innovative health initiative

Bibliometric Analysis of Ongoing Projects

13th Report
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COCIR Advancing Healthcare
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1 EXECUTIVE SUMMARY

This report presents a bibliometric analysis of the Innovative Medicine Initiative Joint Undertaking's (IMI JU) research published between 2010 and 2021, using citations as an index of academic impact and co-authorship as an index of collaboration. This is the thirteenth report commissioned by IMI from Clarivate.

The data show that IMI continues to perform well. To date, IMI projects have produced 8,609 publications which have been matched to the Clarivate Web of Science™. This represents a 20% increase from the 7,177 publications matched to the Web of Science in the twelfth report, which covered IMI project research published between 2010 and 2021.

The number of IMI research publications has generally increased year on year, except for the year 2019 where output fell by almost 8% (likely due to some of the longest running projects e.g. BTCure coming to an end) as noted in the eleventh report. Publication growth has since recovered and in 2021, the most recent publication year, publication output has increased by nearly 10% from 2020. IMI's publication growth is showing signs of stabilisation, which is expected as the IMI programme matures. As a programme matures, longer running projects that have now closed observe lower publication outputs while the newer projects slowly see an increase in publication outputs. These changes in publication output cause the overall output to begin stabilising.

The majority of IMI research (65%) continues to be published in high impact journals, i.e., those journals in the highest quartile (Q1) when ranked by Journal Impact Factor, and the average Journal Impact Factor of all IMI project publications was 7.53. IMI research was wide-ranging from basic biological research to clinical practice. IMI project research has been published most frequently in the fields of Neurosciences, Pharmacology & Pharmacy, and Biochemistry & Molecular Biology.

The impact of IMI project research (as indicated by citation impact) remains twice (2.03) that of the world average (1.00), which indicates that the research was internationally influential. Between 2010 and 2021, the field-normalised citation impact of IMI papers was considerably higher (76%) than the European Union's (EU) average citation impact (1.15) in similar biomedical fields (journal subject categories). Around a quarter (25.3%) of IMI project papers were highly cited; that is, the papers were in the world's top 10% of papers (taking journal category and year of publication into account), when ranked by number of citations.

The output of individual IMI projects has also increased between 2010 and 2021. BTCure (Call 2) has remained the most prolific IMI project, with 719 publications as of this report. This is a 2% increase on the 703 publications attributed to BTCure in the previous report. It is also worth noting that AIMS-2-TRIALS is new to the Top 10 projects, ranking 6th, as its publication output has nearly doubled since the previous report (2020).

Projects funded by IMI are highly collaborative. Since the last report, an increasing percentage of IMI publications involve collaboration between researchers in different sectors. Two-thirds (67.0%) of all IMI project papers were co-authored by researchers working in different sectors, more than three-quarters (85.9%) involved collaboration between institutions and more than half (64.5%) were internationally collaborative. Internationally collaborative IMI project research had an average citation impact (2.73) well over twice the world average (1.00) and higher than domestically collaborative IMI project research (1.82).

Research in both Europe and North America tends to be clustered in major cities with an existing strong academic research base. The citation impact of IMI papers within these clusters is higher than

national averages and rates of international co-authorship are very high (70-100%) compared to the averages for EU-28 biomedical research (40%). The European and North American clusters with the highest proportion of open access papers are Lyon, France (98.8%) and Seattle (94.4%) respectively.

IMI's field-normalised citation impact (2.03) is two times the world average and is comparable to other well-established funding bodies such as the Medical Research Council (MRC) and the Wellcome Trust (WT) and is higher than all other comparators.

IMI's field-normalised citation impact increased more than the Critical Path Institute, Foundation for the National Institutes of Health (FNIH), and Grand Challenges in Global Health (GCGH) which saw no change or a decrease in their citation impact.

IMI's journal-normalised citation impact (1.23) is the second highest among the comparators only surpassed by CSIRO (1.25). IMI's percentage of highly cited papers (25.3%) outperforms all the comparators, except GCGH (26.5%). IMI publishes more open access papers than three out of the seven comparators (CSIRO, C-Path, and ICMR).

A more detailed summary of the key findings of this report (with cross-references to the relevant sections) is provided below.

Summary of key findings

Since its first call for proposals in 2008, IMI has funded 182 projects from a total of 34 funding calls. Of the calls, 11 were from IMI's first phase (IMI 1), which ran from 2008 to 2013, and the rest from its second phase (IMI 2), which was launched in 2014 and ended in 2020. While the IMI 1 and 2 programmes have ended, many of the projects funded by these programmes are still ongoing.

It may take several months for a project to progress from inception to the point where it has generated sufficient data for a publication. It may take further months or years until it has produced its most valuable results. As some of the IMI projects analysed in this report are relatively young, the bibliometric indicators may not fully reflect their eventual impact.

- IMI projects have published a total of 8,609 unique Web of Science publications (Figure 4.1.1).
- IMI's publication growth is showing signs of stabilising as the programme matures (Figure 4.3.1).
- A quarter (25.3%) of IMI papers were in the world's top 10% of most highly cited papers in the relevant field and year of publication, suggesting very strong performance (Table 4.6.1).
- The field-normalised citation impact of IMI project papers was twice the world average (2.03) between 2010 and 2021, higher than last years (1.99). (Figure 4.6.1)
- More IMI project publications appeared in *Scientific Reports* (195 publications) and *PLOS One* (193 publications) than in other journals. Of the 20 journals in which IMI-funded projects published most frequently, nearly two-thirds (13 journals) rank in the top quartile by Journal Impact Factor (Table 4.7.1).
- The highest Impact Factor journal in which IMI research was published is the *Lancet* (6 publications), which has a Journal Impact Factor of 202.73. Of the Top 20 journals by Impact

Factor, IMI published most frequently in *Nature* (69.50) with 26 publications, followed by *Nature Medicine* (87.24) with 17 publications (Table 4.7.2).

- IMI project research was most frequently published in Neuroscience journals (Figure 4.8.1) a change from previous years where Pharmacology & Pharmacy was the most frequently published in category. Of the 875 papers published in Neuroscience, 28.1% were highly cited, 69.5% were open access, and the average citation impact of these papers was 2.12 times higher than the world average for the year and field of publication (Table 4.8.2 and Table 4.8.3).

- IMI research in the Clinical Neurology remains the category with the highest percentage of highly cited papers (37.5%). (Table 4.8.3)

- IMI project research had a citation impact well above the European (EU-28) average in all of the 20 journal subject categories to which most IMI publications are assigned (Table 4.9.1 and Figure 4.9.1).

- Early IMI 1 calls (1-4) follow a similar pattern of initial growth in publication output for 3 to 6 years followed by a decline as the projects end (Figure 5.1.1). Later IMI 1 calls published very few papers over the time period, normally less than 50 each year. The exception being IMI 1 call 11.

- The publication output of most of IMI 2 calls is currently growing. Especially Call 21 which had a 400% increase in publication output from last year's report. This is likely driven by the fact that many of the projects within this call are coronavirus related. IMI 2 Call 10 is also growing steadily. (Figure 5.1.3)

- Papers assigned to IMI 2 call 21 had the highest average field-normalised citation impact (3.71), more than three times the world average. Again, this is likely due to the projects within this call being coronavirus related. (Table 5.1.1)

- The largest geographic clusters of research supported by IMI in Europe are London (1,800 publications), Amsterdam (1,515 publications) and Stockholm (843 publications). The largest clusters in North America are Boston (392 publications), Toronto (368 publications) and New York (257 publications). (Table 6.1.1 and Table 6.1.3)

- IMI research in all the European and North American geographic clusters performs well above the national averages in terms of citation impact. The highest citation impact clusters in Europe are Maastricht (3.83) and Zurich (3.65), both more than twice their respective national averages which are both 1.71. (Table 6.1.2 and Table 6.1.4)

- Around 40% of all EU-28 biomedical research involves international co-authorship while in comparison rates of international collaboration for IMI project research are very high for most clusters, especially in North America where most clusters have around 90% international collaboration which is expected as IMI is a European funding organisation that primarily funds researchers working in EU-28. The European cluster with the highest rate of internationally collaborative papers was Basel, with 94.5% of its research involving international co-authorship. While the European cluster, Rome, was the lowest at 75.3% international collaboration. (Table 6.1.1 and Table 6.1.3).

- IMI project research is collaborative across sectors, institutions, and countries. Two-thirds (67%) of IMI project papers were co-authored by researchers from different sectors. More than three-

quarters (86%) of IMI project papers involved collaboration between different institutions. Nearly two-thirds (65%) of all IMI project papers were internationally collaborative (Table 7.1.1).

- IMI's collaborative research for sectors, institutions, and countries has an average field-normalised citation impact that is almost 50% higher than IMI's non-collaborative research. (sectors: 2.71 vs 1.82, institutions: 2.61 vs 1.60, and countries: 2.74 vs 1.82) (Figure 7.1.1)

- BTCURE, followed by EU-AIMS, had the highest number of papers with co-authors from more than one country, institution and sector. This may be due to these projects having the highest and second highest overall number of papers. (Table 7.1.1-Table 7.2.3)

- For those projects with at least 100 papers, BigData@Heart had the highest percentage of its papers with co-authors from more than one country (76.3%), sector (90.4%), and institution (98.5%), indicating the highly collaborative nature of this project. (Table 7.2.1-Table 7.2.3).

- King's College London is part of six out of the ten most productive pairs of collaborating institutions, including the second most productive pair where King's College London collaborated with Heidelberg University on 134 publications. (Figure 7.3.3.1)

- Karolinska University Hospital and Karolinska Institute were the top collaborating pair, collaborating on 148 publications.

- PROACTIVE has the highest collaboration index score of 2.66. (Table 7.4.1)

- IMI's research output grew faster between 2010 and 2021 than any of the seven selected comparators (Table 8.2.1.1).

- IMI's field-normalised citation impact (2.03) was lower than the Wellcome Trust's (2.09) and the MRC's (2.13) and higher than all the other comparators (Figure 8.2.2.2).

- IMI's percentage of uncited research has been the lowest of all the comparators since 2017, including the most recent year of 2021 (44.6%). (Table 8.2.5.1) However, it has the third highest percentage of uncited papers between 2010-2021.

- IMI has a higher percentage of highly cited papers (25.3%) than all the comparators except GCGH (26.5%). (Figure 8.2.6.2

2 OVERVIEW

The Innovative Medicines Initiative (IMI) Joint Undertaking has commissioned Clarivate to undertake a yearly evaluation of its research portfolio using bibliometric indicators.

The commissioned evaluation comprises a series of reports focusing on research publications produced by IMI funded researchers. This report is the twelfth evaluation in the series.

2.1 Innovative Medicines Initiative (IMI)

IMI's purpose is to improve health by speeding up the development of, and patient access to, innovative medicines, particularly in areas where there is an unmet medical or social need. It does this by facilitating collaboration between the key players in healthcare research, including universities, pharmaceutical companies and other industries, small and medium-sized enterprises (SMEs), patient organisations, and medicines regulators.

IMI is a partnership between the EU and the European pharmaceutical industry, represented by the European Federation of Pharmaceutical Industries and Associations (EFPIA). IMI, as part of its second phase (IMI 2), has a budget of €3.3 billion for the period of 2014 to 2024. Half of this comes from the EU's research and innovation programme, Horizon 2020. The other half comes from large companies, mostly in the pharmaceutical sector; these organisations do not receive any EU funding, but contribute to the projects 'in kind', for example by donating their researchers' time or providing access to research facilities or resources. The first phase of IMI had a budget of €2 billion equally shared between EU and EFPIA.

To date, IMI has announced 11 calls for proposals under its first phase and a further 23 calls for proposals under its second phase. The first funding call was announced in 2008 and the final calls were launched in June 2020. In February 2021, the Innovative Health Initiative (IHI), a new public-private partnership in health was announced that will run under Horizon Europe, the new European framework programme for research and innovation. This new partnership will build upon the Innovative Medicines Initiative (IMI) but will have a greater focus on cross sectoral collaborations involving biopharmaceutical, medical technology, and biotechnology sectors. This report covers the research output (publications and papers) of a total of 61 projects from IMI phase one and 126 projects from IMI phase two.

2.2 Clarivate

Clarivate, provides reporting and consultancy services to enable customers to understand and interpret their research performance and to inform strategic decision-making. We have extensive experience with databases of research inputs, activity and outputs and have developed innovative analytical approaches for benchmarking, interpreting and visualising research impact.

Clarivate's Research Analytics is a suite of products, services and tools that provide comprehensive research analysis, evaluation and management. For over half a century we have pioneered the world of citation indexing and analysis, helping to connect scientific and scholarly thought around the world. Today, academic and research institutions, governments, not-for-profits, funding agencies, and all others with a stake in research, need reliable, objective methods for managing and measuring performance.

Our consultants have up to 20 years of experience in research performance analysis and interpretation. In addition, the Clarivate regional Sales team provide effective on-site support to maximise the value of our work.

Visit Clarivate or our Professional Research Data Services team online for more information.

2.3 Scope of this report

The analyses and indicators presented in this report have been selected to provide an analysis of IMI research published output for research management purposes:

- To identify excellence in IMI-supported research overall and at individual call or project level.
- To benchmark IMI project research performance against other funders research, the EU-28 biomedical research and world averages.
- To show that collaboration, at all levels (researcher, institutional and country), is being encouraged through the projects funded by IMI.

Outline of this report:

- Section 3 describes the data sources and methodology used in this report along with definitions of the indicators and guidelines to interpretation.

Bibliometrics

- Section 4 presents analyses of IMI project publications overall, including trends in publications, frequently used journals, and top research fields. Where possible IMI research is benchmarked to EU-28 biomedical research.[1]
- Section 5 presents citation analyses of IMI publications at the call level, examining the citation impact and outputs of individual project. Where possible the IMI projects are benchmarked to world output and overall IMI output.
- Section 6 presents geographic clusters where IMI research activity occurs, including bibliometric data, the constituent institutions and top five journal subject categories within the clusters.

Collaboration

- Section 7 presents collaboration analyses for IMI publications overall and at the project level, examining collaboration between different sectors, institutions, and countries.

Benchmarking

- Section 8 presents analysis of IMI publications, benchmarked to similar funding organisations. The organisations are: Commonwealth Scientific and Industrial Research Organisation (CSIRO), Critical Path Institute (C-Path), Foundation for the National Institutes of Health (FNIH), Grand

[1] At time of publication, September 2022, the United Kingdom has left the European Union, however to date there has not been any large changes to the United Kingdom's participation in Horizon 2020 funded research therefore the United Kingdom is still included in the EU-28.

Challenges in Global Health (GCGH), Indian Council of Medical Research (ICMR), Medical Research Council (MRC), and the Wellcome Trust (WT)

3 DATA SOURCES, INDICATORS AND INTERPRETATION

3.1 Bibliometrics and citation analysis

Research evaluation increasingly uses bibliometric data and analyses to assess performance. Bibliometrics is the analysis of data derived from publications and their citations. Publication of research outcomes is an integral part of the research process and is a universal activity. Consequently, bibliometric data have a currency across subjects, time and location that is found in few other sources of research-relevant data. The use of bibliometric analysis, allied to informed review by experts, increases the objectivity of, and confidence in, evaluation.

Research publications accumulate citation counts when they are referred to by more recent publications. Citations to prior work are a normal part of publication and reflect the value placed on a work by later researchers. Some papers get cited frequently and many remain uncited. Highly cited work is recognised as having a greater impact and Clarivate has shown that high citation rates are correlated with other qualitative evaluations of research performance, such as peer review.[2] This relationship holds across most science and technology areas and, to a limited extent, in social sciences and even in some humanities subjects.

Indicators derived from publication and citation data should always be used with caution. Some fields publish at faster rates than others and citation rates also vary. Citation counts must be carefully normalised to account for such variations by field. Because citation counts naturally grow over time, it is essential to account for growth by year. Normalisation is usually done by reference to the relevant global average for the field and for the year of publication.

Bibliometric indicators have been found to be more informative for core natural sciences, especially for basic science, than they are for applied and professional areas and for social sciences. In professional areas the range of publication modes used by leading researchers is likely to be diverse as they target a diverse, non-academic audience. In social sciences there is also a diversity of publication modes and citation rates are typically much lower than in natural sciences.

Bibliometrics work best with large data samples. As the data are disaggregated, so the relationship weakens. Average indicator values (e.g., of citation impact) for small numbers of publications can be skewed by single outlier values. At a finer scale, when analysing the specific outcome for individual departments, the statistical relationship is rarely a sufficient guide by itself. For this reason, bibliometrics are best used in support of, but not as a substitute for, expert decision processes. Well-founded analyses can enable conclusions to be reached more rapidly and with greater certainty and are therefore an aid to management and to increased confidence among stakeholders, but they cannot substitute for review by well-informed and experienced peers.

[2] *Evidence* Ltd. (2002) Maintaining Research Excellence and Volume: A report by *Evidence* Ltd to the Higher Education Funding Councils for England, Scotland and Wales and to Universities United Kingdom (UK). (*Adams J, et al.)* 48pp.

3.2 Data source

For the bibliometric analysis, data will be sourced from the databases underlying the Clarivate **Web of Science**, which gives access to conference proceedings, patents, websites, and chemical structures, compounds and reactions in addition to journals. It has a unified structure that integrates all data and search terms together and therefore provides a level of comparability not found in other databases. It is widely acknowledged to be the world's leading source of citation and bibliometric data.

The **Web of Science Core Collection** is part of the Web of Science and focuses on research published in journals and conferences in science, medicine, arts, humanities, and social sciences. The authoritative, multidisciplinary content covers over 34,000 of the highest impact journals worldwide, including open access and over 205,000 conference proceedings. Coverage is both current and retrospective in the sciences, social sciences, arts, and humanities, in some cases back to 1900. Within the research community, these data are often still referred to by the acronym 'ISI'.[3] Clarivate has extensive experience with databases on research inputs, activity and outputs and has developed innovative analytical approaches for benchmarking and interpreting international, national, and institutional research impact.

3.3 Methodology

Publications: Many different document types are indexed in the Web of Science, including editorials, meeting abstracts, book reviews as well as research journal articles and reviews. In this report all documents regardless of type are referred to as 'publications'.

Article: Reports of research on original works. Includes research papers, features, brief communications, case reports, technical notes, chronology, and full papers that were published in a journal and/or presented at a symposium or conference.

Review: A renewed study of material previously studied. Includes review articles and surveys of previously published literature. Usually will not present any new information on a subject.

Papers: The terms 'paper' and 'publication' are often used interchangeably to refer to printed and electronic outputs of many types. However, in this report the term 'paper' is used exclusively to refer to articles and reviews - a subset of 'publications' that excludes all other document types.

Articles and reviews are the main way researchers communicate their results to the wider community and standards in methodology and interpretation are ensured by pre-publication peer-review by experts in the same field. Therefore, citation data for papers is the most informative for bibliometric evaluations and only citations to papers are used in calculations of the citation impact indicators presented in this report.

Citations: Papers mention earlier papers to acknowledge their intellectual contribution to a field of research. A paper receives a citation when it is mentioned or cited by another, usually more recent paper.

[3] The origins of citation analysis as a tool that could be applied to research performance can be traced to the mid-1950s, when Eugene Garfield proposed the concept of citation indexing and introduced the Science Citation Index, the Social Sciences Citation Index and the Arts & Humanities Citation Index, produced by the Institute of Scientific Information – ISI (now Clarivate).

Citation count: The number of citations received by a paper since it was published reflects the impact it has had on later research. Not all citations are necessarily recorded as not all the citing papers are indexed in the Web of Science. The material indexed by Clarivate, however, is estimated to attract about 95% of global citations.

Citation impact: Citations per paper is an index of academic or research impact (as compared with economic or social impact). for a single paper, raw citation impact is the same as its citation count. For a set of papers, it is calculated by dividing the sum of citations by the total number of papers in any given dataset. Impact can be calculated for papers within a specific research field such as Clinical Neurology, or for a specific institution or group of institutions, or a specific country.

Citation count declines in the most recent years of any time-period as papers have had less time to accumulate citations (papers published in 2007 will typically have more citations than papers published in 2010).

Field-normalised citation impact: Broadly the field-normalised citation impact compares the citation impact of a paper or set of papers to the average citation impact of all similar papers published worldwide in the same field and year.

As citation rates vary between research fields and with time, analyses must take both field and year into account. In addition, the type of publication will influence the citation count. For this reason, only citation counts of papers (as defined above) are used in calculations of citation impact. The standard normalisation factor is the world average citations per paper for the year and journal category in which the paper was published.

As field-normalised citation impact is normalised to global averages the performance of papers in different fields can be directly compared as the world average always equals 1.00. Therefore, a field-normalised citation impact exceeding 1.00 indicates papers have received more citations than the world average, conversely a value below 1.00 suggests papers are underperforming. See page 113 for a worked example of how field-normalised citation impact is calculated.

Highly Cited Papers: Highly cited papers are papers that are recognized as having a greater impact than other papers published in a similar year and field. For a paper to be considered highly cited they must be in the Top 10% in terms of citation frequency, considering the field and year of publication. High citation rates have shown to be correlated with other qualitative research performance evaluations, such as peer reviews.

Web of Science journal categories or Clarivate InCites: Essential Science Indicators[SM] fields: Standard bibliometric methodology uses journal category or ESI fields as a proxy for research fields. ESI fields aggregate data at a higher level than the journal categories – there are only 22 ESI research fields compared to 254 journal categories. [4] Journals are assigned to one or more categories, and every article within that journal is subsequently assigned to that category. Papers from prestigious, 'multidisciplinary' and general medical journals such as *Nature, Science*, *The Lancet*, *The BMJ*, *The New England Journal of Medicine* and the *Proceedings of the National Academy of Sciences* (PNAS) are assigned to specific categories based on the journal categories of

[4] Essential Science Indicators are defined by a unique grouping of journals with no journal being assigned to more than one field. These fields are focussed on the science, technology, engineering and medicine subjects and arts & humanities subjects are excluded. Customised analyses, however, can be designed to include these as an additional category.

the references cited in the article. The selection procedures for the journals included in the citation databases are documented here http://mjl.clarivate.com/.

Journal-normalised citation impact: Broadly the journal-normalised citation impact compares a paper or set of papers citation impact to all the other papers published in the same journal in the same year.

It is another bibliometric indicator which can be very useful in small datasets. This indicator is calculated from the citation impact relative to the specific journal in which the paper is published. For example, a paper published in the journal *Acta Biomaterialia* in 2005 that has been cited 189 times, would have an expected citation rate of 49.57 (the average number of citations per paper for this journal and publication year) and hence a journal-normalised citation impact of 6.3. This paper, therefore, has been cited more than expected for the journal.

