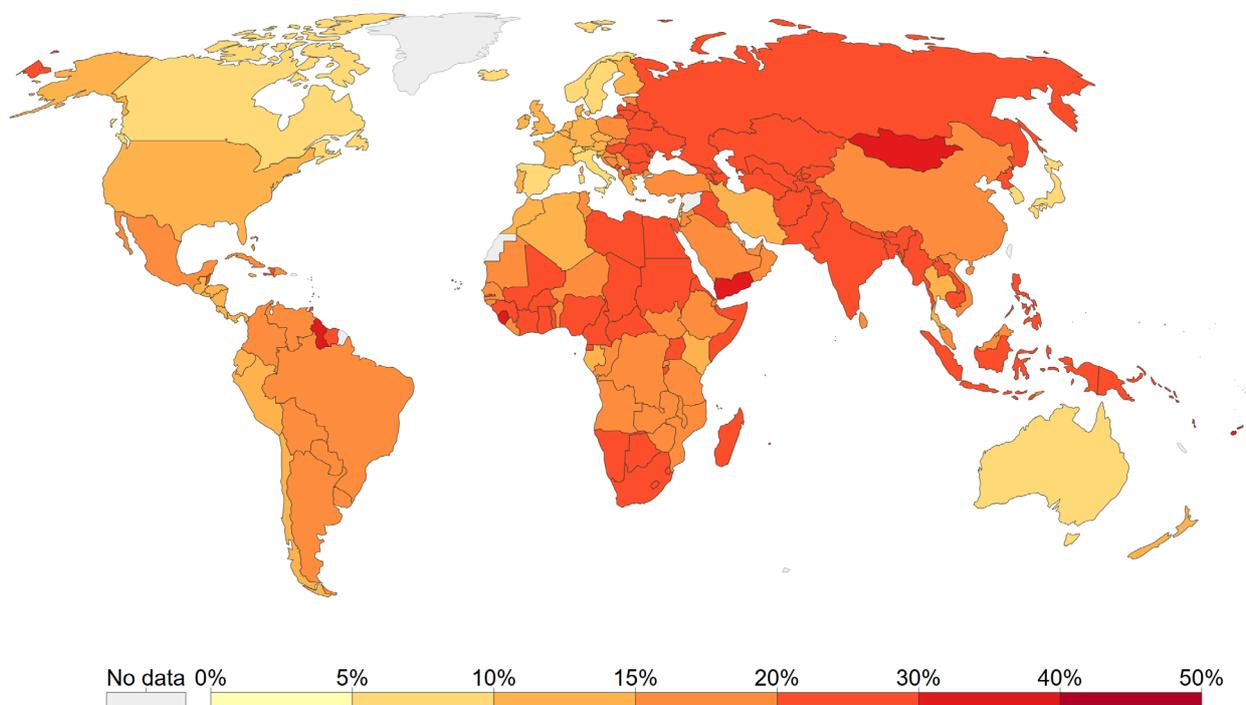
Non-communicable diseases represent major causes of disability, ill health, health-related retirement, and premature death in the EU, resulting in considerable social and economic costs. According to the Organisation for Economic Co-operation and Development (OECD), every year in the EU approximately 550,000 people of working age die prematurely from non-communicable diseases.

As the leading cause of mortality in the EU, non-communicable diseases account for the majority of healthcare expenditure, costing EU economies €115 billion annually (0.8% of GDP).

Mortality from non-communicable diseases, 2016

Mortality from CVD, cancer, diabetes or CRD is the percent of 30-year-old-people who would die before their 70th birthday from any of cardiovascular disease, cancer, diabetes, or chronic respiratory disease, assuming that s/he would experience current mortality rates at every age and s/he would not die from any other cause of death (e.g., injuries or HIV/AIDS).

Our World
in Data



Source: World Bank

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A look at EU-funded research

The European Commission's Joint Research Centre (JRC) and the Directorate General for Research and Innovation have defined a set of indicators that provide the basis for retrospective assessment of the innovation and impact of EU-funded research.

Using these indicators as a guide, the JRC carried out a comprehensive survey to gather feedback from current and former participants of EU-funded research projects, mainly in the fields of AD, BC and PC.

