Current JRC activities in the field of biomedical research, with a focus on indicators to monitor impact and innovation of funded biomedical research
Non-communicable diseases

- increasingly prevalent in Western countries, > 86% of total premature deaths

- 9.9 million new cases of dementia every year, Alzheimer’s disease (AD) accounting for 60-80% of cases

- Breast cancer (BC) and prostate cancer (PC) ranked as the 1st and 4th most common cancers in 2020

- result of a combination of genetic, physiological, and environmental factors (e.g., diet, exercise and smoking)
Translational failures in these fields of biomedical research

- basic/fundamental and pre-clinical research successes have not, in most cases, translated into effective therapeutic treatments for humans;

- **AD** → failure rate >99%, no disease-modifying therapies have been developed so far (*Alzheimers Dement (N Y). 2018; 4():330-343*)

- **Cancer** → failure rate 97% (*Sci Transl Med. 2019 Sep 11; 11(509]*)

- Lack of efficacy and (off-target) toxicity represent the most common causes of trial failure
Translational failures in these fields of biomedical research

Possible reasons behind drug development failure:

- flaws in animal experimentation design
- inappropriate target selectivity
- neglecting efficacy, PK and PD properties of new compounds
- inappropriate selection of clinical trial participants

https://www.nature.com/articles/d41586-018-07352-7
Animal use in Europe

✓ Each year, more than 100 million animals are used in research worldwide

Within applied/translational research, human cancer (27%) and human nervous and mental disorders (14%) accounted for the highest numbers of animals
Are Animal Models Needed to Discover, Develop and Test Pharmaceutical Drugs for Humans in the 21st Century?

Alzheimer’s Disease, and Breast and Prostate Cancer Research: Translational Failures and the Importance to Monitor Outputs and Impact of Funded Research

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Animals 2020, 10(7), 1194; https://doi.org/10.3390/ani10071194
What is the impact of EU-funded research on AD, BC and PC?
Can we use indicators to retrospectively measure innovation and impact of funded research?
Indicators

Funding/Economic

Number of EU projects
Value of EU projects
Value of projects from non-EC funding bodies

Dissemination

Number of publications on new scientific insights
Number of publications on new methods, tools and approaches
Number of citations

Scientific and technological

Number of patents
Number of new diagnostic tools
Number of approved drugs, treatments or medical devices
Number of clinical trials for new drugs
Number of new preventive measures

Regulatory and policy

Number of public health guidance values/options in regulatory medical-health sectors
Number of new regulatory policy actions
Number of new non-regulatory targeted policy actions

Public and social engagement

Level of public/social engagement
Global indicators: Public health trends

Education, training and job opportunities

New job opportunities
New learning opportunities

Global indicators:
Public health trends
Education, training and job opportunities
New job opportunities
New learning opportunities
Main goals

Through these indicators we aim to gain insight and understanding:

i. how EU-funded projects have contributed to innovation and major scientific breakthroughs;

ii. how scientific results have translated into effective socioeconomic impacts;

iii. what scientific methods and research approaches underpinned the advances made.
The overall strategy

- **Funding/Economic**
- **Dissemination**
- **Scientific and technological**
- **Regulatory and policy**

**Survey & interview**

**EU Project Participants**

- animal vs non-animal

**Data gathering on indicators** (GOPA, DG ESTAT)

**Data gathering (tenderer)**

**Public and social engagement**

**Education, training and job opportunities**

**subjective**
Survey

• Launched Feb. 14 2020

• Addressed to current and former participants of EC-funded research projects in the fields of Alzheimer’s disease and other dementias, breast cancer or prostate cancer.

https://publications.jrc.ec.europa.eu/repository/handle/JRC120502
Survey Respondents

Survey on Innovation and Societal Impact of EU-funded Research

202 respondents

EU Framework Programmes*
- FP5: 9
- FP6: 24
- FP7: 87
- H2020: 151

Areas of research*
- 120: Basic/fundamental
- 76: Translational/applied
- 70: Clinical
- 19: Epidemiological
- 6: Regulatory

Type of organisation*
- 144: Academia
- 39: Industry & Co
- 33: Government
- 31: Healthcare
- 15: NGOs

Primary country of the conducted research

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<th>Country</th>
<th>Answers</th>
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<tr>
<td>Other</td>
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</table>

Table 1: Geographical distribution of survey participants (primary country where they conducted their research activities)

https://publications.jrc.ec.europa.eu/repository/handle/JRC120502
Follow-up analysis of survey replies: Synopsis report

- **The type of impact** of EU-funded research concerning the EU FP, the area and field of research, and the **selection of the models**;

- **The challenges** encountered and the possible issues concerning **follow-up funding**;

- What **ingredients** have contributed to research **success** and the generation of impact;

- **The importance of public engagement.**

[https://publications.jrc.ec.europa.eu/repository/handle/JRC125539](https://publications.jrc.ec.europa.eu/repository/handle/JRC125539)
Selection of experimental models across fields of research

70% of users of human-derived materials considered them as highly relevant to their research questions.

57% of users of animal models considered them as highly relevant to their research question:
- 63% of AD researchers
- 56% of BC researchers
- 50% of PC researchers
Encountered challenges across fields of research

28% AD, 26% PC, and 18% BC researchers had difficulties in obtaining additional funding at the end of funding cycle

Other popular challenges:
- difficulty to enroll participants
- insufficient allocation of project funding
Ingredients for success in projects that claimed impact

Ingredients for success among projects that had an impact

- Research strategy
- Collaboration with project partners
- International dimension
- Multidisciplinary
- Dissemination of results
- Effective management
- Uptake by SMEs or large companies
- Public outreach
- Others
Public engagement across FPs

- 76% H2020 participants
- 72% FP7 participants
- 67% FP6 participants
- 56% FP5 participants

→ indicated public engagement efforts
Interviews of Survey Respondents

• Conducted 29 in-depth interviews to seek further input in 4 main areas, each correlate to specific question(s) in the survey:
  1. Major research outcomes and their social impact
  2. Translatability issues
  3. Challenges obtaining funding
  4. Dissemination to the general public

• Coding analysis of interview transcripts (NVivo)
Main findings

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 AD

11. Disseminating science to the public is important but needs to be done properly
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