Like the field-normalised citation impact a value exceeding 1.00 indicates that a paper or set of papers is receiving more citations than other papers in the same journal, and a value less than 1.00 indicates that a paper or set of papers is underperforming, receiving fewer citations that papers in the same journal.

Open access publication: Open access publications are publications that are made available online, at no cost to the reader. The Web of Science open access data come from the Directory of Open Access Journals (DOAJ) and collaborations with Impact Story and Our Research's Unpaywall services. The Web of Science therefore provides unrivalled coverage of open access publications that are published through DOAJ Gold, Other Gold, Green Published, Green Accepted or Bronze routes.

It is also possible that some publishers make publications available without following a recognised open access route. In these cases publications will not be indexed as open access in the Web of Science. Additionally, the analysis presented in this report covers all document types and not just papers, and some of these are not indexed as open access in the Web of Science databases.

The Web of Science open access data coverage is summarised at:
clarivate.com/webofsciencegroup/solutions/open-access/

3.4 Data collation

This analysis used a dataset comprising publications arising from IMI-supported projects. These publications were identified using grant acknowledgments, title, and abstract text searches, as well as other parameters developed in conjunction with IMI staff. There are currently 187 IMI projects. IMI staff validated the publications identified by this process and the list of projects to be analysed was provided by IMI staff.

4 CITATION ANALYSIS – IMI SUPPORTED PUBLICATIONS OVERALL

This section analyses the volume and citation impact of publications arising from IMI-supported projects, and where possible, benchmarks this against similar European research funders.

The datasets analysed in this, the thirteenth report, include IMI-supported publications identified in Clarivate Web of Science up to 31st December 2021. The census point for inclusion of publications into the twelfth report was 31st December 2020. Therefore, this report reflects changes in IMI activity between these points. Citations to these publications were counts up to 31st December 2021. Unless otherwise specified metrics are for all IMI-supported documents from all calls in IMI 1 and IMI 2, in aggregate.

When considering the analyses in this section, earlier caveats regarding paper numbers should be borne in mind (Section 3).

4.1 Publications from IMI-supported projects

Publications from IMI-supported projects were identified using bibliographic data supplied by IMI, and through specific keyword searches using funding acknowledgment data in the Web of Science. The process of identifying publications from IMI-supported projects that have Clarivate citation data is outlined in Figure 4.1.1.

The IMI project dataset started with 7,177 publications which were previously identified as IMI publications and used as the IMI publication dataset in the previous report. Separately, 1,630 new publications were identified as IMI-associated through keyword searches of funding acknowledgement text in databases which underlie Clarivate Web of Science. The combination of these two datasets led to a total of 8,807 unique publication records associated with IMI-supported projects. Of these 8,807 publications, 198 were eliminated as they were either published in 2022 or could not be distinguished as IMI from a manual review of the dataset. Therefore, 8,609 Web of Science publications remained.

The citation counts for this report were sourced from the citation databases which underlie Clarivate Web of Science and were extracted in June 2022. Normalised bibliometric indicators were calculated using standard methodology and the Clarivate National Science Indicators (NSI) database for 2021.

Figure 4.1.1 Process for IDENTIFYING PUBLICATIONS FROM IMI-SUPPORTED PROJECTS, 2010-2021

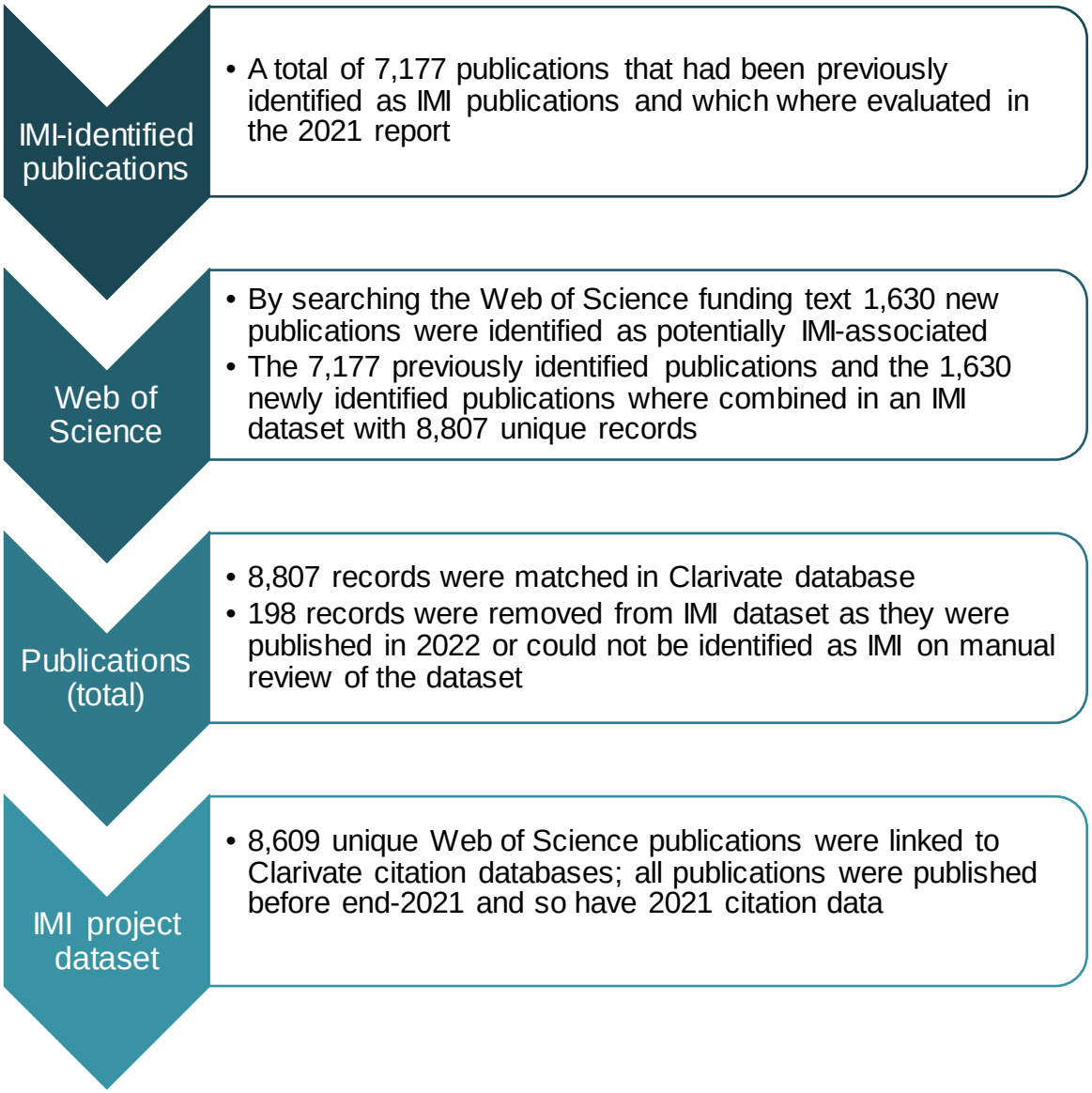


Table 4.1.1 NUMBER OF PUBLICATIONS FROM IMI PROJECTS, 2010-2021

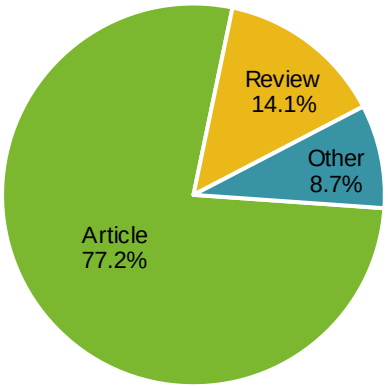
	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS
All IMI	8,609	7,856
IMI 1	6,323	5,896
IMI 2	2,382	2,070

Note that some publications belong to IMI 1 and IMI 2, therefore the total number of publications shown for All IMI is smaller than the sum of publications shown for IMI 1 and IMI 2.

4.2 Publications from IMI projects by document type

Figure 4.2.1 shows the percentage of Web of Science publications by document type and the same data is shown in Table 4.2.1.

Figure 4.2.2 PERCENTAGE OF IMI PROJECT PUBLICATIONS BY DOCUMENT TYPE, 2010-2021



Articles + Reviews = Papers, 91.3%

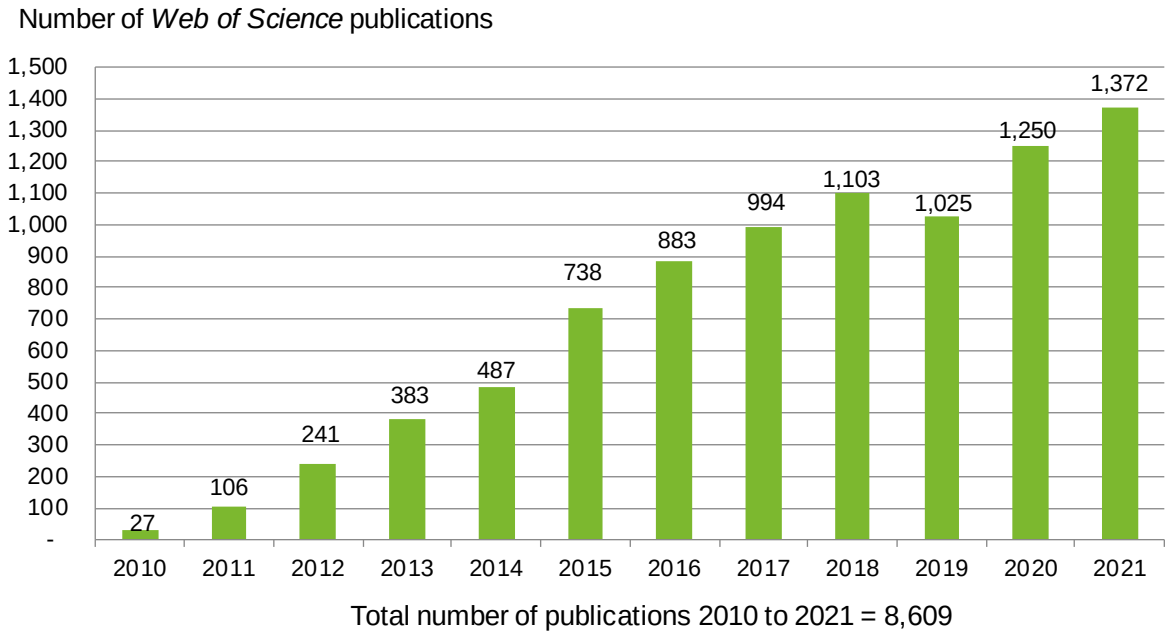
- IMI project research resulted in 8,609 unique Web of Science publications.
- Of these publications, 91.3% were articles (77.2%) and reviews (14.1%) which are collectively referred to as 'papers' in this report.
- A further 753 publications (8.7%) were not papers. These 'other' publications are composed of 174 editorials, 378 meeting abstracts, 87 proceeding papers, 92 letters, 15 corrections and three news items and four data papers.

Table 4.2.1 NUMBER AND PRECENTAGE OF IMI PROJECT PUBLICATIONS BY DOCUMENT TYPE, 2010-2021

	DOCUMENT TYPE	NUMBER OF PUBLICATIONS	% OF IMI PUBLICATIONS
Papers	Article	6,643	77.16%
	Review	1,213	14.09%
Other document types	Meeting Abstract	378	4.39%
	Editorial Material	174	2.02%
	Letter	92	1.07%
	Proceedings Paper	87	1.01%
	Correction	15	0.17%
	Data Paper	4	0.05%
	News Item	3	0.03%

4.3 Trends in publication output

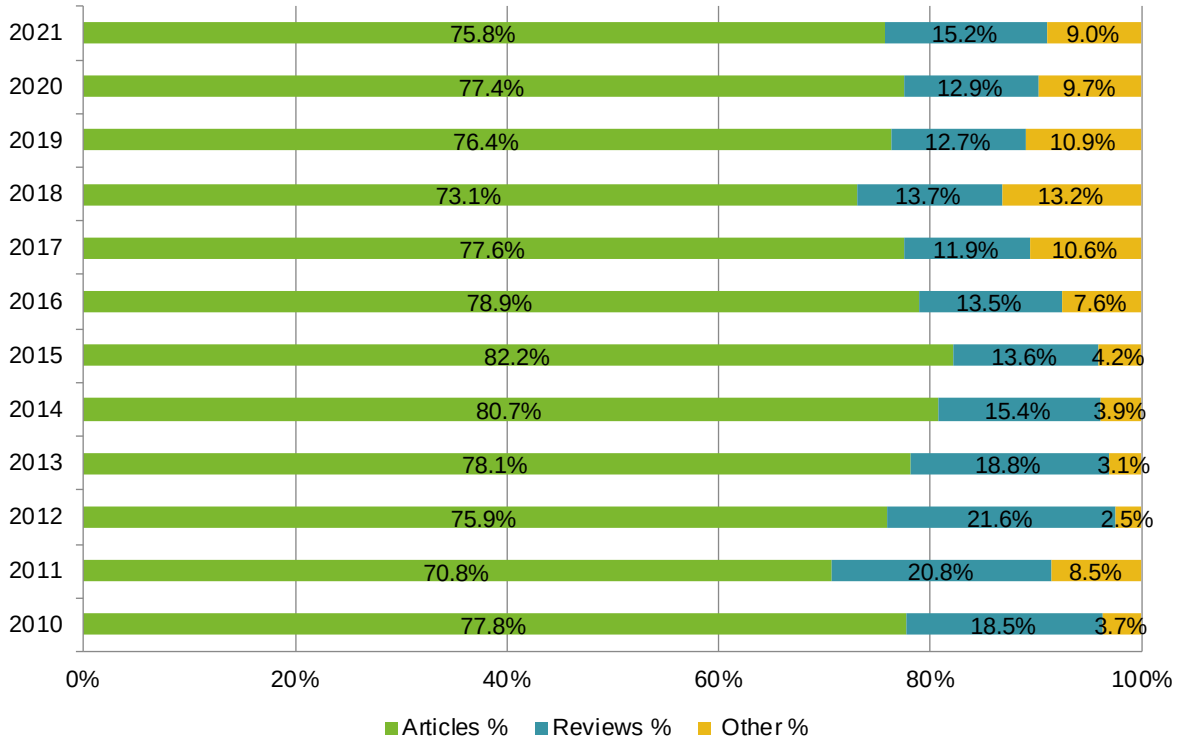
Figure 4.3.3 NUMBER OF WEB OF SCIENCE PUBLICATIONS FOR IMI PROJECTS BY YEAR, 2010-2021



- IMI project research output continued to increase in 2021, however at a slower pace with a change of nearly 10%. The stabilization of the rate of growth is expected as IMI programme matures.

Figure 4.3.2 shows the proportion of papers (articles and reviews) relative to other document types for IMI project research between 2010 and 2021.

Figure 4.3.4 PERCENTAGE OF IMI PROJECT PUBLICATIONS EACH YEAR BY DOCUMENT TYPE, 2010-2021



- IMI project research continued to generate a high proportion of papers relative to other document types. Articles accounted for around 75.8% of all publications in 2021, consistent with recent years.

4.4 Publication output by country

Figure 4.4.1 shows a map highlighting all countries with one or more publication from IMI projects between 2010 and 2021. Figure 4.4.2 shows a map highlighting all countries with at least ten Web of Science publications from IMI projects between 2010 and 2021. Table 4.4.1 and Figure 4.4.3 shows the corresponding data; the total number of publications for the 20 and 10 countries respectively with the highest number publications from IMI projects between 2010 and 2021. A full list of all countries output of publications is included in Annex 3.

Figure 4.4.5 MAP OF COUNTRIES WHICH HAVE AT LEAST ONE WEB OF SCIENCE PUBLICATION FOR IMI PROJECTS, 2010-2021

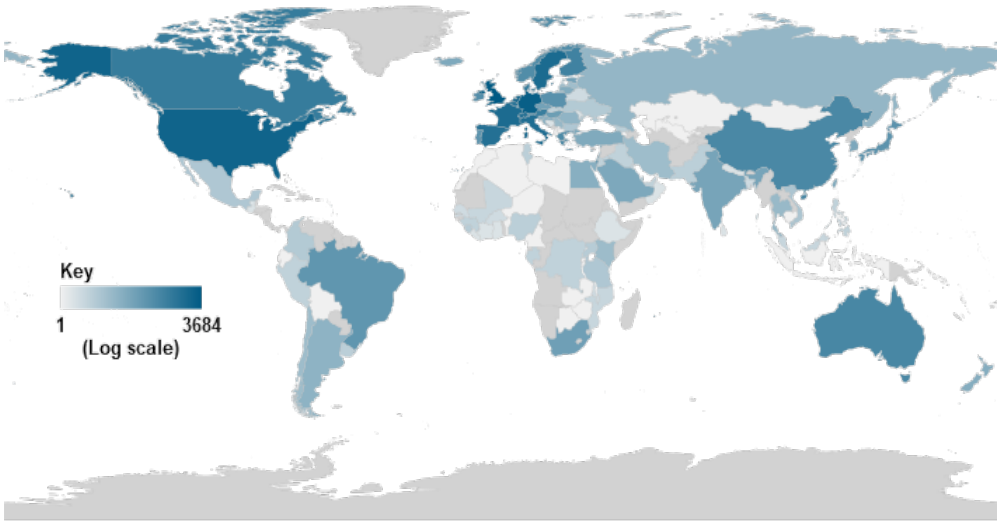
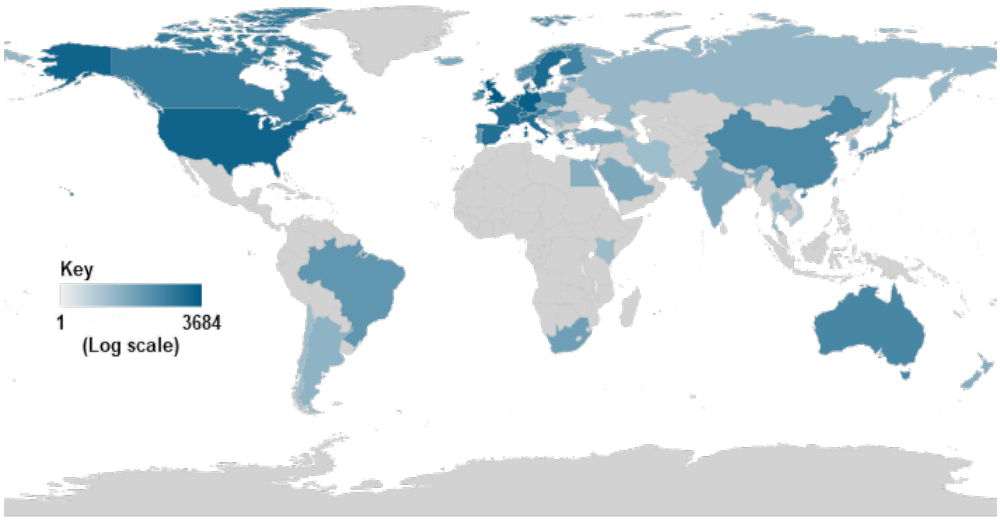


Figure 4.4.6 MAP OF COUNTRIES WHICH HAVE AT LEAST TEN WEB OF SCIENCE PUBLICATION FOR IMI PROJECTS, 2010-2021



- In total 122 countries have at least one IMI publication and 55 countries have at least ten IMI publications.

Figure 4.4.7 TEN COUNTRIES WITH THE MOST IMI PROJECT PUBLICATIONS. ANNEX 3 LISTS ALL COUNTRIES WITH AT LEAST ONE IMI PROJECT PUBLICATION, 2010-2021

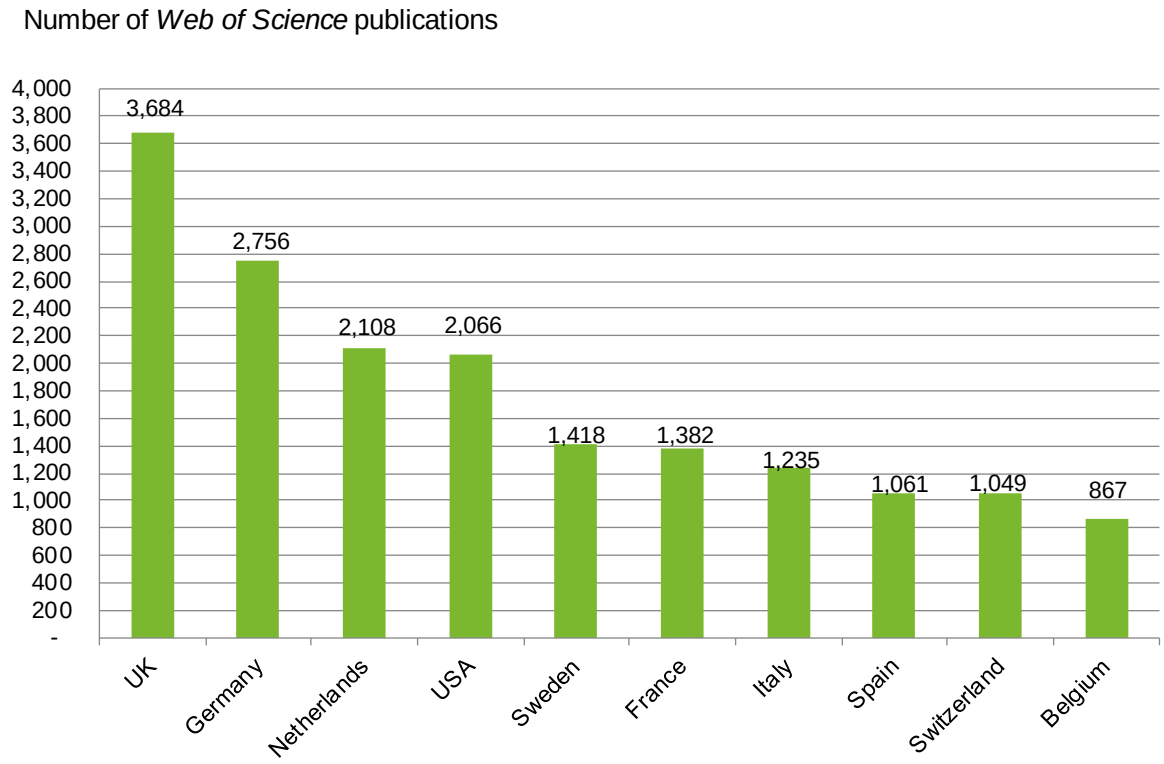


Table 4.4.2 TWENTY COUNTRIES WITH THE MOST IMI PROJECT PUBLICATIONS. ANNEX 3 LISTS ALL COUNTRIES WITH AT LEAST ONE IMI PROJECT PUBLICATION, 2010-2021