A factual summary report provides an overview of the 202 responses received⁴. This summary report is complemented by a synopsis report that presents a detailed analysis of the survey replies, along with insights obtained from phone interviews with 29 respondents⁵.



What researchers think about impact

The majority of the respondents considered that their research already had an impact or that impact would be seen in the near future.

The highest impact was declared by participants under framework programmes (FP) FP5, FP6 and FP7, while the proportion of respondents declaring their research had an impact was a bit lower for the most recent H2020 FP.

This indicates that the temporal dimension plays a role and that in most cases a concrete impact can only be identified several years after the end of the project.

Amongst respondents working on AD, BC and PC claiming an achieved impact for their project, the creation of diagnostic or prognostic tools and new clinical trials were the most frequent types of impact cited, followed by the design of new treatments or prevention actions, or new patents.

A high percentage of respondents who worked on epidemiology declared that their research most likely will generate future impact.

Models used in biomedical research

Scientists make use of a variety of models to conduct biomedical research, including human cohorts, laboratory animals, human and

⁴ Mc Carthy, J. *et al.*, *A Survey on Monitoring Innovation and Societal Impact of EU-funded Research: Factual Summary Report*, EUR 30182 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-18180-4, doi:10.2760/35440, JRC120502.

⁵ Pistollato, F. *et al.*, *A Survey on Monitoring Innovation and Societal Impact of EU-funded Biomedical Research*, EUR 30712 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN X978-92-76-39456-3, doi:10.2760/644131, JRC12539.

animal derived cells and tissues and computer simulation. Depending on the attributes of the model, different aspects of human physiology, function and disease can be studied.

Regardless of research area, participants considered human cohorts, population studies and human-derived biological samples (Box 2) as highly relevant to address their research questions and thus, consider them as essential for research success.

Traditionally, animal models have been used to model human diseases. There was a tendency within the AD research community, compared to the BC and PC groups, to rate more frequently the use of animal models and animal-derived specimens as essential or highly relevant to their research.

Phone interviews suggested that the use of animals is generally considered unavoidable. However, it was also questioned whether animal models could recapitulate the complexity of human disease (especially for AD and other causes of dementia) and may therefore contribute to, and possibly explain, failures in translation and impact of research results.

Respondents considered complex *in vitro* models such as engineered tissues and organ-on-chip devices (Box 3), together with computational modelling, as having the potential to deliver significant innovation and impact in the long term, since they were believed to still be at an early stage of development.

Lastly, (bio)chemical methods (assays) were considered only marginally relevant and not essential to the success of a project.

Most significant challenges and ingredients for success

While human cohorts and population studies were considered particularly relevant to research success, scientists working on AD experienced difficulties to enrol participants in clinical studies.

What also emerged from the survey was that targeted follow-on funding after the completion of a project was believed to increase chances of having concrete impact on public health. However, several participants indicated that they had difficulties in obtaining additional funding at the end of the usual funding cycle.

Box 2. Human-based research

Human-based studies can contribute to understand disease etiopathology and better elucidate disease processes at multiple levels of biological complexity, from population to cellular level (Herrmann, K. *et al.*, Beyond the 3Rs: Expanding the use of human-relevant replacement methods in biomedical research. *ALTEX*, 2019, 36(3):343-352, doi:[10.14573/altex.1907031](https://doi.org/10.14573/altex.1907031)).

Human cohorts and population studies: epidemiology studies in which a defined population is followed up and observed to investigate the causes of disease and to establish links between risk factors and health outcomes.

Human-derived biological samples: parts of organs, cells and tissues and components of such material acquired or derived from living or deceased human beings.

In particular, it seems that PC researchers have a lower probability of securing additional funding to follow up aspects of their research when compared to their AD and BC counterparts. This finding correlates with the higher levels of funding allotted over the last 20 years to AD and BC research, when compared to the PC domain⁶.

The most commonly indicated ingredients of research success were a multidisciplinary environment, a healthy collaboration between project partners, and the typical multinational dimension of EU project consortia.