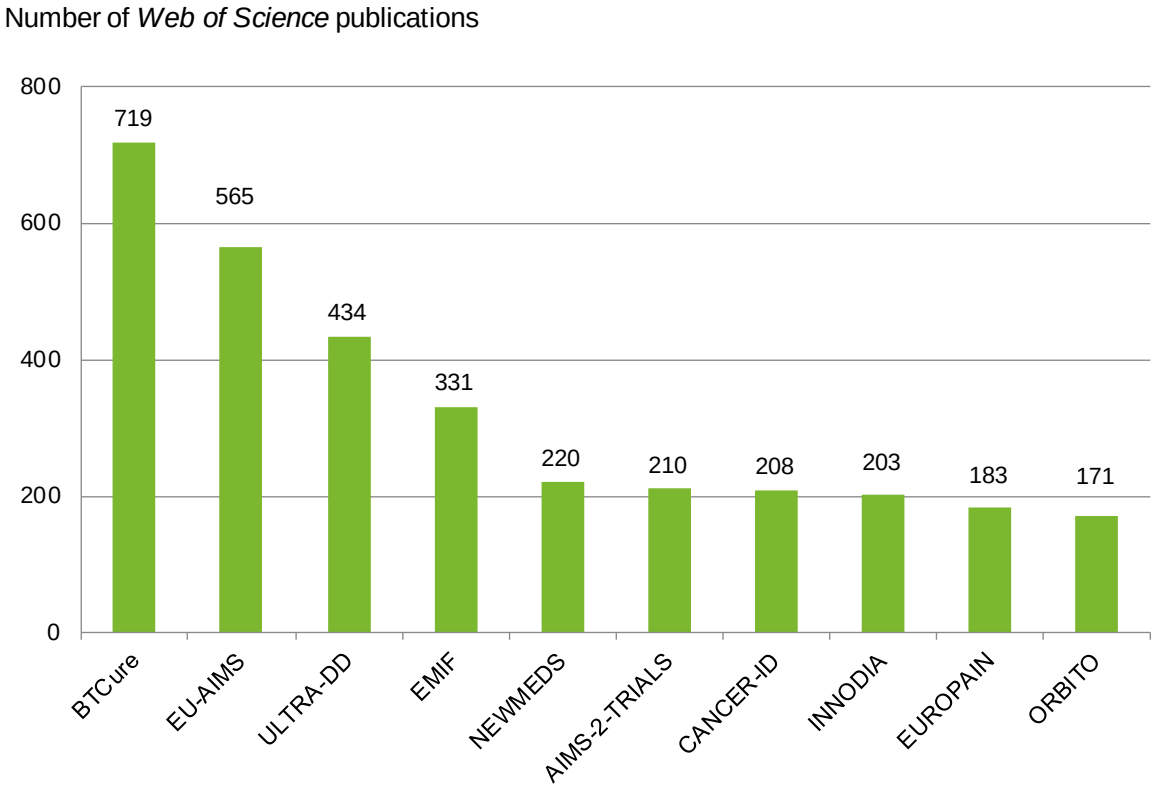
COUNTRY	NUMBER OF PUBLICATIONS
UK	3,684
Germany	2,756
Netherlands	2,108
USA	2,066
Sweden	1,418
France	1,382
Italy	1,235
Spain	1,061
Switzerland	1,049
Belgium	867
Denmark	633
Canada	568
Austria	508
Finland	402
Australia	313
China	286
Greece	249
Norway	225
Ireland	203
Poland	172

- Researchers affiliated to the United Kingdom authored the most IMI project publications (3,684 publications).
- Other EU-28 countries were among the countries with the highest output. The most productive exceptions are the USA (2,066 publications) and Switzerland (1,049 publications).

4.5 Publication output by IMI project

Figure 4.5.1 shows the ten IMI projects with the highest output of publications between 2010 and 2021. Table 4.5.1 expands upon Figure 4.5.1, listing the 20 IMI projects with the most publications, including the number and percentage of open access papers and the number of papers between 2010 and 2021. A full list of projects and the number of associated publications is presented in Annex 4.

Figure 4.5.8 NUMBER OF WEB OF SCIENCE PUBLICATIONS FOR TEN IMI PROJECTS WITH THE HIGHEST OUTPUT OF PUBLICATIONS, 2010-2021



- BTCure remains the most productive IMI project in terms of number of publications (719 publications) and the second most productive project is still EU-AIMS (565 publications).
- AIMS-2-TRIALS project continued its rapid growth nearly doubling the number of publications from last year and is now 6th in the top 10 projects with highest output of publications (210 publications), displacing Translocation (164 publications)
- AIMS-2-TRIALS and INNODIA are the only two projects from IMI phase 2 in the Top 10 projects by highest publication output.

Table 4.5.3 TWENTY IMI PROJECTS WITH THE MOST PUBLICATIONS, THE NUMBER OF PAPERS, NUMBER AND PERCENTAGE OF OPEN ACCESS PAPERS, 2010-2021.

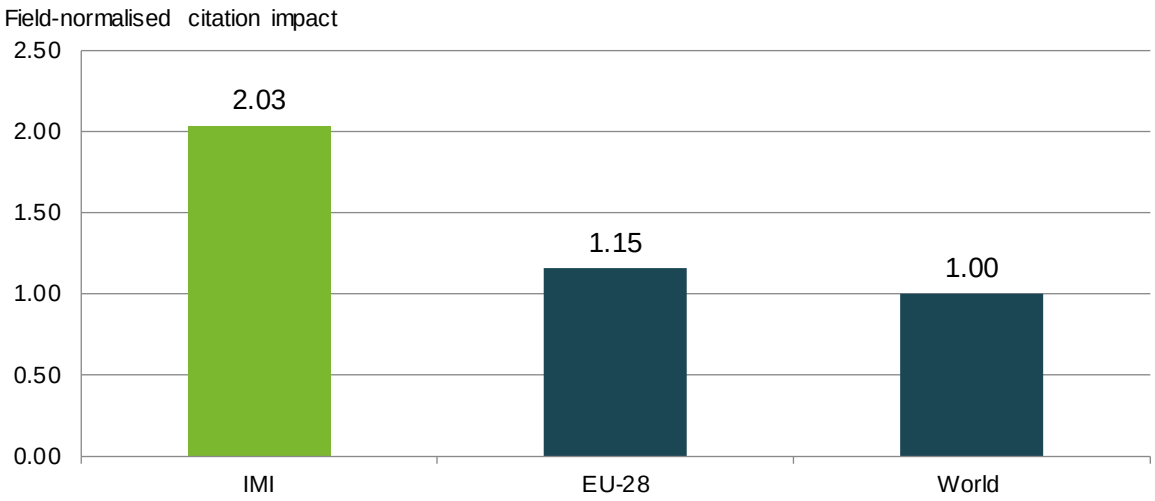
PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	NUMBER OF OPEN ACCESS PAPERS	% OF OPEN ACCESS PAPERS
BTCure	719	672	487	72.5%
EU-AIMS	565	546	453	83.0%
ULTRA-DD	434	425	362	85.2%
EMIF	331	310	261	84.2%
NEWMEDS	220	214	124	57.9%
AIMS-2-TRIALS	210	196	182	92.9%
CANCER-ID	208	180	132	73.3%
INNODIA	203	166	146	88.0%
EUROPAIN	183	181	73	40.3%
ORBITO	171	168	61	36.3%
TRANSLOCATION	164	164	110	67.1%
BigData@Heart	157	135	125	92.6%
STEMBANCC	153	147	120	81.6%
IMIDIA	151	141	121	85.8%
U-BIOPRED	148	93	68	73.1%
RTCure	146	131	112	85.5%
SUMMIT	141	136	106	77.9%
ELF	135	134	108	80.6%
CHEM21	131	128	64	50.0%
PreDiCT-TB	124	118	109	92.4%

4.6 Is IMI project research well cited?

The number of citations a paper receives (also known as its raw citation impact) is at least partly determined by the field to which it relates and the year in which it was published. Typically, papers published in disciplines such as biomedical research receive more citations than papers published in subjects such as engineering, and older papers tend to have higher citations counts on average than newer ones because they have had longer to accrue them. Therefore, citation impact is usually normalised to the relevant world average to allow comparison between years and fields; the resulting indicator is called the field-normalised citation impact.

Figure 4.6.1 shows the average field-normalised citation impact for all IMI papers compared to the average for EU-28 papers in relevant biomedical journal categories (see Annex 2) and all global papers published between 2010 and 2021. Table 4.6.1 and Table 4.6.2 present average citation impact indicators for all IMI papers.

Figure 4.6.9 FIELD-NORMALISED CITATION IMPACT FOR IMI SUPPORTED RESEARCH PAPERS COMPARED TO THE AVERAGE FOR EU-28 AND WORLD PAPERS, 2010-2021



- IMI's field-normalised citation impact remains twice that of the world average and is 2% higher than last year's report and 77% higher than the EU-28.

Table 4.6.4 SUMMARY CITATION ANALYSIS FOR IMI SUPPORTED RESEARCH PAPERS, 2010-2021

		CITATION IMPACT			
	NUMBER OF PAPERS	NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL	AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
IMI projects	7,856	2.03	1.23	35.0	25.3%
IMI 1	5,896	1.95	1.18	32.9	25.1%
IMI 2	2,070	2.19	1.34	41.6	25.6%

Table 4.6.5 SUMMARY OF IMI SUPPORTED RESEARCH PUBLICATIONS, 2010-2021

	NUMBER OF PUBLICATIONS	% OF OPEN ACCESS PAPERS*	NUMBER OF PAPERS	CITATIONS	RAW CITATION IMPACT
IMI Projects	8,609	77.2%	7,856	246,617	31.39
IMI 1	6,323	73.3%	5,896	218,147	37.00
IMI 2	2,382	89.2%	2,070	26,099	12.61

Summary of key findings

- The field-normalised citation impact of IMI project papers was 2.03 for the twelve-year period, 2010-2021, 2% higher than last year's report and double the World average.
- The field-normalised citation impact of IMI project papers was 76% higher than the EU's average citation impact (1.15)[5] between 2010 and 2021, in similar biomedical journal categories.
- More than a quarter (25.3%) of IMI papers were highly cited, that is they were in the world's top 10% of most highly cited papers in the relevant journal category and year of publication.
- IMI 2 has a higher percentage of open access papers compared with IMI 1. This is likely due to the stipulation that IMI 2 funded researcher should publish open access articles.[6]

[5] EU-28 grouping of countries: Clarivate National Science Indicators 2021 database; similar research has been defined as biomedical journal categories listed in Annex 2.

[6] Note that IMI 2 funded researchers are contractually obliged to make their scientific articles open access through Green or Gold routes. However, for some of other document types, such as editorials, reviews or conference proceedings open access publication is strongly encouraged but not mandatory.

4.7 In which journals do IMI project publications appear most frequently?

The 20 journals in which IMI project publications appeared most frequently (ranked by number of IMI publications) between 2010 and 2021, are listed in Table 4.7.1. Together, the 20 most frequently used journals account for 1,745 publications, 20.3% of IMI's publications

IMI project publications appeared most frequently in *Scientific Reports* which IMI published 195 publications. This was followed by *Plos One* where they published 193 publications. For most journals, papers (articles and reviews) were the most frequent publication type, however large collections of meeting abstracts were published in *European Respiratory Journal* (28 meeting abstracts).

IMI had a strong focus within Multidisciplinary Sciences and Pharmacology where four of the top 20 journals were assigned to each subject category. Followed by Rheumatology and Neurosciences which each had 3 journal titles in the top 20 titles.

Of the 20 most frequently used journals, nearly two thirds were in the top quartile (Q1) by Journal Impact Factor (JIF) while the rest were in the second quartile (Q2) ranked against other journals in the same category.

Overall, IMI project publications were published in a total of 1,555 journals. The average Journal Impact Factor for all IMI project publications is 7.53, a slight increase of 0.60 compared to the previous year.

The 20 highest Journal Impact Factor journals in which IMI project research was published are listed in Table 4.7.2. The journal with the highest Impact Factor is *Lancet*, with a Journal Impact Factor of 202.73 where IMI published 6 publications, four of which are papers. This is followed by *New England Journal of Medicine* with an Impact Factor of 176.08 where IMI published 1 publication. Of the top 20 journals by Impact Factor, IMI published the most publications (26) in *Nature* which has an Impact Factor of 69.50. IMI published a total of 132 publications in these top ranked journals by journal impact factor.

The 20 open access journals in which IMI projects publish most frequently (ranked by number of publications), are listed in Table 4.7.3. Of the top 20 open access journals, IMI published most frequently in *Scientific Reports* (195 publications) and the Journal with the highest Impact Factor was the *Annals of the Rheumatic* Diseases. 13 of these journals are ranked in the top quartile in their relevant journal categories, lower than last year's report of 16.

Nevertheless, it is obvious that fewer than all of IMI's publications are classified as open access in this analysis, and this is likely to be due to ancillary factors (such as challenges relating to definitions and coverage) as well as non-compliance. The Web of Science open access data come from the Directory of Open Access Journals (DOAJ) and collaborations with Impact Story and Our Research's Unpaywall services. The Web of Science therefore provides unrivalled coverage of open access publications that are published through DOAJ Gold, Other Gold, Green Published, Green Accepted or Bronze routes.

It is also possible that some publishers make publications available without following a recognised open access route. In these cases, publications will not be indexed as open access in the Web of Science or in this report

The Web of Science open access data coverage is summarised at: https://clarivate.com/webofsciencegroup/solutions/open-access/

Table 4.7.6 JOURNALS IN WHICH IMI PROJECT PUBLICATIONS WERE PUBLISHED MOST FREQUENTLY, TOP 20 RANKED BY NUMBER OF IMI PUBLICATIONS, 2010-2021

JOURNAL	NUMBER OF IMI PUBLICATIONS	NUMBER OF IMI PAPERS	JOURNAL IMPACT FACTOR (2021)	*WEB OF SCIENCE* JOURNAL CATEGORIES	QUARTILE
Scientific Reports	195	195	5.00	Multidisciplinary Sciences	Q2
Plos One	193	193	3.75	Multidisciplinary Sciences	Q2
Annals of the Rheumatic Diseases	191	126	27.97	Rheumatology	Q1
Diabetologia	150	79	10.46	Endocrinology & Metabolism	Q1
Nature Communications	117	116	17.69	Multidisciplinary Sciences	Q1
Frontiers In Immunology	96	95	8.79	Immunology	Q1
Journal Of Medicinal Chemistry	76	76	8.04	Chemistry, Medicinal	Q1
Diabetes	73	51	9.34	Endocrinology & Metabolism	Q1
Arthritis Research & Therapy	69	69	5.61	Rheumatology	Q1
Journal of Alzheimers Disease	67	66	4.16	Neurosciences	Q2
Arthritis & Rheumatology	64	55	15.48	Rheumatology	Q1
European Respiratory Journal	58	21	33.80	Respiratory System	Q1
Pain	57	55	7.93	Anesthesiology; Clinical Neurology; Neurosciences	Q1
International Journal of Molecular Sciences	54	54	6.21	Biochemistry & Molecular Biology; Chemistry, Multidisciplinary	Q2
European Journal of Pharmaceutics and Biopharmaceutics	50	50	5.59	Pharmacology & Pharmacy	Q1
European Journal of Pharmaceutical Sciences	48	46	5.11	Pharmacology & Pharmacy	Q2
Journal Of Antimicrobial Chemotherapy	48	47	5.76	Infectious Diseases; Microbiology; Pharmacology & Pharmacy	Q2
Translational Psychiatry	48	48	7.99	Psychiatry	Q1
Proceedings of the National Academy of Sciences of The United States of America	47	47	12.78	Multidisciplinary Sciences	Q1
Psychopharmacology	44	44	4.42	Neurosciences; Pharmacology & Pharmacy; Psychiatry	Q2

Table 4.7.7 JOURNALS IN WHICH IMI PROJECT PUBLICATIONS WERE PUBLISHED MOST FREQUENTLY, TOP 20 RANKED BY JOURNAL IMPACT FACTOR, 2010-2021

JOURNAL	NUMBER OF IMI PUBLICATIONS	NUMBER OF IMI PAPERS	JOURNAL IMPACT FACTOR (2021)	*WEB OF SCIENCE* JOURNAL CATEGORIES	QUARTILE
Lancet	6	4	202.73	Medicine, General & Internal	Q1
New England Journal Of Medicine	1	0	176.08	Medicine, General & Internal	Q1
Jama-Journal Of The American Medical Association	9	7	157.34	Medicine, General & Internal	Q1
Nature Reviews Molecular Cell Biology	1	1	113.92	Cell Biology	Q1
Nature Reviews Drug Discovery	15	8	112.29	Biotechnology & Applied Microbiology; Pharmacology & Pharmacy	Q1
Nature Reviews Immunology	4	2	108.56	Immunology	Q1
Lancet Respiratory Medicine	4	3	102.64	Critical Care Medicine; Respiratory System	Q1
BMJ-British Medical Journal	8	7	93.33	Medicine, General & Internal	Q1
Nature Medicine	17	16	87.24	Biochemistry & Molecular Biology; Cell Biology; Medicine, Research & Experimental	Q1
World Psychiatry	1	1	79.68	Psychiatry	Q1
Nature Reviews Microbiology	2	2	78.30	Microbiology	Q1
Lancet Psychiatry	6	4	77.06	Psychiatry	Q1
Nature Reviews Gastroenterology & Hepatology	4	3	73.08	Gastroenterology & Hepatology	Q1
Chemical Reviews	3	3	72.09	Chemistry, Multidisciplinary	Q1
Lancet Infectious Diseases	11	10	71.42	Infectious Diseases	Q1
Nature Reviews Cancer	2	2	69.80	Oncology	Q1
Nature	26	26	69.50	Multidisciplinary Sciences	Q1
Nature Biotechnology	3	1	68.16	Biotechnology & Applied Microbiology	Q1
Cell	6	6	66.85	Biochemistry & Molecular Biology; Cell Biology	Q1
Nature Reviews Disease Primers	3	3	65.04	Medicine, General & Internal	Q1

Table 4.7.8 OPEN ACCESS JOURNALS IN WHICH IMI PROJECT PUBLICATIONS WERE PUBLISHED MOST FREQUENTLY, TOP 20 RANKED BY NUMBER OF OPEN ACCESS WEB OF SCIENCE PUBLICATIONS, 2010-2021

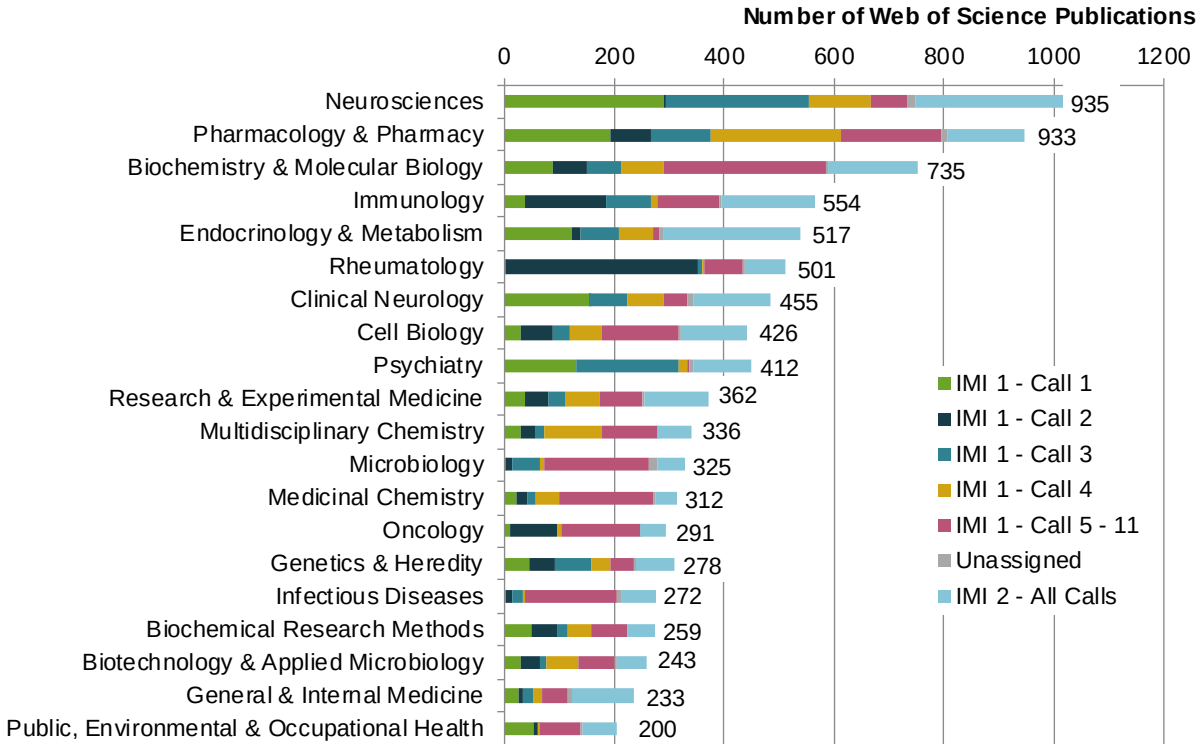
JOURNAL	NUMBER OF IMI PUBLICATIONS	NUMBER OF IMI PAPERS	JOURNAL IMPACT FACTOR (2021)	*WEB OF SCIENCE* JOURNAL CATEGORIES	QUARTILE
Scientific Reports	195	195	5.00	Multidisciplinary Sciences	Q2
Plos One	193	193	3.75	Multidisciplinary Sciences	Q2
Nature Communications	117	116	17.69	Multidisciplinary Sciences	Q1
Annals Of The Rheumatic Diseases	116	74	27.97	Rheumatology	Q1
Frontiers In Immunology	96	95	8.79	Immunology	Q1
Diabetologia	73	70	10.46	Endocrinology & Metabolism	Q1
Arthritis Research & Therapy	69	69	5.61	Rheumatology	Q1
International Journal Of Molecular Sciences	54	54	6.21	Biochemistry & Molecular Biology; Chemistry, Multidisciplinary	Q2
Journal Of Medicinal Chemistry	51	51	8.04	Chemistry, Medicinal	Q1
Journal Of Alzheimers Disease	51	50	4.16	Neurosciences	Q2
Translational Psychiatry	48	48	7.99	Psychiatry	Q1
Journal Of Antimicrobial Chemotherapy	46	45	5.76	Infectious Diseases; Microbiology; Pharmacology & Pharmacy	Q2
Arthritis & Rheumatology	46	45	15.48	Rheumatology	Q1
Proceedings Of The National Academy Of Sciences Of The United States Of America	45	45	12.78	Multidisciplinary Sciences	Q1
Antimicrobial Agents And Chemotherapy	43	42	5.94	Microbiology; Pharmacology & Pharmacy	Q1
BMJ Open	43	43	3.01	Medicine, General & Internal	Q2
Molecular Autism	42	41	6.48	Genetics & Heredity; Neurosciences	Q1
Diabetes	40	40	9.34	Endocrinology & Metabolism	Q1
Alzheimers Research & Therapy	40	40	8.82	Clinical Neurology; Neurosciences	Q1
Cell Reports	40	40	9.99	Cell Biology	Q1

4.8 Which research fields account for the highest volume of IMI project publications?

Figure 4.8.1 shows the twenty Web of Science journal categories[7] most frequently associated with IMI funded research between 2010 and 2021. IMI 1 calls 5-11 have a lower number of publications relative to calls 1-4 and for clarity of presentation these publications are shown as one group in Figure 4.8.1. Likewise, IMI 2 has far fewer publication compared to IMI 1 and so all IMI 2 publications are shown as one group in Figure 4.8.1. Publications that acknowledge IMI funding but do not specify a project, phase or call are classed as Unassigned. Note that some bars are longer than the total number of IMI publications in a journal category (indicated by the data labels) due to some papers being associated with multiple calls. Figure 4.8.2 shows the ten Web of Science journal categories most frequently associated with IMI 2 funded research.

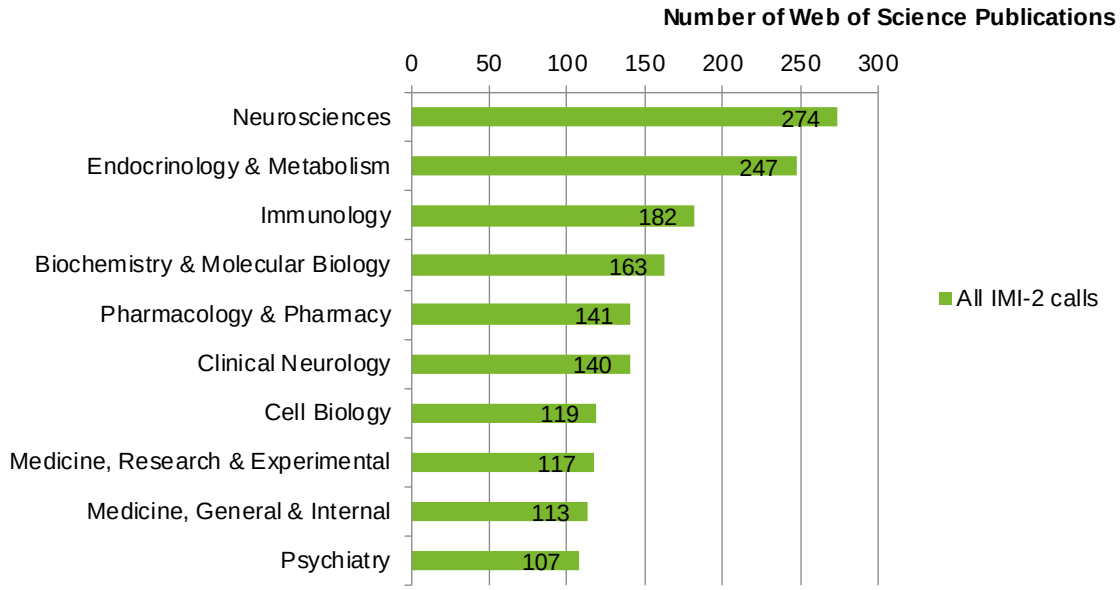
Table 4.8.1 shows the same data as Figure 4.8.1 and Figure 4.8.2 for the top twenty journal categories. It provides the number of publications assigned to each of the top twenty Web of Science journal categories in which IMI project research is published by IMI 1 calls and IMI 2 in total.

Figure 4.8.10 TOP TWENTY WEB OF SCIENCE JOURNAL CATEGORIES IN WHICH IMI PROJECT RESEARCH WAS PUBLISHED MOST FREQUENTYLY, 2010-2021. DATA LABELS SHOWS THE TOTAL NUMBER OF PUBLICATIONS PER JOURNAL CATEGORY



[7] Journals can be associated with more than one Web of Science category.

Figure 4.8.11 TOP TEN WEB OF SCIENCE JOURNAL CATEGORIES IN WHICH IMI 2 PROJECT RESEARCH (ALL CALLS) WAS PUBLISHED MOST FREQUENTLY, 2010-2021. DATA LABELS SHOWS THE TOTAL NUMBER OF PUBLICATIONS PER JOURNAL CATEGORY



- IMI projects produced more publications in Neurosciences (935) than other journal categories which is a change from previous years where Pharmacology & Pharmacy (933 publications), now second, was the most productive journal category. They are followed by Biochemistry & Molecular Biology (735 publications) and Immunology (554 publications).

- Most publications in IMI 1 calls 5 to 11 belong to call 11.

- IMI 2 publications most frequently appeared in Neurosciences (274 publications) again a change from last year where Endocrinology & Metabolism journals (247 publications) was the most productive. They are followed by Immunology (182 publications) and Biochemistry & Molecular Biology.

Table 4.8.9 NUMBER OF PUBLICATIONS BY IMI 1 CALL AND IMI 2 FOR TWENTY WEB OF SCIENCE JOURNAL CATEGORIES IN WHICH IMI PROJECT RESEARCH WAS PUBLISHED MOST FREQUENTLY, 2010-2021. ORDERED BY TOTAL NUMBER OF PUBLICATIONS.

JOURNAL CATEGORY	NUMBER OF PUBLICATIONS BY IMI 1 CALL												
	1	2	3	4	5	6	7	8	9	10	11	IMI 2	Not assigned
Neurosciences	291	3	261	110	0	0	0	33	3	0	34	274	13
Pharmacology & Pharmacy	194	71	110	239	14	44	9	17	50	0	71	141	12
Biochemistry & Molecular Biology	89	61	63	77	30	44	0	36	16	1	172	163	5
Immunology	37	146	83	12	1	9	17	16	10	35	31	182	4
Endocrinology & Metabolism	121	19	68	63	0	0	0	1	2	0	8	247	8
Rheumatology	2	348	11	2	0	0	1	36	0	0	34	75	2
Clinical Neurology	154	1	68	68	0	0	0	13	0	0	30	140	11
Cell Biology	29	59	30	61	2	6	0	23	11	1	95	119	5
Psychiatry	132	0	185	14	0	0	1	1	1	0	4	107	5
Research & Experimental Medicine	36	45	29	63	0	3	19	4	2	15	36	117	4
Chemistry, Multidisciplinary	30	25	16	107	36	15	0	8	5	0	38	59	1
Microbiology	2	12	52	5	2	90	1	11	60	8	77	56	16
Chemistry, Medicinal	23	18	15	42	50	9	0	14	1	0	102	44	5
Oncology	10	87	0	8	1	0	2	1	0	0	137	44	2
Genetics & Heredity	45	47	65	36	0	2	0	10	1	0	33	69	3
Infectious Diseases	4	8	23	2	2	60	2	7	65	10	82	71	7
Biochemical Research Methods	48	46	20	43	2	9	0	16	1	1	40	49	0
Biotechnology & Applied Microbiology	31	34	13	55	2	3	0	25	2	6	28	56	5
General & Internal Medicine	25	7	20	16	0	7	2	4	24	0	20	113	8
Public, Environmental & Occupational Health	53	7	2	4	0	12	20	0	28	1	24	65	3

Table 4.8.2 and Table 4.8.3 show the citation impact, percentage of highly cited papers and percentage of open access papers for IMI project research in the top twenty journal categories.

Table 4.8.10 FIELD-NORMALISED, JOURNAL-NORMALISED AND RAW CITATION IMPACT OF PAPERS FOR THE TWENTY WEB OF SCIENCE JOURNAL CATEGORIES IN WHICH IMI PROJECT RESEARCH WAS PUBLISHED MOST FREQUENTLY, 2010-2021. ORDERED BY TOTAL NUMBER OF PAPERS.

JOURNAL CATEGORY	NUMBER OF PAPERS	CITATION IMPACT		
		NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL	RAW CITATION IMPACT
Neurosciences	875	2.12	1.40	31.94
Pharmacology & Pharmacy	875	1.36	1.09	21.10
Biochemistry & Molecular Biology	718	2.20	1.49	36.67
Immunology	526	1.65	1.21	25.89
Endocrinology & Metabolism	409	1.82	1.18	20.86
Rheumatology	408	1.90	0.90	28.89
Clinical Neurology	403	2.51	1.43	39.66
Cell Biology	408	2.08	1.31	36.49
Psychiatry	379	2.34	1.26	31.47
Medicine, Research & Experimental	352	1.97	1.03	27.32
Chemistry, Multidisciplinary	331	1.41	1.14	33.90
Microbiology	315	1.66	1.10	22.84
Chemistry, Medicinal	309	1.44	1.19	16.20
Oncology	262	2.54	1.41	50.11
Genetics & Heredity	259	2.14	1.26	40.28
Infectious Diseases	250	2.17	1.34	22.62
Biochemical Research Methods	254	1.36	1.16	22.87
Biotechnology & Applied Microbiology	223	1.66	1.26	26.68
Medicine, General & Internal	219	3.21	1.60	39.49
Public, Environmental & Occupational Health	178	1.54	1.28	14.47

Table 4.8.11 NUMBER OF PUBLICATIONS, NUMBER OF PAPERS, PERCENTAGE OPEN ACCESS AND PERCENTAGE HIGHLY CITED PAPERS FOR THE TOP TWENTY WEB OF SCIENCE JOURNAL CATEGORIES IN WHICH IMI PROJECT RESEARCH WAS PUBLISHED MOST FREQUENTLY, 2010-2021. ORDERED BY TOTAL NUMBER OF PUBLICATIONS.

JOURNAL CATEGORY	NUMBER OF PUBLICATIONS	% OF OPEN ACCESS PAPERS	NUMBER OF PAPERS	% OF HIGHLY CITED PAPERS
Neurosciences	935	72.9%	875	28.1%
Pharmacology & Pharmacy	933	59.1%	875	19.1%
Biochemistry & Molecular Biology	735	76.5%	718	25.9%
Immunology	554	79.7%	526	19.6%
Endocrinology & Metabolism	517	80.2%	409	20.5%
Rheumatology	501	68.9%	408	27.7%
Clinical Neurology	455	64.3%	403	37.5%
Cell Biology	426	84.6%	408	36.3%
Psychiatry	412	74.4%	379	25.6%
Research & Experimental Medicine	362	77.0%	352	26.7%
Multidisciplinary Chemistry	336	72.2%	331	19.6%
Microbiology	325	88.9%	315	24.1%
Medicinal Chemistry	312	66.0%	309	14.6%
Oncology	291	76.3%	262	35.1%
Genetics & Heredity	278	83.4%	259	27.0%
Infectious Diseases	272	86.8%	250	26.8%
Biochemical Research Methods	259	65.7%	254	23.6%
Biotechnology & Applied Microbiology	243	83.9%	223	26.9%
General & Internal Medicine	233	94.1%	219	30.6%
Public, Environmental & Occupational Health	161	57.8%	142	19.0%

- IMI project research was most frequently published in Neurosciences journals. Of the 875 papers published in this category, more than a quarter (28%) were highly cited.
- Clinical Neurology (403 papers) remains the category with the highest percentage of highly cited papers (37.5%), followed by Cell Biology with 408 papers of which 36.3% are highly cited.
- The percentage of open access papers is highest in General & Internal Medicine (94.1%), followed by Microbiology (88.9%) and Infectious Diseases (86.8%).

4.9 IMI research fields with the highest volume of publications benchmarked against EU-28 publications of the same field

Figure 4.9.1 shows the field-normalised citation impact of IMI funded research in the twenty Web of Science journal categories in which IMI project research was published most frequently between 2010 and 2021. These data are benchmarked against the average citation impact of all EU-28 research papers in the same journal categories. Table 4.9.2, expands on the data presented in Figure 4.9.1, showing the percentage of IMI and EU-28 papers in each journal category.

Figure 4.9.12 THE FIELD-NORMALISED CITATION IMPACT OF IMI PROJECT RESEARCH IN THE TOP 20 WEB OF SCIENCE JOURNAL CATEGORIES WHICH IMI PROJECT RESEARCH WAS MOST FREQUENTLY PUBLISHED, BENCHMARKED AGAINST EU-28 PAPERS IN THE SAME JOURNAL CATEGORIES, 2010-2021. ORDERED BY THE FIELD-NORMALISED CITATION IMPACT OF IMI RESEARCH.

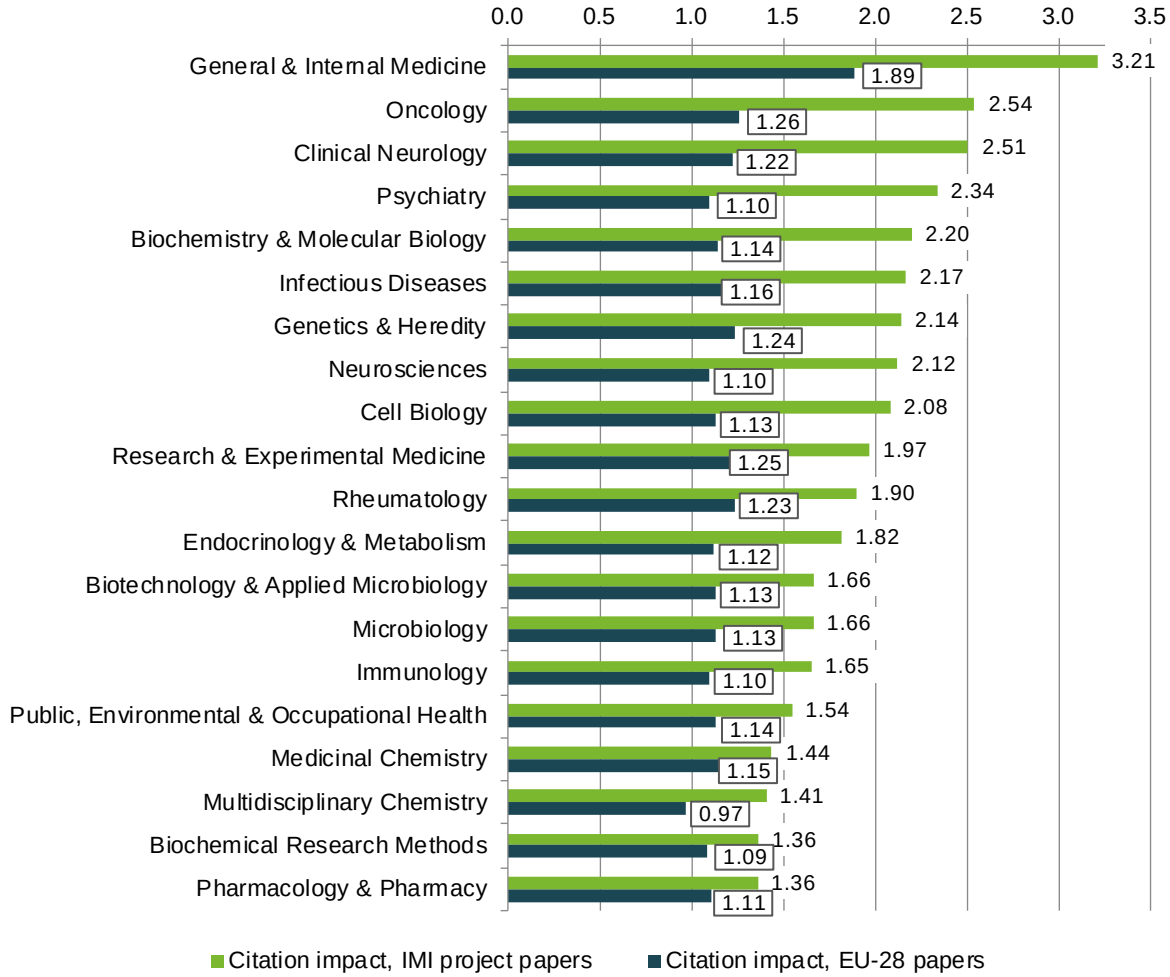


Table 4.9.2 CITATION IMPACT AND PERCENTAGE OF PAPERS IN TOP TWENTY WEB OF SCIENCE JOURNAL CATEGORIES IN WHICH IMI PROJECT RESEARCH WAS MOST FREQUENTLY PUBLISHED, BENCHMARKED AGAINST EU-28 IN THE SAME JOURNAL CATEGORIES, 2010-2021

JOURNAL CATEGORY	% OF IMI PAPERS	% OF EU-28 PAPERS	CITATION IMPACT NORMALISED AT FIELD LEVEL	
			IMI papers	EU-28
General & Internal Medicine	2.97%	0.24%	3.21	1.89
Oncology	3.70%	2.37%	2.54	1.26
Clinical Neurology	5.79%	1.94%	2.51	1.22
Psychiatry	5.24%	1.48%	2.34	1.10
Biochemistry & Molecular Biology	9.36%	3.60%	2.20	1.14
Infectious Diseases	3.46%	1.02%	2.17	1.16
Genetics & Heredity	3.54%	1.31%	2.14	1.24
Neurosciences	11.90%	2.71%	2.12	1.10
Cell Biology	5.42%	1.70%	2.08	1.13
Research & Experimental Medicine	4.61%	1.14%	1.97	1.25
Rheumatology	6.38%	0.45%	1.90	1.23
Endocrinology & Metabolism	6.58%	1.34%	1.82	1.12
Biotechnology & Applied Microbiology	3.09%	1.31%	1.66	1.13
Microbiology	4.14%	1.54%	1.66	1.13
Immunology	7.05%	1.51%	1.65	1.10
Public, Environmental & Occupational Health	2.55%	1.96%	1.54	1.14
Medicinal Chemistry	3.97%	0.67%	1.44	1.15
Multidisciplinary Chemistry	4.28%	3.13%	1.41	0.97
Biochemical Research Methods	3.30%	1.04%	1.36	1.09
Pharmacology & Pharmacy	11.88%	2.19%	1.36	1.11

- In all twenty journal categories listed, IMI project research had a higher field-normalised citation impact than EU-28 papers in the same field.
- General & Internal Medicine (3.21) and Oncology (2.54) were the top two journal categories in which IMI-supported research had the highest field-normalised citation impact. This is a change from last year where Clinical Neurology was the top journal category but is now third with a field-normalised citation impact of 2.51.
- The average field-normalised citation impact of EU-28 papers was also the highest in the same two categories of General & Internal Medicine (1.89) and Oncology (1.26).

5 CITATION ANALYSIS – AT IMI PROJECT LEVEL

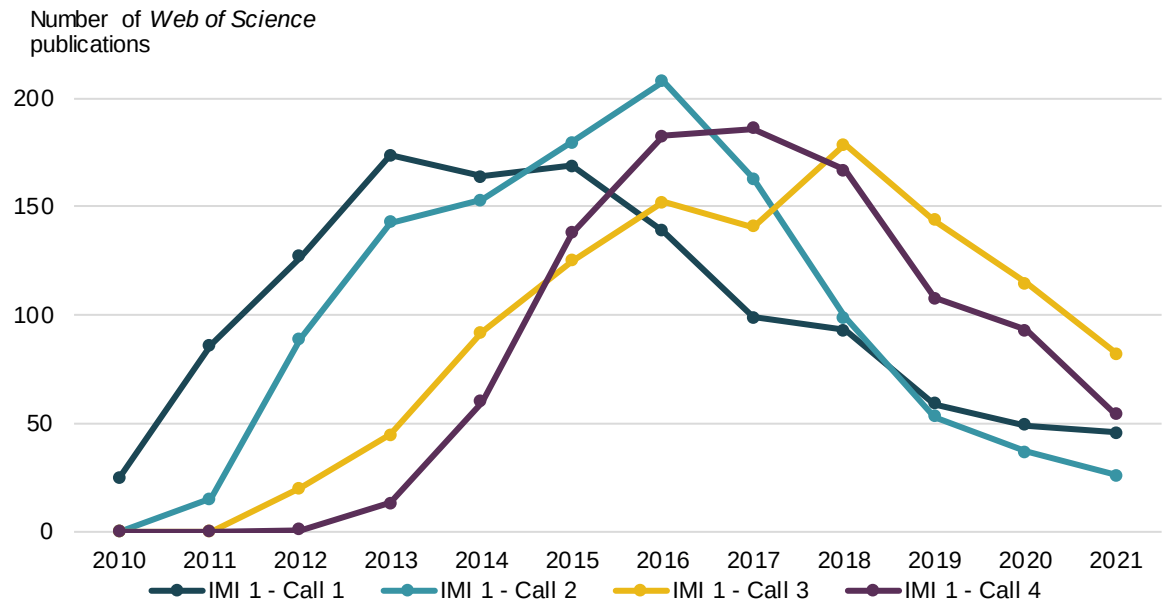
This section analyses the volume and citation impact of publications arising from different IMI-phases and calls.

5.1 Trends in publication output by IMI funding call

Figure 5.1.1 and Figure 5.1.2 show the number of Web of Science publications between 2010 and 2021 for IMI project research disaggregated by call. IMI 1 calls 1-4 (Figure 5.1.1) are shown separately from the more recent IMI 1 calls 5-11 (Figure 5.1.2) which tend to have fewer publications. Likewise, IMI 2 calls are shown separately in Figure 5.1.3 as individual IMI 2 calls has far fewer publication compared to most IMI 1 calls as the longest running IMI 2 projects only started publishing in 2015.

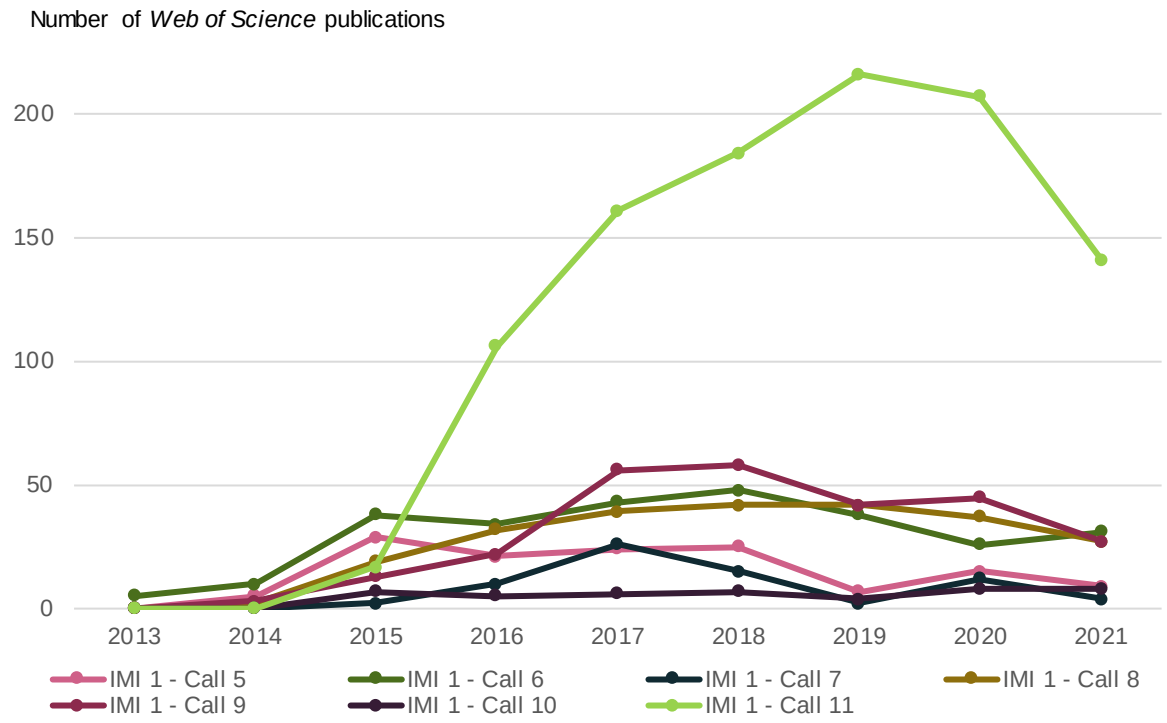
Table 5.1.1 presents summary bibliometric data for all IMI 1 and IMI 2 calls that have at least one publication, including the number of publications, numbers of papers, and citation impact indicators.