Disseminating research outcomes

Project dissemination activities have increased over time. This is likely due to explicit requirements of more recent calls (H2020 and FP7) for projects to share results more widely, demonstrate relevance of the research undertaken, and to engage more with stakeholders including the public.

Some interviewees suggested that dissemination and outreach could be further improved by involving professional science communicators in project consortia to help bridge the gap between scientific and non-scientific communities.

⁶ Pistollato, F. *et al.*, Alzheimer's Disease, and Breast and Prostate Cancer Research: Translational Failures and the Importance to Monitor Outputs and Impact of Funded Research, *Animals* (Basel), 2020, 10(7):1194, doi:10.3390/ani10071194.

Box 3. *In vitro* models

In vitro models use cells or tissues cultured in the laboratory.

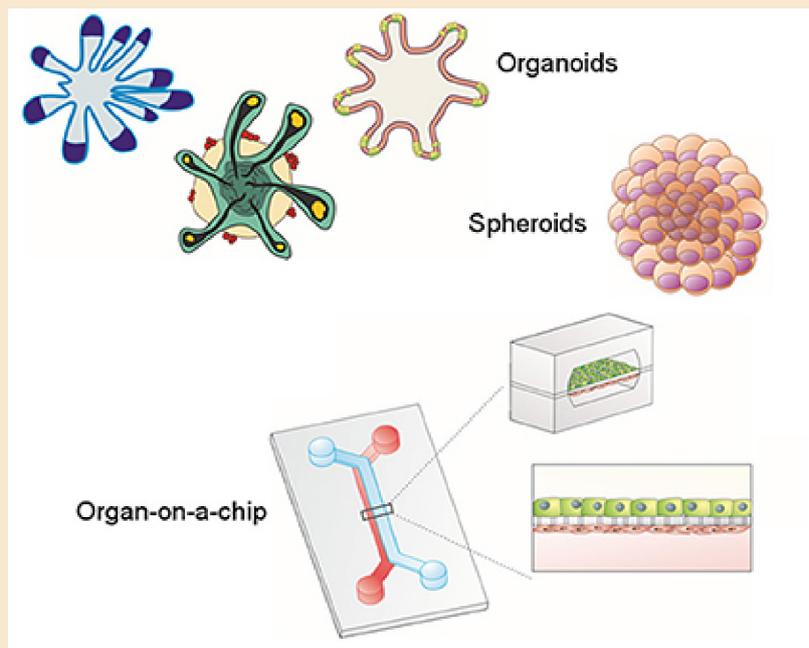
3D tissue cultures: an environment in which cells grow and interact with their surroundings in all three dimensions.

Spheroids: simple 3D models generated by spontaneous cell aggregation that does not require any scaffolding system.

Organoids: miniaturised 3D representations of an organ that reflect histological and functional aspects of *in vivo* tissue.

Microfluidic or organ-on-chip systems: micro-fabricated platforms

engineered to capture the physiology of human organs by capturing critical aspects of living organs, such as cell-tissue interfaces and biochemical and physical stimuli, such as flow and pressure.



Main findings

The main findings of this study are summarised below.

They provide a useful starting point to explore strategies and initiatives to foster human relevance and increase translatability of biomedical research outcomes, with a view to maximising impact on public health.

- 1** Most respondents feel their research **will have an impact**.
- 2** **Time** is an important factor in the generation of **societal impact**.
- 3** Obtaining **follow-up funding** to continue research is often an issue.
- 4** The design of the overall **research strategy**, positive **collaboration** with project partners, the **international dimension** and the **multidisciplinary nature** of the project are considered as the major ingredients for success.
- 5** **Epidemiology based research** has significant potential to generate relevant results.
- 6** Research aimed at designing **novel diagnostic or prognostic tools** often leads to more immediate impact.
- 7** The impact of sophisticated **in vitro and computational models** is increasing with time.
- 8** Use of **animal models** is still considered unavoidable by many, despite associated translational failures.
- 9** **Human cohorts and population studies** and the use of human specimens are highly relevant.
- 10** It is very difficult to **enrol participants in clinical studies**, especially in the field of Alzheimer's disease or other dementias.
- 11** **Disseminating science** to the public is important but needs to be done properly.

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