Figure 5.1.1 NUMBER OF WEB OF SCIENCE PUBLICATIONS BY YEAR AND FUNDING CALL, 2010-2021



- Over the five years 2010 to 2014, IMI 1 call 1 had the highest output of publications, reaching a peak output of 174 publications in 2013.
- In 2015 and 2016, IMI 1 call 2 had the highest number of publications (180 and 208, respectively). In 2017 call 2's output fell (163 publications) and call 4 had the highest output of publications (186 publications).
- In 2021 all IMI 1 calls 1-4 continue to trend downward. Which is likely to continue since all the calls are now closed.
- Call 3 remains the call with the highest number of publications and appears to have a steeper decline then the other calls.

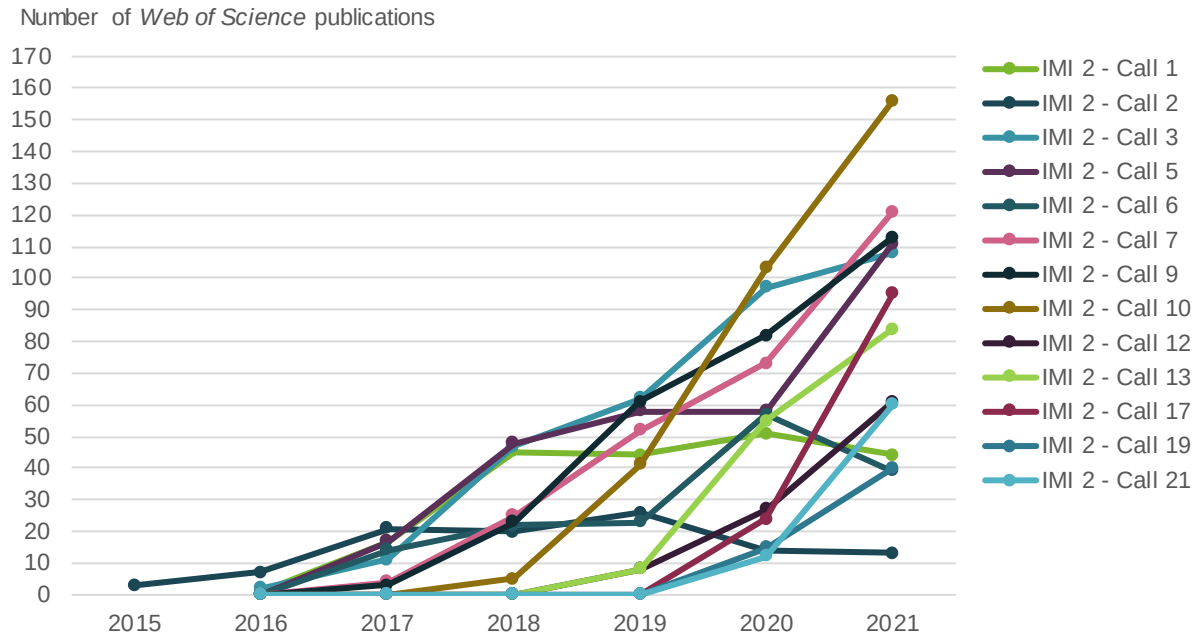
Figure 5.1.2 NUMBER OF WEB OF SCIENCE PUBLICATIONS BY YEAR AND FUNDING CALL, 2010-2021



- Overall, IMI 1 calls 5-10 have not grown as rapidly as IMI 1 calls 1-4, most calls produce fewer than 50 publications a year. Call 11 is the exception, with growth in output akin to IMI 1 calls 1-4. This growth has declined substantially in 2021 (-32%).

- Many of the call 11 projects closed in 2021 so it is likely that we will continue to see this type of decline for call 11.

Figure 5.1.3 NUMBER OF WEB OF SCIENCE PUBLICATIONS BY YEAR AND FUNDING CALL, 2010-2021. ONLY SHOWING IMI 2 CALLS WITH AT LEAST 50 PUBLICATIONS IN TOTAL.



- The output of publications from IMI 2 calls is growing. IMI 2 call 2 was the first to start publishing in 2015 and after plateauing between 2017-2019 it has now begun declining.
- IMI 2 Calls 12, 17, 19 and 21 are newly included to this analysis as the number of publications within these calls have increased rapidly, mostly driven by the project EHDEN, EubOPEN, INNODIA HARVEST, and DRAGON, respectively.
- Call 10's rapid increase continues and is still largely driven by the AIMS-2-Trials which published 101 publications in 2021 which is 64% of Call 10s publications in 2021.
- In contrast to last year, call 5 had a rapid increase in publications. While the rest of the calls continue on their trajectory from last year with the exception of Call 6 which has decreased from last year.

Table 5.1.1 SUMMARY BIBILIOMETRIC ANALYSES OF IMI PROJECTS AGGREGATED BY FUNDING CALL, 2010-2021

PHASE	CALL	NUMBER OF PUBLICATIONS[8]	% OF OPEN ACCESS PAPERS	NUMBER OF PAPERS	CITATION IMPACT		
					RAW CITATION IMPACT	NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL
1	1	1,230	61.6%	1,134	44.92	1.08	1.79
1	2	1,166	75.1%	1,098	50.05	1.19	2.16
1	3	1,095	80.9%	1,010	32.60	1.06	1.94
1	4	1,003	67.8%	957	36.57	1.27	2.02
1	5	135	80.6%	134	18.61	1.01	1.11
1	6	273	73.9%	264	20.68	0.95	1.28
1	7	71	85.9%	64	18.81	1.28	1.53
1	8	240	79.8%	213	31.21	1.36	2.18
1	9	266	72.5%	247	26.44	1.41	1.63
1	10	45	84.1%	44	15.34	0.95	1.58
1	11	1,032	81.9%	945	28.40	1.25	2.18
2	1	203	88.0%	166	15.39	1.15	1.62
2	2	104	89.9%	99	19.67	1.26	1.93
2	3	327	88.9%	270	14.66	1.21	2.04
2	4	4	50.0%	4	8.25	0.32	0.58
2	5	292	93.5%	261	15.27	1.23	2.41
2	6	155	92.2%	129	14.05	1.26	2.01
2	7	275	91.4%	244	19.62	1.37	2.72
2	8	26	91.7%	24	8.83	0.77	0.83
2	9	282	85.5%	241	16.72	1.41	2.84
2	10	305	90.0%	270	8.95	1.19	2.21

[8] Publications can be associated with more than one call.

PHASE	CALL	NUMBER OF PUBLICATIONS[8]	% OF OPEN ACCESS PAPERS	NUMBER OF PAPERS	CITATION IMPACT		
					RAW CITATION IMPACT	NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL
2	12	96	92.5%	80	4.64	1.28	1.74
2	13	147	90.3%	134	8.16	1.38	1.96
2	14	39	82.4%	34	6.00	1.12	2.30
2	15	47	85%	33	4.61	2.51	1.81
2	16	2	100%	2	10.00	5.21	4.39
2	17	119	79%	117	4.50	1.45	2.07
2	18	4	75%	4	4.00	4.20	3.97
2	19	55	98%	46	4.70	1.48	1.60
2	20	10	88%	8	2.75	0.83	2.70
2	21	72	97%	59	9.42	3.71	4.08
2	23	3	100%	3	0.67	0.34	0.50

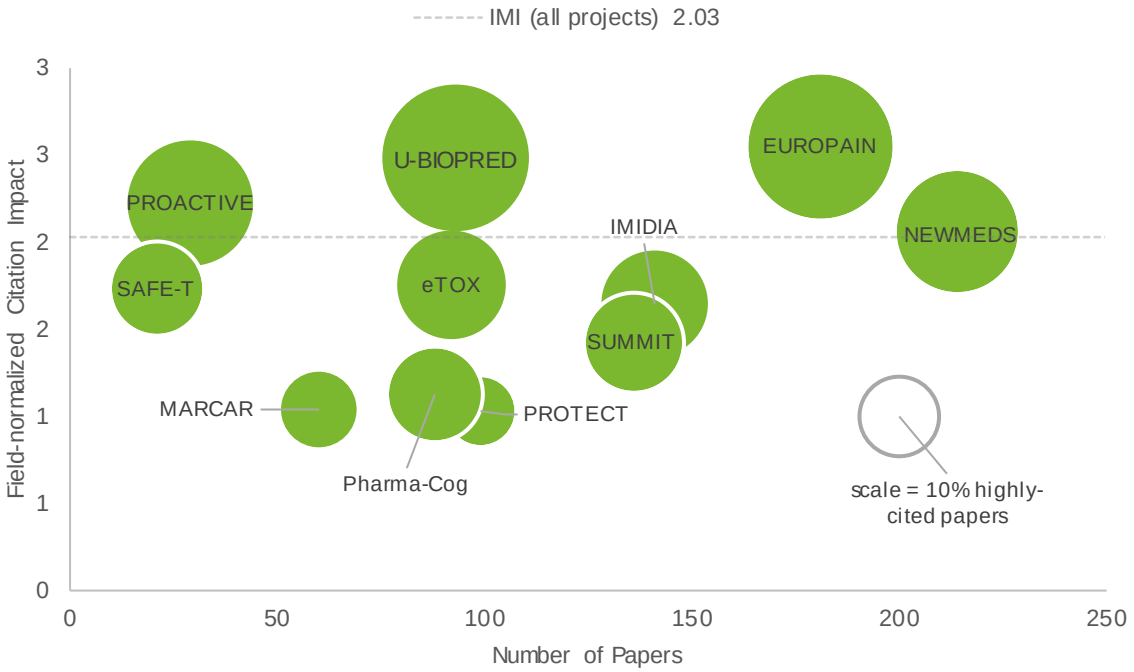
- IMI 1 call 1 remains the funding call that produced the highest number of publications (1,230), and papers (1,134). Although papers from IMI 1 call 2 had the highest raw citation impact (50.05).
- Papers assigned to IMI 2 call 21 had the highest average field-normalised citation impact (3.71)[9], which is three times the world average and is likely driven by the fact that many of these projects in this call are Coronavirus related. This is driven by a few highly cited papers, mainly within the CARE and DRAGON projects, which were cited between 10 and 30 times the world average.
- The highest percentage of open access papers belongs to IMI 2 call 19 where 98% of the publications are open access[9].
- Generally, IMI 2 calls have a higher proportion of open access papers compared to IMI 1 calls likely due to the mandate that papers in IMI 2 be published as open access.
- IMI 2 call 3 with 327 publications is IMI 2's highest output call.

9 Only calls with at least 10 papers were considered

5.2 Summary bibliometric analyses for imi 1 projects – call 1

Figure 5.2.1 compares the number of papers, average field-normalised citation impact and share of highly cited papers for IMI 1 call 1 projects. Only projects with at least 10 papers and one highly cited paper over the time period (2010-2021) are shown. The area of the 'bubble' is proportional to the share of highly cited papers. The dotted horizontal line indicates the average field-normalised citation impact for all IMI project papers.

Figure 5.2.4 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 1 PROJECTS - CALL 1, 2010-2021



The data in Figure 5.2.1 shows that:

- The average field-normalised citation impact of all IMI 1 call 1 projects with at least 10 papers was above the world average (1.00). Furthermore, the percentage of highly cited research was also above or in line with the world average (10%) for all projects except for the PROTECT Project which 8.1% of its papers were highly cited. This indicates excellent research performance.
- Research associated with NEWMEDS, EUROPAIN, PROACTIVE and U-BIOPRED was cited more than twice the world average. These four projects also have an average citation impact greater than the average citation impact of all IMI project papers (2.03).

Table 5.2.1 shows raw citation impact and the percentage of open access papers by project for IMI 1 call 1 publications. Table 5.2.2 shows the normalised citation impact (normalised against world average values) of IMI 1 call 1 projects and is an expansion of the data shown in Figure 5.2.1.

Table 5.2.2 BIBLIOMETRIC INDICATORS FOR IMI 1 PROJECTS IN CALL 1, 2010-2021

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	CITATIONS	RAW CITATION IMPACT
NEWMEDS	220	214	57.9%	12,350	57.71
EUROPAIN	183	181	40.3%	11,592	64.04
IMIDIA	151	141	85.8%	6,834	48.47
SUMMIT	141	136	77.9%	3,888	28.59
PROTECT	101	99	46.5%	2,327	23.51
U-BIOPRED	148	93	73.1%	4,348	46.75
eTOX	97	92	69.6%	4,184	45.48
Pharma-Cog	94	88	44.3%	3,196	36.32
MARCAR	61	60	73.3%	1,518	25.30
PROACTIVE	34	29	89.7%	1,520	52.41
SAFE-T	23	21	38.1%	637	30.33

Table 5.2.3 SUMMARY CITATION INDICATORS FOR IMI1 PROJECTS IN CALL 1, 2010-2021

PROJECT	NUMBER OF PAPERS	CITATION IMPACT		AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
		NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL		
NEWMEDS	214	2.06	1.10	31.78	25.7%
EUROPAIN	181	2.55	1.37	24.99	36.5%
IMIDIA	141	1.65	1.03	31.43	19.9%
SUMMIT	136	1.42	0.90	38.19	16.2%
PROTECT	99	1.03	0.91	40.28	8.1%
U-BIOPRED	93	2.49	1.33	22.09	37.6%
eTOX	92	1.76	1.24	30.89	20.7%
Pharma-Cog	88	1.13	0.84	44.54	14.8%
MARCAR	60	1.04	0.76	42.33	10.0%
PROACTIVE	29	2.22	1.57	26.19	27.6%
SAFE-T	21	1.73	1.06	33.06	14.3%
Overall (IMI projects)	**7,856**	**2.03**	**1.23**	**34.98**	**25.3%**

- Of the projects in call 1, NEWMEDS had the highest number of publications (220) and PROACTIVE had the highest percentage of open access papers (89.7%).

5.3 Summary bibliometric analyses for IMI 1 projects – call 2

Figure 5.3.1 compares the number of papers, average field-normalised citation impact and share of highly cited papers for IMI 1 call 2 projects. Only projects with at least 10 papers and one highly cited paper over the time period (2010-2021) are shown. The area of the 'bubble' is proportional to the share of highly cited papers. The dotted horizontal line indicates the average field-normalised citation impact for all IMI project papers. The same data is shown in Figure 5.3.1 and Figure 5.3.2, however Figure 5.3.1 has a smaller x-axis range that excludes BTCure so that the other projects are less clustered.

Figure 5.3.5 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 1 PROJECTS – CALL 2, 2010-2021

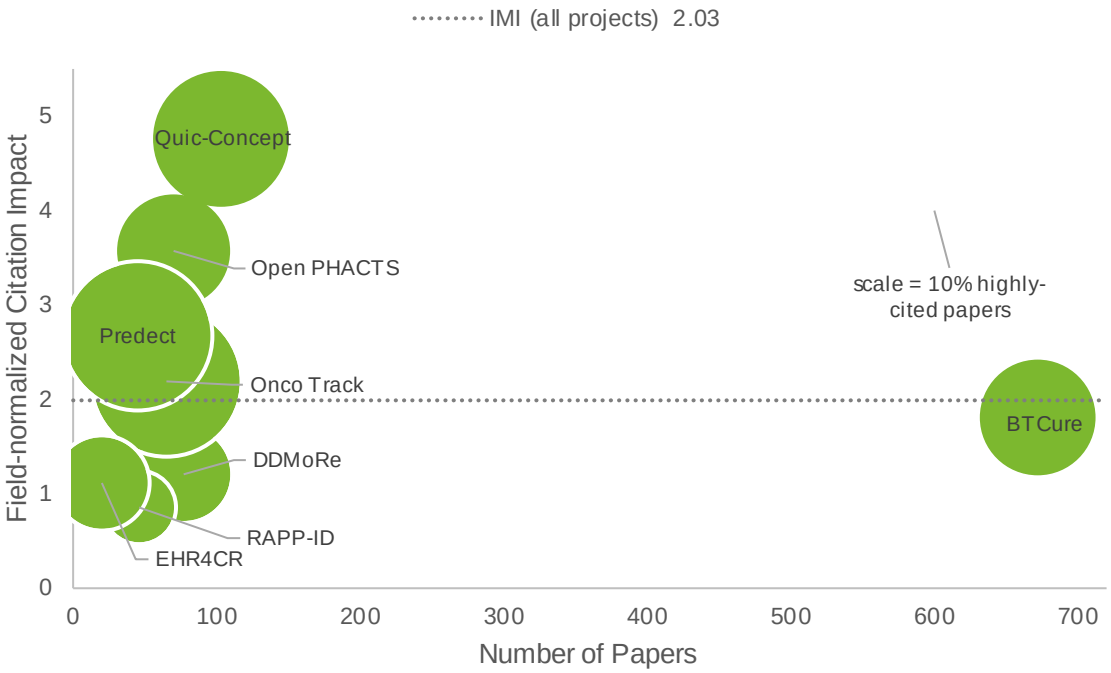
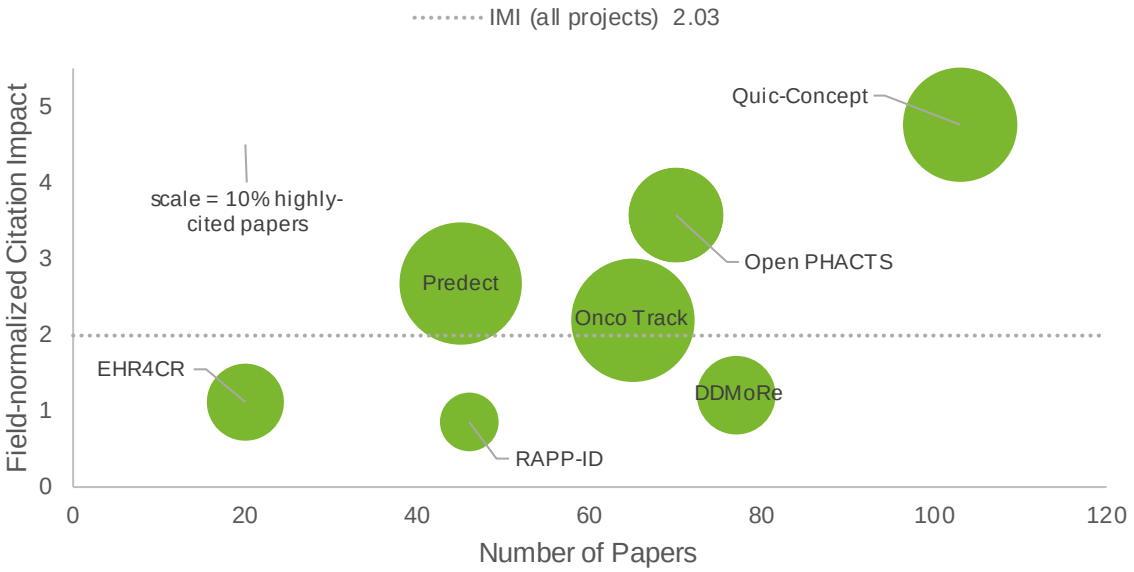


Figure 5.3.6 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 1 PROJECTS – CALL, 2010-2021. SAME GRAPH AS FIGURE 5.3.1 BUT WITH A SMALLER X-AXIS RANGE



The data in Figure 5.3.1 and Figure 5.3.2 shows that:

- The average field-normalised citation impact of most IMI 1 call 2 projects was above world average apart from RAPP-ID which had the lowest citation impact (0.86). Similarly, all except RAPP-ID had a higher percentage of highly cited papers than the world average (10%).
- BTCURE remains the most prolific IMI 1 call 2 project with 672 papers and a citation impact of 1.81, which is lower than the citation impact of all IMI project papers (2.03).
- QUIC-CONCEPT is the most highly cited project with a citation impact more than four times the world average (4.76).
- Open Phacts, OncoTrack and Predect are also well cited with a citation impact of 3.57, 2.19 and 2.67, respectively.
- Half of the projects in this call had an average citation impact greater than the average citation impact of all IMI project papers (2.03).

Table 5.3.1 shows raw citation impact and the percentage of open access papers by project for IMI 1 call 2 publications. Table 5.3.2 shows the normalised citation impact (normalised against world average values) of IMI 1 call 2 projects and is an expansion of the data shown in Figure 5.3.1 and Figure 5.3.2.

Table 5.3.4 BIBLIOMETRIC INDICATORS FOR IMI 1 PROJECTS IN CALL 2, 2010-2021

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	CITATIONS	RAW CITATION IMPACT
BTCure	719	672	72.5%	28,560	42.50
Quic-Concept	104	103	85.4%	10,696	103.84
DDMoRe	82	77	70.1%	1,617	21.00
Open PHACTS	73	70	90.0%	5,819	83.13
Onco Track	69	65	70.8%	4,321	66.48
RAPP-ID	47	46	71.7%	1,038	22.57
Predect	49	45	84.4%	2,988	66.40
EHR4CR	23	20	80.0%	436	21.80

Table 5.3.5 SUMMARY CITATION INDICATORS FOR IMI 1 PROJECTS IN CALL 2, 2010-2021

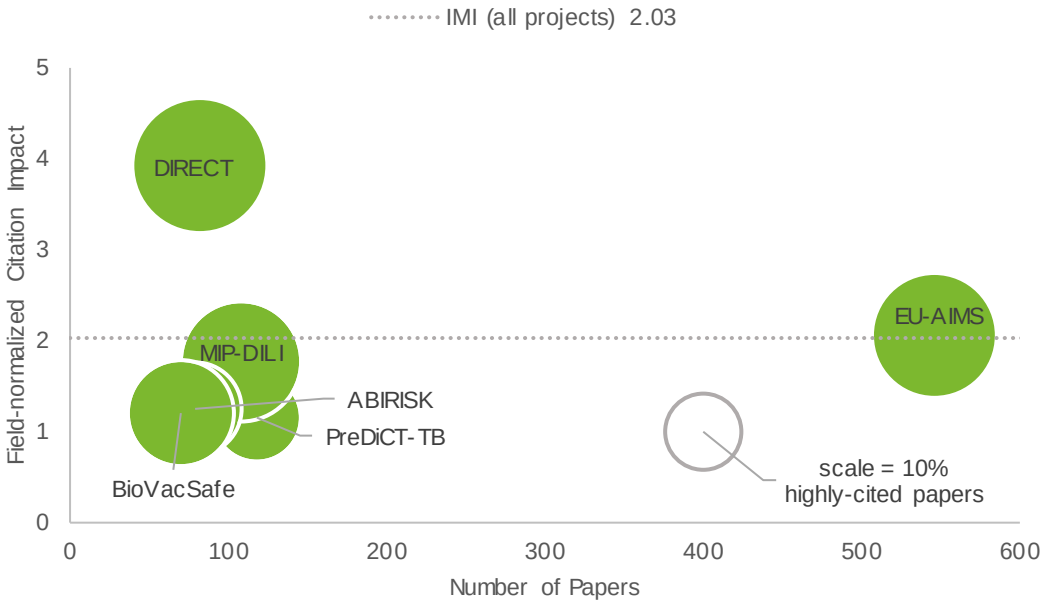
PROJECT	NUMBER OF PAPERS	CITATION IMPACT		AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
		NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL		
BTCure	672	1.81	0.99	30.43	24.0%
Quic-Concept	103	4.76	2.19	31.90	33.0%
DDMoRe	77	1.21	1.07	46.27	15.6%
Open PHACTS	70	3.57	1.84	36.53	22.9%
Onco Track	65	2.19	1.19	29.00	38.5%
RAPP-ID	46	0.86	0.77	41.68	8.7%
Predect	45	2.67	1.49	34.99	37.8%
EHR4CR	20	1.11	1.10	40.75	15.0%
Overall (IMI projects)	**7,856**	**2.03**	**1.23**	**34.98**	**25.3%**

- Among IMI 1 call 2 projects Open PHACTS has the highest percentage of open access papers (90%).
- OncoTrack has the highest percentage of highly cited papers (38.5%)

5.4 Summary bibliometric analyses for IMI 1 projects – call 3

Figure 5.4.1 compares the number of papers, average field-normalised citation impact and share of highly cited papers for IMI 1 call 3 projects. Only projects with at least 10 papers and one highly cited paper over the time period (2010-2021) are shown. The area of the 'bubble' is proportional to the share of highly cited papers. The dotted horizontal line indicates the average field-normalised citation impact for all IMI project papers.

Figure 5.4.7 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 1 PROJECTS – CALL 3, 2010-2021, 2010-2021



The data in Figure 5.4.1 shows that:

- The average citation impact and percentage of highly cited papers for all projects in this call was above the world average.
- EU-AIMS was by far the most prolific IMI 1, call 3 project with 546 papers. The field-normalised citation impact of this research was twice the world average (2.06) and above average for all IMI research (2.03).
- Research associated with DIRECT was very well-cited with a field-normalised citation impact of almost four times (3.93) the world average and nearly a third (32.9%) of its papers were highly cited.

Table 5.4.1 shows raw citation impact and the percentage of open access papers by project for IMI 1 call 3 publications. Table 5.4.2 shows the normalised citation impact (normalised against world average values) of IMI 1 call 3 projects and is an expansion of the data shown in Figure 5.4.1.

Table 5.4.6 SUMMARY BIBLIOMETRIC INDICATORS FOR IMI 1 PROJECTS IN CALL 3, 2010-2021

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	CITATIONS	RAW CITATION IMPACT
EU-AIMS	565	546	83.0%	19,198	35.16
PreDiCT-TB	124	118	92.4%	2,545	21.57
MIP-DILI	116	108	64.8%	3,278	30.35
DIRECT	109	82	86.6%	3,735	45.55
ABIRISK	100	79	64.6%	2,076	26.28
BioVacSafe	73	70	80.0%	2,179	31.13

Table 5.4.7 SUMMARY CITATION INDICATORS FOR IMI 1 PROJECTS IN CALL 3, 2010-2021

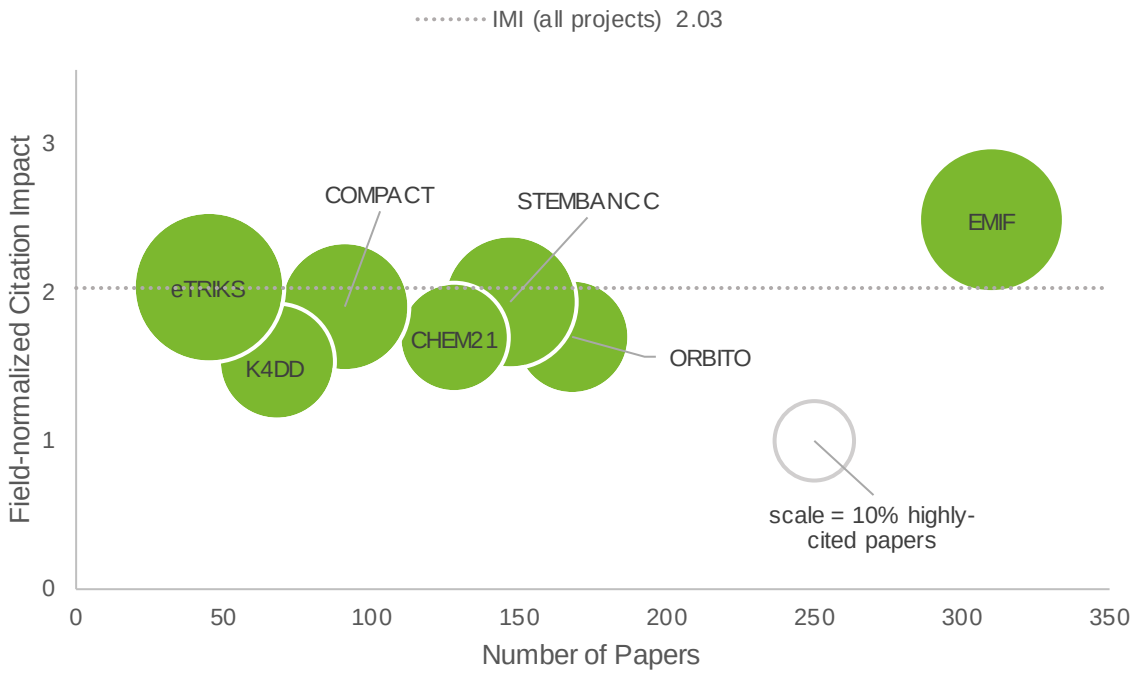
PROJECT	NUMBER OF PAPERS	CITATION IMPACT		AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
		NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL		
EU-AIMS	546	2.06	1.12	29.94	28.0%
PreDiCT-TB	118	1.16	0.79	42.81	13.6%
MIP-DILI	108	1.77	1.35	34.44	25.9%
DIRECT	82	3.93	0.99	32.64	32.9%
ABIRISK	79	1.25	0.86	43.41	15.2%
BioVacSafe	70	1.20	0.94	33.23	20.0%
Overall (IMI projects)	**7,856**	**2.03**	**1.23**	**34.98**	**25.3%**

- PreDiCT-TB had the highest percentage of open access papers (92.4%).

5.5 Summary bibliometric analyses for IMI 1 projects – call 4

Figure 5.5.1 compares the number of papers, average field-normalised citation impact and share of highly cited papers for IMI 1 call 4 projects. Only projects with at least 10 papers and one highly cited paper over the time period (2010-2021) are shown. The area of the 'bubble' is proportional to the share of highly cited papers. The dotted horizontal line indicates the average field-normalised citation impact for all IMI project papers.

Figure 5.5.8 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 1 PROJECTS – CALL 4, 2010-2021



The data in Figure 5.5.1 shows that:

- The average field-normalised citation impact of all projects in this call is above world average.
- EMIF produced the highest number of papers in call 4, with 310 papers published by the end of 2021 and has a field-normalised citation impact two and half times the world average (2.49).
- eTRIKS has the highest percentage of highly cited papers (37.8%)
- Two-of-the-seven projects in this call had an average field-normalised citation impact greater than the average citation impact for all IMI project research (2.03).

Table 5.5.1 shows raw citation impact and the percentage of open access papers by project for IMI 1 call 4 publications. Table 5.5.2 shows the normalised citation impact (normalised against world average values) of IMI 1 call 4 projects and is an expansion of the data shown in Figure 5.5.1.

Table 5.5.8 BIBLIOMETRIC INDICATORS FOR IMI 1 PROJECTS IN CALL 4, 2010-2021

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	CITATIONS	RAW CITATION IMPACT
EMIF	331	310	84.2%	12,728	41.06
ORBITO	171	168	36.3%	4,475	26.64
STEMBANCC	153	147	81.6%	4,905	33.37
CHEM21	131	128	50.0%	5,499	42.96
COMPACT	91	91	53.8%	4,174	45.87
K4DD	70	68	75.0%	1,795	26.40
eTRIKS	56	45	95.6%	1,660	36.89

Table 5.5.9 SUMMARY CITATION INDICATORS FOR IMI 1 PROJECTS IN CALL 4, 2010-2021

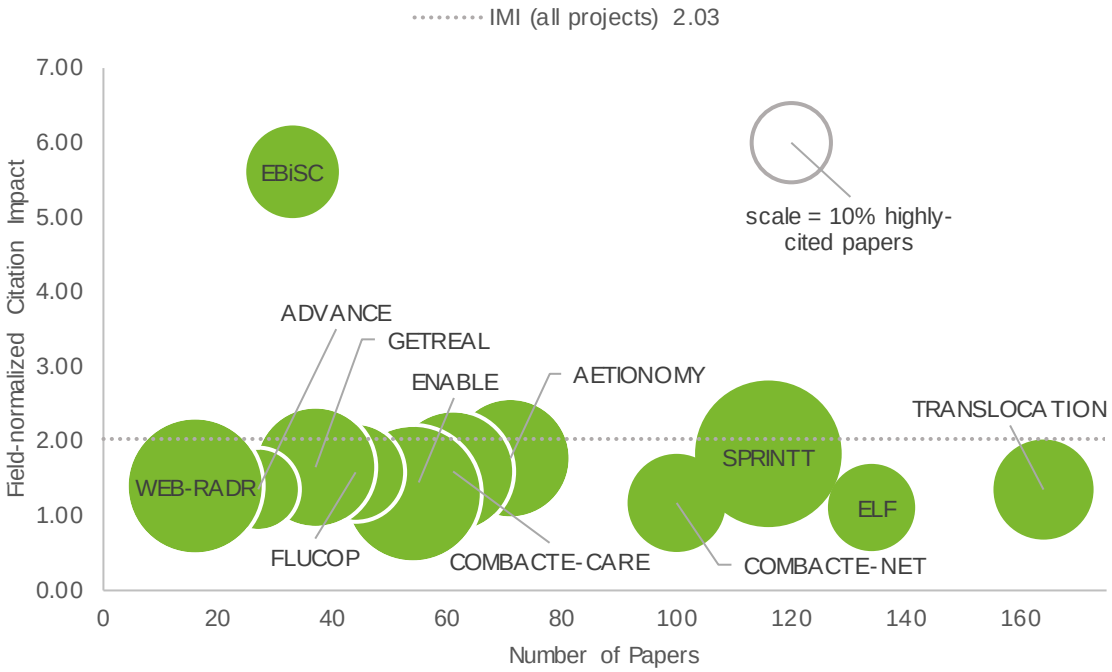
PROJECT	NUMBER OF PAPERS	CITATION IMPACT		AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
		NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL		
EMIF	310	2.49	1.26	29.10	34.8%
ORBITO	168	1.70	1.27	29.23	21.4%
STEMBANCC	147	1.94	1.28	31.38	29.3%
CHEM21	128	1.70	1.27	36.72	19.5%
COMPACT	91	1.90	1.42	29.94	27.5%
K4DD	68	1.53	1.20	33.04	22.1%
eTRIKS	45	2.04	1.22	30.24	37.8%
Overall (IMI projects)	**7,856**	**2.03**	**1.23**	**34.98**	**25.3%**

- eTRIKS has the highest percentage of open access papers (95.6%).

5.6 Summary bibliometric analyses for IMI 1 projects – calls 5-10

Figure 5.6.1 compares the number of papers, average field-normalised citation impact and share of highly cited papers for IMI 1 calls 5-10 projects. Only projects with at least 10 papers and one highly cited paper over the time period (2010-2021) are shown. The area of the 'bubble' is proportional to the share of highly cited papers. The dotted horizontal line indicates the average field-normalised citation impact for all IMI project papers.

Figure 5.6.9 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 1 PROJECTS – CALLS 5-10, 2010-2021



The data in Figure 5.6.1 shows that:

- Research associated with EBiSC was very well cited with an astounding field-normalised citation impact of more than five times the world average (5.61). However, the total number of EBiSC papers is still relatively low (33), so it is possible that only a few highly cited papers has inflated the citation impact.
- SPRINTT has the highest percentage of highly cited papers (37.9%)
- TRANSLOCATION produced the most papers (164) likely due to it being one of the longest running projects from IMI 1 calls 5-10.
- All the projects in calls 5-10 have a field-normalised citation impact greater than the world average but below average for all IMI project research (2.03), apart from EBiSC.

Table 5.6.1 shows raw citation impact and the percentage of open access papers by project for IMI 1 call 5-10 publications. Table 5.6.2 shows the normalised citation impact (normalised against world average values) of IMI 1 calls 5-10 projects and is an expansion of the data shown in Figure 5.6.1.

Table 5.6.10 BIBLIOMETRIC INDICATORS FOR IMI 1 PROJECTS IN CALLs 5-10, 2010-2021

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	CITATIONS	RAW CITATION IMPACT
TRANSLOCATION	164	164	67.1%	4,123	25.14
ELF	135	134	80.6%	2,495	18.62
SPRINTT	123	116	57.8%	3,611	31.13
COMBACTE-NET	109	100	85.0%	1,370	13.70
AETIONOMY	74	71	81.7%	1,866	26.28
COMBACTE-CARE	66	61	86.9%	1,446	23.70
ENABLE	56	55	85.5%	1,104	20.07
PRECISESADS	74	54	63.0%	1,027	19.02
DRIVE-AB	60	54	83.3%	1,303	24.13
FLUCOP	45	44	84.1%	752	17.09
GETREAL	43	37	81.1%	858	23.19
EBiSC	36	33	93.9%	2,694	81.64
ADVANCE	28	27	92.6%	397	14.70
WEB-RADR	17	16	87.5%	283	17.69

Table 5.6.11 SUMMARY CITATION INDICATORS FOR IMI 1 PROJECTS IN CALLS 5-10, 2010-2021

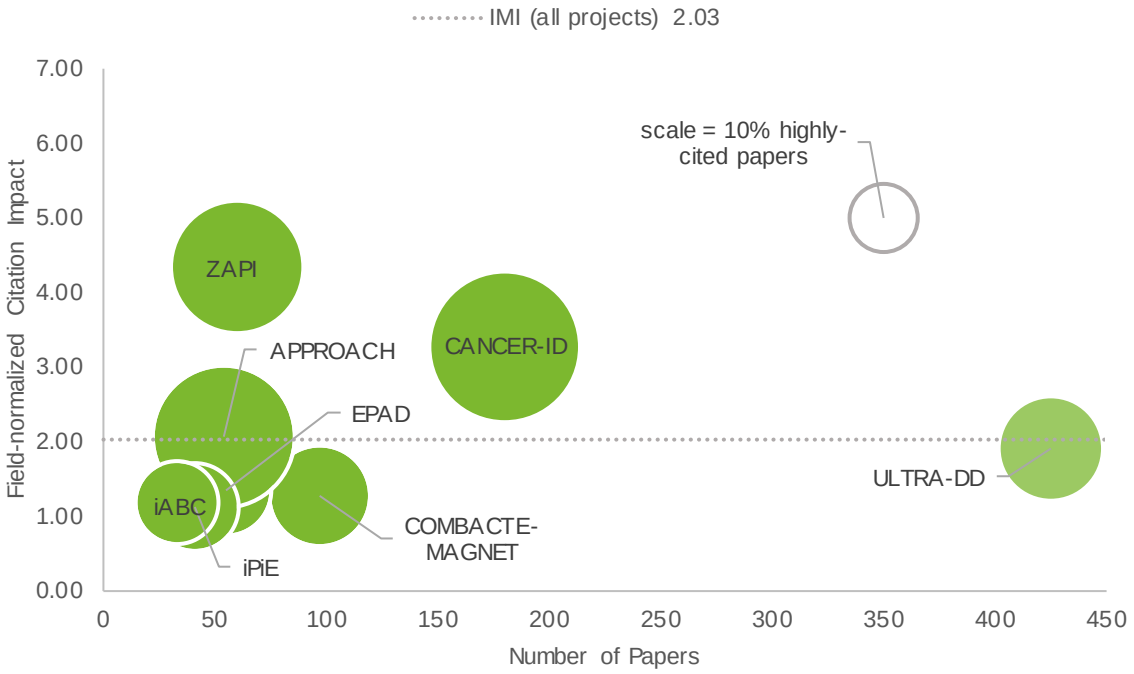
PROJECT	NUMBER OF PAPERS	CITATION IMPACT		AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
		NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL		
TRANSLOCATION	164	1.35	0.98	36.32	17.7%
ELF	134	1.11	1.01	41.96	13.4%
SPRINTT	116	1.83	1.87	26.97	37.9%
COMBACTE-NET	100	1.17	0.91	37.63	17.0%
AETIONOMY	71	1.77	1.24	34.72	23.9%
COMBACTE-CARE	61	1.59	0.94	35.90	24.6%
ENABLE	55	1.45	1.10	34.83	21.8%
PRECISESADS	54	1.38	0.89	35.25	16.7%
DRIVE-AB	54	1.30	0.99	32.62	31.5%
FLUCOP	44	1.58	0.95	44.12	15.9%
GETREAL	37	1.65	1.13	36.77	24.3%
EBiSC	33	5.61	2.80	33.52	15.2%
ADVANCE	27	1.36	1.48	32.70	11.1%
WEB-RADR	16	1.40	1.32	33.20	31.3%
Overall (IMI projects)	**7,856**	**2.03**	**1.23**	**34.98**	**25.3%**

- EBiSC has the highest percentage (93.9%) of open access papers.

5.7 Summary bibliometric analyses for IMI 1 projects – call 11

Figure 5.7.1 compares the number of papers, average field-normalised citation impact and share of highly cited papers for IMI 1 call 11 projects. Only projects with at least 10 papers and one highly cited paper over the time period (2010-2021) are shown. The area of the 'bubble' is proportional to the share of highly cited papers. The dotted horizontal line indicates the average field-normalised citation impact for all IMI project papers.

Figure 5.7.10 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 1 PROJECTS – CALL 11, 2010-2021



The data in Figure 5.7.1 shows that:

- ULTRA-DD produced by far the most papers (425).
- All the projects performed above world average for percentage of highly cited papers and field-normalised citation impact.
- Research papers associated with APPROACH, CANCER-ID and ZAPI were very well-cited with field-normalised citation impacts of two (2.07), three (3.27), and four (4.34) times the world average, respectively. They are also the only projects in this call that are higher than the average for all IMI projects (2.03).
- Over half of CANCER-ID papers are highly cited (52.2%).

Table 5.7.1 shows raw citation impact and the percentage of open access papers by project for IMI 1 call 11 publications. Table 5.7.2 shows the normalised citation impact (normalised against world average values) of IMI 1 call 11 projects and is an expansion of the data shown in Figure 5.7.1.

Table 5.7.12 BIBLIOMETRIC INDICATORS FOR IMI 1 PROJECTS IN CALL 11, 2010-2021

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	CITATIONS	RAW CITATION IMPACT
ULTRA-DD	434	425	85.2%	9,417	22.16
CANCER-ID	208	180	73.3%	9,700	53.89
COMBACTE-MAGNET	108	97	84.5%	1,583	16.32
ZAPI	63	60	95.0%	2,847	47.45
EPAD	59	55	87.3%	817	14.85
APPROACH	67	54	72.2%	1,887	34.94
iPiE	42	41	70.7%	741	18.07
iABC	51	33	75.8%	365	11.06

Table 5.7.13 SUMMARY CITATION INDICATORS FOR IMI 1 PROJECTS IN CALL 11, 2010-2021

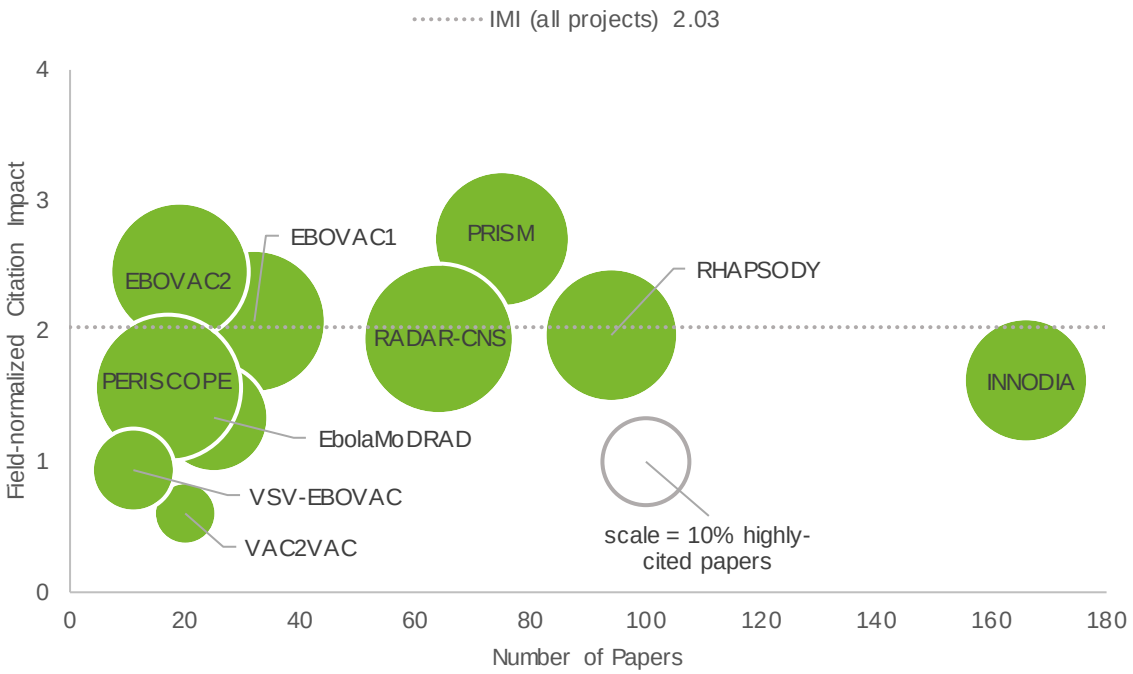
PROJECT	NUMBER OF PAPERS	CITATION IMPACT		AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
		NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL		
ULTRA-DD	425	1.91	1.07	32.74	24.5%
CANCER-ID	180	3.27	1.58	18.26	52.2%
COMBACTE-MAGNET	97	1.28	0.88	38.61	22.7%
ZAPI	60	4.34	2.34	29.74	40.0%
EPAD	55	1.35	1.01	37.91	18.2%
APPROACH	54	2.07	1.72	30.39	46.3%
iPiE	41	1.13	0.93	37.71	17.1%
iABC	33	1.19	0.91	47.82	15.2%
Overall (IMI projects)	**7,856**	**2.03**	**1.23**	**34.98**	**25.3%**

- ZAPI has the highest percentage (95%) of open access papers.

5.8 Summary bibliometric analyses for IMI 2 calls 1-4 projects

Figure 5.8.1 compares the number of papers, average field-normalised citation impact and share of highly cited papers from IMI 2 projects from calls 1-4. Only projects with at least 10 papers and one highly cited paper over the time period (2015-2021) are shown. The area of the 'bubble' is proportional to the share of highly cited papers. The dotted horizontal line indicates the average field-normalised citation impact for all IMI project papers.

Figure 5.8.11 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 2 PROJECTS – CALLS 1-4, 2015-2021



The data in Figure 5.8.1 shows that:

- INNODIA was the most productive project, publishing 166 papers.
- PERISCOPE and VAC2VAC have published enough papers to be included in this year's analysis.
- Apart from VAC2VAC and VSV-EBOVAC, all the projects meet or exceed the world average (10%) for highly cited papers.
- PRISM and EBOVAC2 are the most impactful projects with a field-normalized citation impact of more than two times the world average, 2.70 and 2.45, respectively.
- Three-out-of-ten projects performed above the average field-normalized citation impact for all IMI projects (2.03)

Table 5.8.1 shows raw citation impact and percentage of open access papers by project for IMI 2 calls 1-4 publications and Table 5.8.2 shows indicators for IMI 2 calls 1-4 project research where citation impact has been normalised against world average values.

Table 5.8.14 BIBLIOMETRIC INDICATORS FOR IMI 2 CALLS 1-4 PROJECTS, 2015-2021[10]

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	CITATIONS	RAW CITATION IMPACT
INNODIA	203	166	77.3%	2,684	16.17
RHAPSODY	115	94	78.3%	1,576	16.77
PRISM	87	75	78.2%	1,625	21.67
RADAR-CNS	87	64	80.5%	901	14.08
EBOVAC1	34	32	100.0%	808	25.25
EbolaMoDRAD	26	25	73.1%	355	14.20
VAC2VAC	20	20	95.0%	61	3.05
EBOVAC2	19	19	100.0%	384	20.21
PERISCOPE	18	17	100.0%	103	6.06
VSV-EBOVAC	12	11	75.0%	206	18.73

- All the EBOVAC1, EBOVAC2, and PERISCOPE project papers are open access.
- EbolaMoDRAD has the lowest percentage of open access papers (73.1%).

[10] Note that IMI 2 funded researchers are contractually obliged to make their scientific articles open access through Green or Gold routes. However, for some of other document types, such as editorials, reviews or conference proceedings open access publication is strongly encouraged but not mandatory. Nevertheless, it is obvious that fewer than all of IMI's papers are classified as open access in this analysis, and this is likely to be due to ancillary factors. See footnote 6 for further explanations.

Table 5.8.15 SUMMARY CITATION INDICATORS FOR IMI 2 CALLS 1-4 PROJECTS, 2015-2021

PROJECT	CITATION IMPACT				
	NUMBER OF PAPERS	NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL	AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
INNODIA	166	1.62	1.15	38.30	21.1%
RHAPSODY	94	1.97	1.05	37.51	24.5%
PRISM	75	2.70	1.10	41.21	25.3%
RADAR-CNS	64	1.94	1.66	36.67	31.3%
EBOVAC1	32	2.07	1.42	26.71	28.1%
EbolaMoDRAD	25	1.34	0.95	40.02	16.0%
VAC2VAC	20	0.60	0.66	62.12	5.0%
EBOVAC2	19	2.45	1.38	31.09	26.3%
PERISCOPE	17	1.57	1.64	42.36	29.4%
VSV-EBOVAC	11	0.94	0.62	26.76	9.1%
Overall (IMI projects)	**7,856**	**2.03**	**1.23**	**34.98**	**25.3%**

5.9 Summary bibliometric analyses for IMI 2 calls 5-10 projects

Figure 5.9.1 compares the number of papers, average field-normalised citation impact and share of highly cited papers from IMI 2 projects from calls 5-10. Only projects with at least 10 papers and one highly cited paper over the time period (2017-2021) are shown. The area of the 'bubble' is proportional to the share of highly cited papers. The dotted horizontal line indicates the average field-normalised citation impact for all IMI project papers. The same data is shown in Figure 5.9.1 and Figure 5.9.2, however Figure 5.9.2 has a smaller x-axis range in order to get a better view of the clustered projects in the bottom left corner of Figure 5.9.1.

Figure 5.9.1 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 2 PROJECTS – CALLS 5-10, 2017-2021

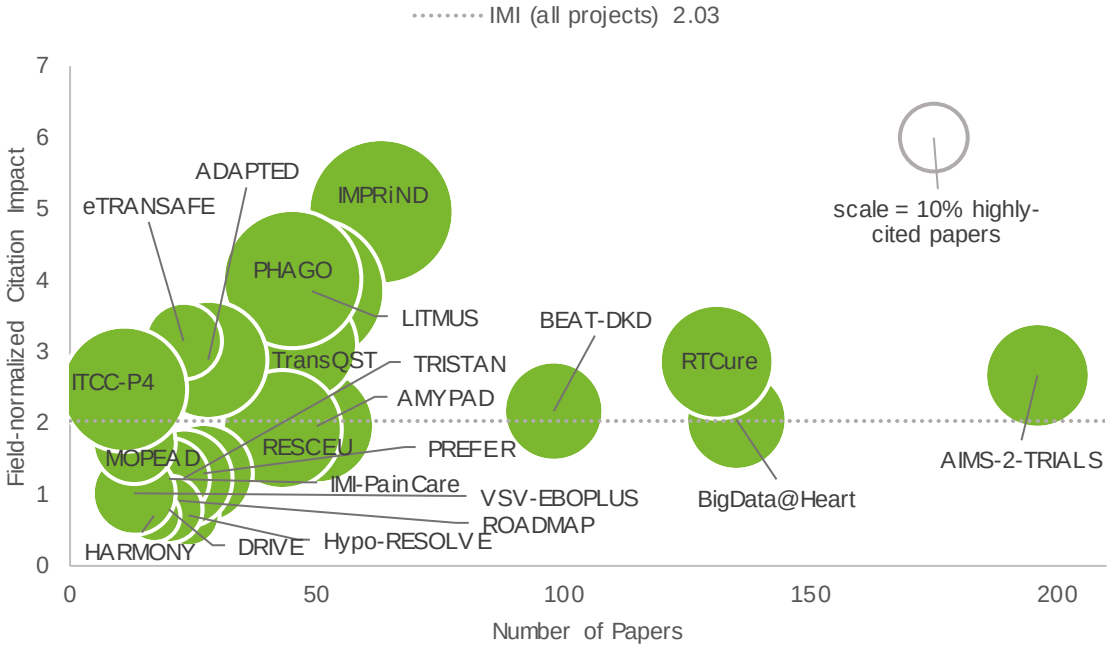
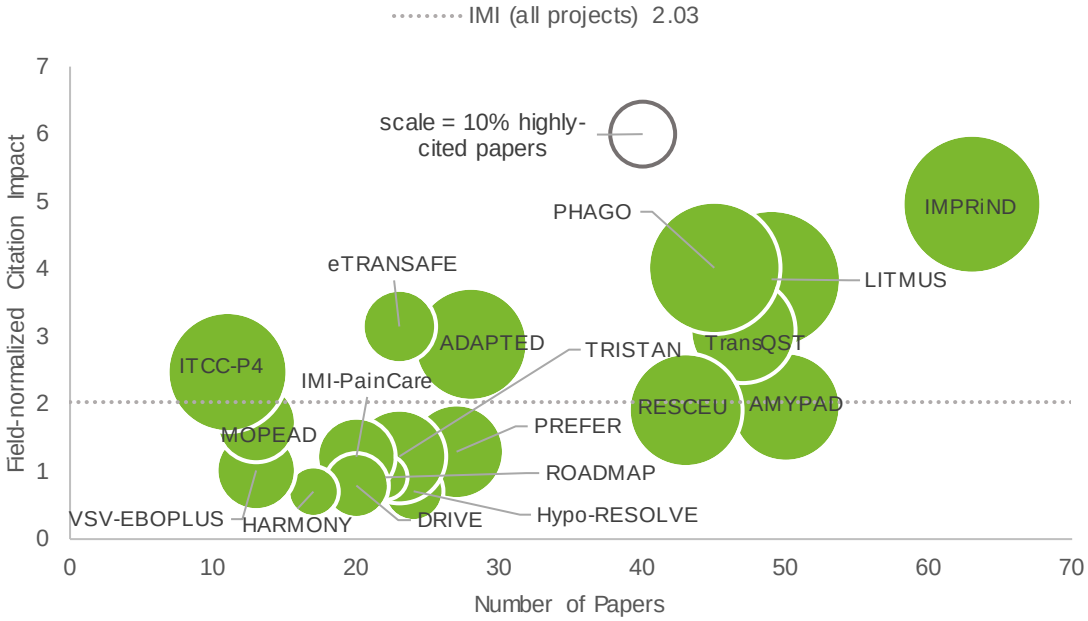


Figure 5.9.2 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 2 PROJECTS – CALLS 5-10, 2017-2020. SMALLER AXIS RANGE.



The data in Figure 5.9.1 and Figure 5.9.2 shows that:

- The AIMS-2-Trials project published the most papers, 196 papers and had a field-normalized citation impact of 2.67, more than 2.5 times higher than the world average (1). IMPRIND remains the top project in terms of field-normalized citation impact with a citation impact of nearly 5 times (4.96) the world average (1). It has (49.2%) of its papers that are highly cited.

Table 5.9.1 shows raw citation impact and percentage of open access papers by project for IMI 2 calls 5-10 publications and Table 5.9.2 shows indicators for IMI 2 calls 5-10 project research where citation impact has been normalised against world average values.

Table 5.9.16 BIBLIOMETRIC INDICATORS FOR IMI 2 CALLS 5-10 PROJECTS, 2017-2021[11]

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	CITATIONS		RAW CITATION IMPACT
AIMS-2-TRIALS	210	196	92.9%	2,331		11.89
BigData@Heart	157	135	92.6%	1,215		9.00
RTCure	146	131	85.5%	2,718		20.75
BEAT-DKD	106	98	87.8%	1,369		13.97
IMPRiND	66	63	88.9%	3,077		48.84
AMYPAD	56	50	94.0%	584		11.68
LITMUS	59	49	81.6%	786		16.04
TransQST	52	47	83.0%	898		19.11
PHAGO	46	45	100.0%	1,268		28.18
RESCEU	45	43	100.0%	602		14.00
ADAPTED	30	28	92.9%	533		19.04
PREFER	41	27	100.0%	247		9.15
Hypo-RESOLVE	33	24	87.5%	66		2.75
TRISTAN	23	23	91.3%	331		14.39
eTRANSAFE	30	23	95.7%	483		21.00
ROADMAP	28	22	100.0%	190		8.64
IMI-PainCare	27	20	90.0%	97		4.85
DRIVE	21	20	70.0%	114		5.70
HARMONY	30	17	88.2%	263		15.47
VSV-EBOPLUS	14	13	84.6%	177		13.62
MOPEAD	13	13	100.0%	63		4.85
ITCC-P4	11	11	81.8%	133		12.09

- Most of the projects in IMI 2 Calls 5-10 have more than 80% of their papers as open access, except for DRIVE which only 70% of the projects are open access.

[11] Note that IMI 2 funded researchers are contractually obliged to make their scientific articles open access through Green or Gold routes. However, for some of other document types, such as editorials, reviews or conference proceedings open access publication is strongly encouraged but not mandatory. Nevertheless, it is obvious that fewer than all of IMI's papers are classified as open access in this analysis, and this is likely to be due to ancillary factors. See footnote 6 for further explanations.

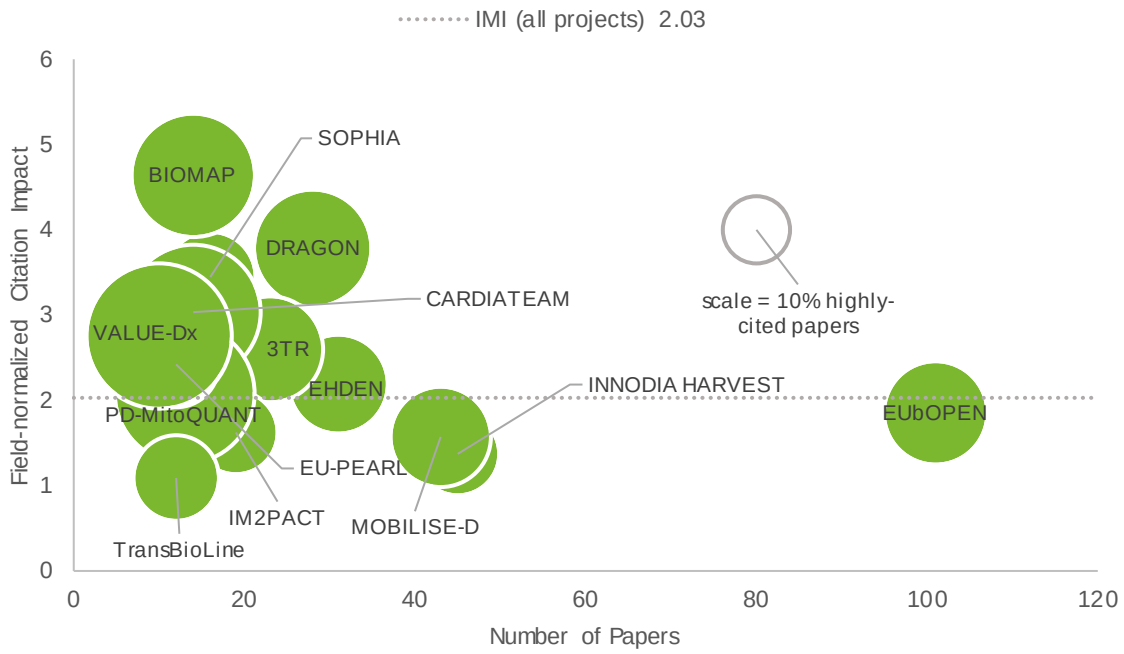
Table 5.9.17 SUMMARY CITATION INDICATORS FOR IMI 2 CALLS 5-10 PROJECTS, 2017-2020

PROJECT	NUMBER OF PAPERS	CITATION IMPACT		AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
		NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL		
AIMS-2-TRIALS	196	2.67	1.28	42.98	25.0%
BigData@Heart	135	2.05	1.32	45.04	23.0%
RTCure	131	2.86	1.45	33.65	29.8%
BEAT-DKD	98	2.17	0.97	39.22	22.4%
IMPRiND	63	4.96	1.73	22.03	49.2%
AMYPAD	50	1.96	1.00	35.43	30.0%
LITMUS	49	3.85	1.54	34.72	49.0%
TransQST	47	3.09	1.98	37.38	27.7%
PHAGO	45	4.02	1.92	27.88	44.4%
RESCEU	43	1.91	1.17	30.67	32.6%
ADAPTED	28	2.89	1.57	45.15	32.1%
PREFER	27	1.29	1.46	41.48	22.2%
Hypo-RESOLVE	24	0.71	0.54	62.34	8.3%
TRISTAN	23	1.22	0.89	39.48	21.7%
eTRANSAFE	23	3.15	1.81	42.05	13.0%
ROADMAP	22	0.91	0.53	47.84	4.5%
IMI-PainCare	20	1.22	1.06	54.06	15.0%
DRIVE	20	0.79	0.80	57.89	10.0%
HARMONY	17	0.70	0.44	55.42	5.9%
VSV-EBOPLUS	13	1.02	1.08	27.59	15.4%
MOPEAD	13	1.73	0.58	64.56	15.4%
ITCC-P4	11	2.48	1.20	26.50	36.4%
Overall (IMI projects)	**7,856**	**2.03**	**1.23**	**34.98**	**25.3%**

5.10 Summary bibliometric analyses for IMI 2 calls 11-23 projects

Figure 5.10.1 compares the number of papers, average field-normalised citation impact and share of highly cited papers from IMI 2 projects from calls 11-23. Only projects with at least 10 papers and one highly cited paper over the time period (2019-2021) are shown. The area of the 'bubble' is proportional to the share of highly cited papers. The dotted horizontal line indicates the average field-normalised citation impact for all IMI project papers.

Figure 5.10.1 PAPER NUMBERS, AVERAGE FIELD-NORMALISED CITATION IMPACT AND SHARE OF HIGHLY CITED RESEARCH FOR SELECTED IMI 2 PROJECTS – CALLS 11-23, 2019-2021



The data in Figure 5.10.1 and Figure shows that:

- Publication rates in calls 11-23 are growing, with EUbOPEN still being the most prolific with 101 papers. Many of these projects are still quite new, and the oldest publication was published in 2019.
- BIOMAP had the highest average field-normalised citation impact which was more than 4 times (4.64) higher than the world average (1). However, the number of papers (14) is still quite low so the field-normalised citation impact should be considered with caution since one highly cited paper can inflate the metric.
- Half (5 out of 10) of Value-Dx papers were highly cited making it the project with the highest percentage of highly cited papers.

Table 5.10.1 shows raw citation impact and percentage of open access papers by project for IMI 2 calls 11-23 publications and Table 5.9.2 shows indicators for IMI 2 calls 11-23 project research where citation impact has been normalised against world average values.

Table 5.10.18 BIBLIOMETRIC INDICATORS FOR IMI 2 CALLS 11-23 PROJECTS, 2019-2021[13]

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	CITATIONS	RAW CITATION IMPACT
EUbOPEN	102	101	77.2%	397	3.93
INNODIA HARVEST	53	45	97.8%	215	4.78
MOBILISE-D	48	43	88.4%	212	4.93
EHDEN	41	31	93.5%	152	4.90
DRAGON	32	28	92.9%	194	6.93
3TR	25	23	78.3%	172	7.48
IM2PACT	19	19	84.2%	45	2.37
SOPHIA	17	16	87.5%	130	8.13
BIOMAP	18	14	78.6%	313	22.36
CARDIATEAM	16	14	100.0%	228	16.29
PD-MitoQUANT	13	13	92.3%	192	14.77
TransBioLine	12	12	91.7%	28	2.33
EU-PEARL	14	12	66.7%	41	3.42
ConcePTION	12	11	81.8%	18	1.64
VALUE-Dx	10	10	100.0%	57	5.70

- Nearly half of the included projects have at least 90% of their papers as open access.
- EU-PEARL and EUbOPEN have the lowest percentage of open access papers, 66.7% and 77.2% respectively.

[13] Note that IMI 2 funded researchers are contractually obliged to make their scientific articles open access through Green or Gold routes. However, for some of other document types, such as editorials, reviews or conference proceedings open access publication is strongly encouraged but not mandatory. Nevertheless, it is obvious that fewer than all of IMI's papers are classified as open access in this analysis, and this is likely to be due to ancillary factors. See footnote 6 for further explanations.

Table 5.10.19 SUMMARY CITATION INDICATORS FOR IMI 2 CALLS 11-23 PROJECTS, 2019-2021

PROJECT	NUMBER OF PAPERS	CITATION IMPACT		AVERAGE PERCENTILE	% OF HIGHLY CITED PAPERS
		NORMALISED AT FIELD LEVEL	NORMALISED AT JOURNAL LEVEL		
EUbOPEN	101	1.85	1.48	53.46	24.8%
INNODIA HARVEST	45	1.37	1.35	47.28	15.6%
MOBILISE-D	43	1.57	1.36	48.50	23.3%
EHDEN	31	2.19	1.58	51.80	22.6%
DRAGON	28	3.78	3.58	40.19	32.1%
3TR	23	2.60	1.26	46.69	26.1%
IM2PACT	19	1.62	1.45	60.16	15.8%
SOPHIA	16	3.45	1.23	69.50	18.8%
BIOMAP	14	4.64	0.91	20.29	35.7%
CARDIATEAM	14	3.03	1.19	33.06	42.9%
PD-MitoQUANT	13	2.08	1.84	28.08	46.2%
EU-PEARL	12	2.42	3.02	61.77	16.7%
TransBioLine	12	1.09	2.52	54.02	16.7%
VALUE-Dx	10	2.75	1.95	39.27	50.0%
Overall (IMI projects)	**7,856**	**2.03**	**1.23**	**34.98**	**25.3%**

6 GEOGRAPHIC CLUSTERING ANALYSIS

6.1 Locations where IMI-funded research takes place

This section of the report analyses geographic clusters where IMI research occurs, the citation impact of research published by these clusters and the clusters' constituent institutions.

Substantial clusters of research activity were identified in Europe and North America. While IMI project research also involves institutions in other parts of the world, publication rates for other geographies were low. This analysis, therefore, focuses on Europe and North America and we have identified the 36 and 18 geographic clusters respectively with the highest output.

Clusters have a 20km radius and the clusters in Europe and North America tend to focus on major cities with an existing strong academic research base. The largest European clusters are London (1,800 publications), Amsterdam (1,515 publications), Stockholm (843 publications), Paris (758 publications) and Oxford (757 publications). The largest clusters in North America are Boston (392 publications), Toronto (368 publications), New York (257 publications), Bethesda (173 publications), and Montreal (138 publications).

IMI research performs well above the national averages for citation impact for all the European and North American clusters. The highest European clusters for citation impact are Maastricht (3.83) and Zurich (3.65) both more than three times their national averages of 1.71 for both.

A relatively high percentage of IMI research is open access, with the Lyon, France cluster being among the highest with 98.8% of its IMI project research as open access papers and Rome being the lowest with over two-thirds (67.9%) of its publications being open access. The USA cluster with the highest percentage of IMI research was Seattle with 94.4 % of its publication being open access.

Around 40% of all EU-28 biomedical research involves international co-authorship while in comparison rates of international collaboration for IMI project research are very high for most clusters, especially in North America where most clusters have around 90% international collaboration which is expected as IMI is European funding organisation that primarily funds researchers working in EU-28. The European cluster with the highest rate of internationally collaborative papers was Basel with 94.5% of its research involving international co-authorship. While the European cluster, Rome, had the lowest at 75.3% international collaboration.

The clusters are visualised on maps in FIGURE 6.1.1 and Figure 6.1.2. Both maps are scaled separately so that the most intensive areas of output are shaded red and the areas of lowest output are blue. This means that the same colour shading is not comparable between maps. Table 6.1.1 to Table 6.1.4 show the research publication outputs of the individual clusters along with bibliometric indicators of their research performance. The citation metrics in Table 6.1.2 and Table 6.1.4 are shaded green when the performance of a cluster of IMI-supported research outperforms the national average performance for biomedical research.[15]

The institutions that constitute the top five clusters within the European and North American regions are shown in Table 6.1.5 and Table 6.1.6 respectively. The five journal subject categories in which the

[15] Web of Science journal categories which capture biomedically related publications used to calculate the national baselines are listed in Annex 2.

top five clusters published most frequently within the European and North American regions are shown in Table 6.1.7 and TABLE 6.1.8 respectively.

FIGURE 6.1.1 MAP SHOWING EUROPEAN GEOGRAPHIC CLUSTERS OF IMI PROJECT RESEARCH, 2010-2021

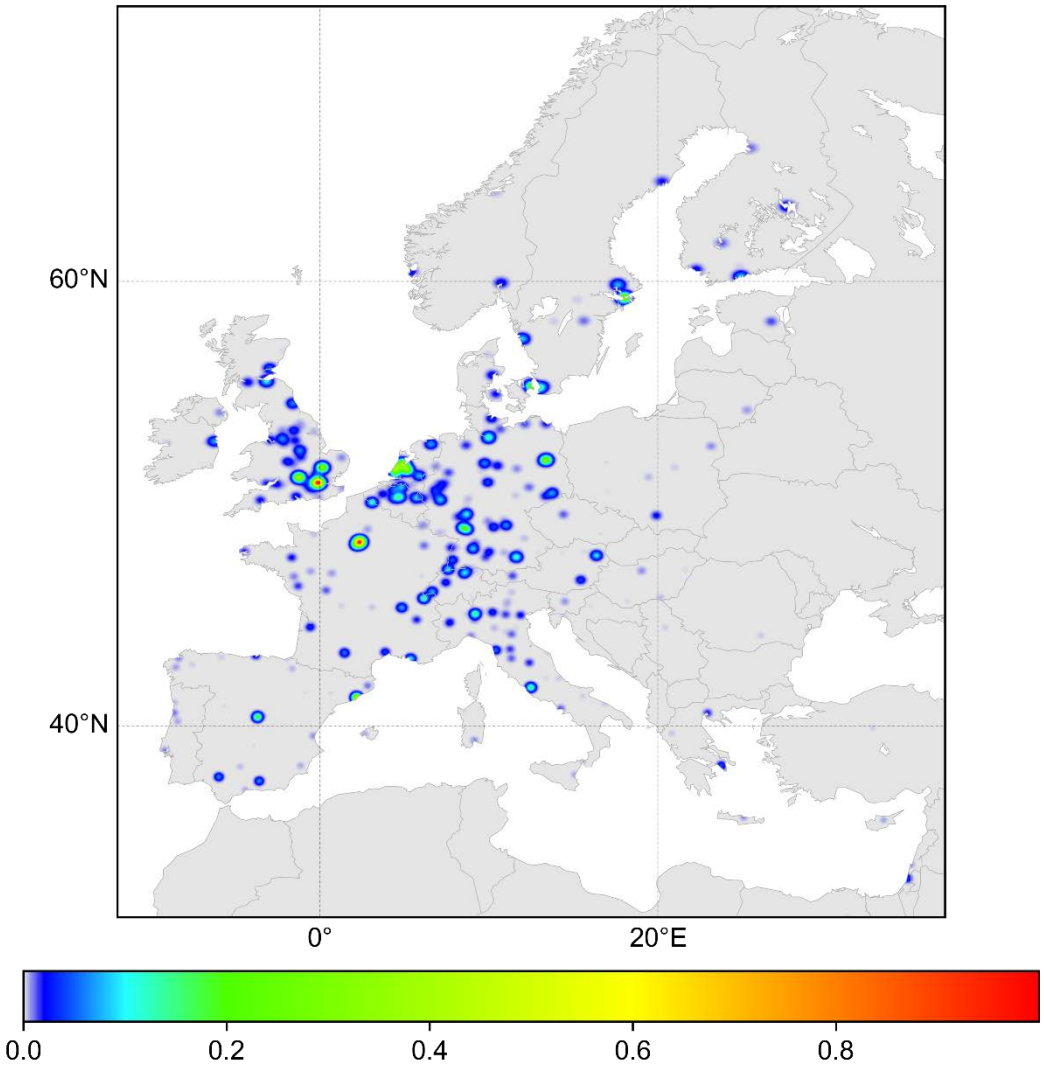


Figure 6.1.2 MAP SHOWING NORTH AMERICAN GEOGRAPHIC CLUSTERS OF IMI PROJECT RESEARCH, 2010-2021

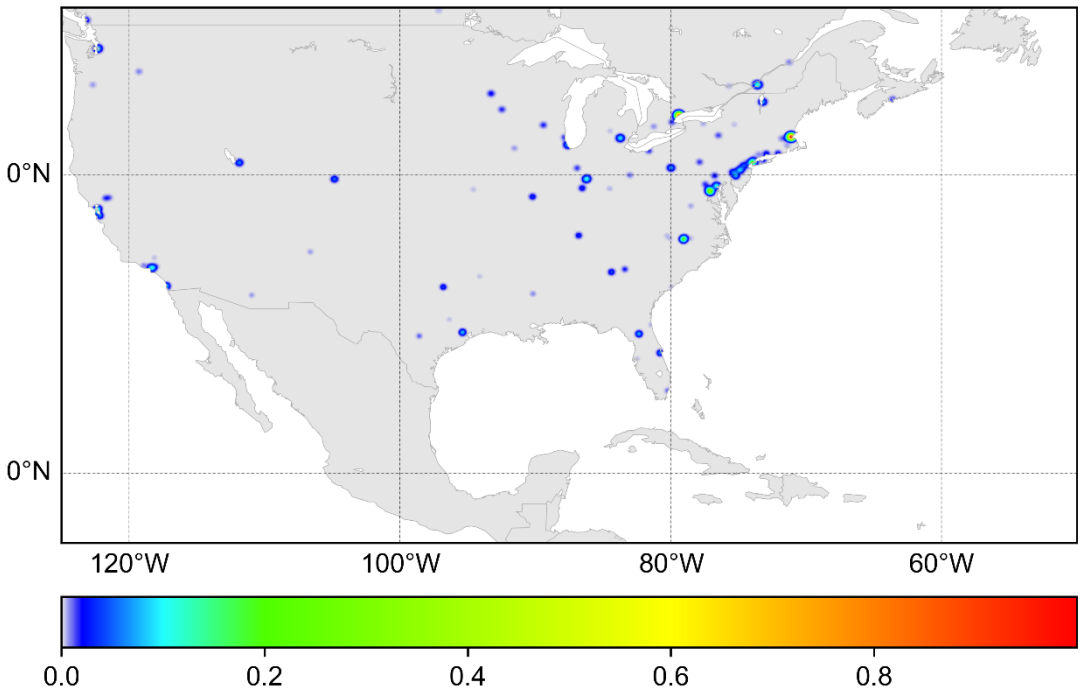


Table 6.1.1 OUTPUT AND RESEARCH PERFORMANCE OF EUROPEAN GEOGRAPHIC CLUSTERS OF IMI IMI PROJECT RESEARCH, 2010-2021

CLUSTER	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	RAW CITATION IMPACT	% OF INTERNATIONALLY COLLABORATIVE PUBLICATIONS
London (UK)	1,800	1,634	87.9%	35.60	83.2%
Amsterdam (Netherlands)	1,515	1,371	81.8%	35.79	82.0%
Stockholm (Sweden)	843	781	79.1%	36.92	80.0%
Paris (France)	758	710	81.5%	39.73	84.9%
Oxford (UK)	757	723	93.5%	32.56	83.7%
Cambridge (UK)	666	619	90.0%	45.30	81.6%
Copenhagen (Denmark)	646	596	75.0%	31.59	84.2%
Barcelona (Spain)	522	474	84.2%	33.95	80.6%
Berlin (Germany)	432	406	85.0%	37.11	82.3%
Mannheim (Germany)	422	408	79.9%	45.03	86.5%
Leuven (Belgium)	401	360	87.5%	34.90	90.8%
Madrid (Spain)	368	336	86.3%	27.68	78.9%
Basel (Switzerland)	361	327	78.9%	31.93	94.5%
Uppsala (Sweden)	330	312	78.5%	26.05	75.3%
Nijmegen (Netherlands)	320	300	84.3%	37.41	83.0%
Rome (Italy)	316	287	67.9%	38.67	75.3%
Frankfurt (Germany)	310	292	74.0%	23.83	84.9%
Vienna (Austria)	307	282	81.6%	25.41	84.0%
Milan (Italy)	306	262	77.1%	38.65	84.4%
Groningen (Netherlands)	305	287	92.3%	33.64	82.2%
Hamburg (Germany)	289	262	83.2%	36.33	80.5%
Gothenburg (Sweden)	288	269	80.3%	39.92	90.0%
Geneva (Switzerland)	277	254	86.6%	43.94	87.4%
Munich (Germany)	276	248	75.4%	37.05	83.5%
Maastricht (Netherlands)	268	257	93.8%	66.65	93.0%
Edinburgh (UK)	230	207	93.7%	42.10	82.1%
Helsinki (Finland)	199	191	88.0%	42.61	88.0%
Zurich (Switzerland)	187	173	89.6%	50.49	87.3%
Bonn (Germany)	178	166	89.8%	32.47	79.5%
Lausanne (Switzerland)	167	152	89.5%	37.75	86.2%

CLUSTER	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	RAW CITATION IMPACT	% OF INTERNATIONALLY COLLABORATIVE PUBLICATIONS
Beerse (Belgium)	167	158	76.6%	25.18	91.8%
Dresden (Germany)	165	149	87.9%	32.14	92.6%
Tubingen (Germany)	163	154	77.3%	28.92	76.6%
Marseille (France)	128	116	76.7%	39.62	82.8%
Lille (France)	91	85	74.1%	29.72	88.2%
Lyon (France)	88	80	98.8%	44.41	90.0%

Table 6.1.2 research performance of European geographic clusters of IMI PROJECT RESEARCH COMPARED TO NATIONAL BENCHMARKS, 2010-2021

	FIELD-NORMALISED CITATION IMPACT		JOURNAL-NORMALISED CITATION IMPACT		% OF HIGHLY CITED PAPERS	
CLUSTER	CLUSTER	NATIONAL	CLUSTER	NATIONAL	CLUSTER	NATIONAL
London (UK)	2.58	1.53	1.37	1.10	31.5%	17.2%
Amsterdam (Netherlands)	2.41	1.71	1.32	1.14	28.7%	19.4%
Stockholm (Sweden)	2.26	1.62	1.29	1.13	27.8%	17.8%
Oxford (UK)	2.54	1.53	1.36	1.10	32.4%	17.2%
Paris (France)	2.83	1.48	1.33	1.08	32.3%	15.5%
Cambridge (UK)	3.33	1.53	1.48	1.10	35.9%	17.2%
Copenhagen (Denmark)	2.28	1.71	1.16	1.15	26.2%	18.4%
Barcelona (Spain)	2.86	1.36	1.43	1.09	29.7%	14.2%
Mannheim (Germany)	2.92	1.34	1.31	1.08	33.3%	14.8%
Berlin (Germany)	2.87	1.34	1.43	1.08	29.6%	14.8%
Leuven (Belgium)	2.45	1.80	1.48	1.22	30.3%	19.7%
Madrid (Spain)	2.59	1.36	1.45	1.09	26.2%	14.2%
Basel (Switzerland)	2.03	1.71	1.42	1.17	28.1%	19.1%
Uppsala (Sweden)	1.98	1.62	1.17	1.13	23.1%	17.8%
Nijmegen (Netherlands)	2.55	1.71	1.33	1.14	32.7%	19.4%
Frankfurt (Germany)	2.04	1.34	1.24	1.08	27.4%	14.8%
Groningen (Netherlands)	2.38	1.71	1.13	1.14	24.4%	19.4%
Rome (Italy)	2.69	1.40	1.81	1.19	35.2%	15.3%
Vienna (Austria)	2.17	1.59	1.30	1.16	25.9%	17.4%
Gothenburg (Sweden)	2.88	1.62	1.59	1.13	36.1%	17.8%
Hamburg (Germany)	2.61	1.34	1.16	1.08	30.9%	14.8%
Milan (Italy)	2.80	1.40	1.42	1.19	36.6%	15.3%
Maastricht (Netherlands)	3.83	1.71	1.84	1.14	34.2%	19.4%
Geneva (Switzerland)	2.93	1.71	1.06	1.17	33.9%	19.1%
Munich (Germany)	3.04	1.34	1.37	1.08	33.1%	14.8%
Edinburgh (UK)	2.69	1.53	1.40	1.10	33.3%	17.2%
Helsinki (Finland)	3.01	1.60	1.38	1.10	39.8%	16.9%
Zurich (Switzerland)	3.65	1.71	1.51	1.17	38.7%	19.1%
Bonn (Germany)	2.42	1.34	1.47	1.08	25.3%	14.8%
Beerse (Belgium)	1.98	1.80	1.31	1.22	23.4%	19.7%
Tubingen (Germany)	3.03	1.34	1.24	1.08	31.8%	14.8%

CLUSTER	FIELD-NORMALISED CITATION IMPACT		JOURNAL-NORMALISED CITATION IMPACT		% OF HIGHLY CITED PAPERS	
	CLUSTER	NATIONAL	CLUSTER	NATIONAL	CLUSTER	NATIONAL
Lausanne (Switzerland)	2.92	1.71	1.17	1.17	27.0%	19.1%
Dresden (Germany)	2.72	1.34	0.98	1.08	25.5%	14.8%
Marseille (France)	2.72	1.48	1.45	1.08	36.2%	15.5%
Lille (France)	1.87	1.48	0.93	1.08	29.4%	15.5%
Lyon (France)	3.05	1.48	1.32	1.08	38.8%	15.5%

Table 6.1.3 OUTPUT AND RESEARCH PERFORMANCE OF NORTH AMERICAN GEORGRAPHIC CLUSTERS OF IMI PROJECT RESEARCH, 2010-2021

CLUSTER	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	% OF OPEN ACCESS PAPERS	RAW CITATION IMPACT	% OF INTERNATIONALLY COLLABORATIVE PAPERS
Boston (USA)	392	376	87.2%	57.18	98.4%
Toronto (Canada)	368	360	87.5%	43.93	90.3%
New York (USA)	257	252	84.1%	54.67	99.6%
Bethesda (USA)	173	166	80.7%	56.70	98.2%
Montreal (Canada)	138	137	86.9%	48.02	98.5%
Chapel Hill (USA)	138	135	93.3%	35.96	88.1%
Indianapolis (USA)	125	116	78.4%	45.19	98.3%
San Francisco (USA)	107	103	86.4%	88.06	100.0%
Burlington (USA)	91	89	88.8%	28.81	100.0%
Baltimore (USA)	88	85	92.9%	79.05	100.0%
Los Angeles (USA)	86	85	85.9%	62.93	98.8%
Titusville (USA)	76	69	73.9%	16.04	97.1%
Seattle (USA)	72	71	94.4%	67.28	98.6%
Philadelphia (USA)	68	65	92.3%	57.75	98.5%
Ann Arbor (USA)	64	62	90.3%	75.16	98.4%
La Jolla (USA)	63	62	91.9%	68.39	100.0%
Houston (USA)	56	54	90.7%	55.37	100.0%
Gainesville (USA)	48	44	68.2%	38.16	97.7%

Table 6.1.4 RESEARCH PEFORMANCE OF NORTH AMERICAN GEOGRAPHIC CLUSTERS OF IMI PROJECT RESEARCH COMPARED TO NATIONAL BENCHMARKS, 2010-2021

	FIELD-NORMALISED CITATION IMPACT		JOURNAL-NORMALISED CITATION IMPACT		% OF HIGHLY CITED PAPERS	
CLUSTER	CLUSTER	NATIONAL	CLUSTER	NATIONAL	CLUSTER	NATIONAL
Boston (USA)	3.87	1.32	1.43	1.03	38.8%	15.4%
Toronto (Canada)	2.93	1.49	1.42	1.08	34.2%	16.1%
New York (USA)	4.53	1.32	1.50	1.03	34.9%	15.4%
Bethesda (USA)	3.52	1.32	1.51	1.03	45.2%	15.4%
Montreal (Canada)	3.32	1.49	1.17	1.08	33.6%	16.1%
Chapel Hill (USA)	3.16	1.32	1.26	1.03	31.9%	15.4%
Indianapolis (USA)	3.64	1.32	1.44	1.03	33.6%	15.4%
San Francisco (USA)	6.57	1.32	2.00	1.03	52.4%	15.4%
Burlington (USA)	1.79	1.32	0.79	1.03	21.3%	15.4%
Baltimore (USA)	6.33	1.32	1.60	1.03	50.6%	15.4%
Los Angeles (USA)	5.43	1.32	1.63	1.03	44.7%	15.4%
Seattle (USA)	5.14	1.32	2.00	1.03	46.5%	15.4%
Titusville (USA)	1.89	1.32	1.30	1.03	27.5%	15.4%
Philadelphia (USA)	6.55	1.32	2.00	1.03	43.1%	15.4%
La Jolla (USA)	5.68	1.32	1.45	1.03	50.0%	15.4%
Ann Arbor (USA)	6.86	1.32	2.13	1.03	58.1%	15.4%
Houston (USA)	4.52	1.32	1.91	1.03	55.6%	15.4%
Gainesville (USA)	2.14	1.32	1.65	1.03	45.5%	15.4%

Table 6.1.5 INSTITUTIONS CONSTITUTING TOP-FIVE, BY NUMBER OF PUBLICATIONS, EUROPEAN GEORGRAPHIC CLUSTERS OF IMI PROJECT RESEARCH, 2010-2021

CLUSTER	COUNTRY	INSTITUTIONS	NUMBER OF PUBLICATIONS
London	UK	King's College London	723
		Imperial College London	492
		University College London	454
		GlaxoSmithKline	116
		South London & Maudsley NHS Trust	89
		Birkbeck University London	84

CLUSTER	COUNTRY	INSTITUTIONS	NUMBER OF PUBLICATIONS
		London School of Hygiene & Tropical Medicine	77
		Guy's & St Thomas' NHS Foundation Trust	73
		Royal Brompton Hospital	71
		University College London Hospitals NHS Foundation Trust	58
		Queen Mary University London	53
		St Georges University London	46
		Royal Brompton & Harefield NHS Foundation Trust	41
		The Medicines & Healthcare Products Regulatory Agency	27
		UK Research and Innovation, India	24
		Medical Research Council UK (MRC)	24
		Francis Crick Institute	24
		Royal Marsden NHS Foundation Trust	22
		Alan Turing Inst	22
		UCB Pharma SA	20
		Institute of Cancer Research - UK	20
		European Med Agcy	18
		London School Economics & Political Science	16
		National Institute for Health & Care Excellence	15
		Hlth Data Res UK	14
		South London & Maudsley NHS Fdn	14
		University of Westminster	13
		UCL Medical School	13
		National Institute for Biological Standards & Control	12
		HEPTARES THERAPEUT LTD	11
		King's College Hospital	11
		EMA	10
		Moorfields Eye Hospital NHS Foundation Trust	10
		Public Health England	9
		University of London Royal Veterinary College	9
		Royal Coll Gen Practitioners	9
		South London & Maudsley NHS Fdn Trust Slam	9
		Royal London Hospital	9
		Takeda Pharmaceutical Company Ltd	9
		TAKEDA DEV CTR EUROPE LTD	9

CLUSTER	COUNTRY	INSTITUTIONS	NUMBER OF PUBLICATIONS
		Cancer Research UK	9
		King's College Hospital NHS Foundation Trust	9
		City University London	8
		Celltech Grp	8
		MRC Social Genet & Dev Psychiat SGDP Ctr	8
		St Georges Univ Hosp NHS Fdn Trust	7
		University of London	7
		Inst Psychiat Psychol & Neurosci	7
		AMGEN LTD	7
		Amgen	7
		Royal Brompton NIHR Biomed Res Unit	7
		South London & Maudsley Fdn NHS Trust	6
		UK Dementia Res Inst	6
		Genet Alliance UK	5
		Barts Health NHS Trust	5
		UK Research & Innovation (UKRI)	3
Amsterdam	Netherlands	Leiden University	409
		Utrecht University Medical Center	351
		Vrije Universiteit Amsterdam	328
		Erasmus MC	270
		Academic Medical Center Amsterdam	239
		University of Amsterdam	204
		Utrecht University	149
		VU UNIVERSITY MEDICAL CENTER	106
		Netherlands National Institute for Public Health & the Environment	55
		Erasmus University Rotterdam	35
		Delft University of Technology	16
		Wilhelmina Kinderziekenhuis	14
		Emma Children's Hospital	14
		Netherlands Cancer Institute	13
		Janssen Vaccines & Prevent BV	11
		ICIN Netherlands Heart Inst	10
		ReSViNET Fdn	10
		Netherlands Heart Inst	10

CLUSTER	COUNTRY	INSTITUTIONS	NUMBER OF PUBLICATIONS
		Lygature	9
		Med Evaluat Board	9
		Netherlands Institute for Health Services Research	9
		Leiden Univ Med Ctr	8
		GGz inGeest	7
		Jan van Breemen Res Inst Reade	6
		St. Antonius Hospital Utrecht	6
		Amsterdam Univ Med Ctr	6
		Weibel Consulting	5
		Erasmus MC - Sophia Children's Hospital	2
		Leiden Univ Excl LUMC	1
Stockholm	Sweden	Karolinska Institutet	641
		Karolinska University Hospital	292
		Royal Institute of Technology	76
		Stockholm University	55
		Stockholm County Council	55
		Stockholm Hlth Care Serv	12
		Danderyds Hospital	10
		Publ Hlth Agcy Sweden	9
		AstraZeneca	8
		SciLifeLab	7
Paris	France	Universite de Paris	432
		Institut National de la Sante et de la Recherche Medicale (Inserm)	413
		UDICE French Res Univ	314
		Sorbonne Universite	205
		CEA	149
		Hopital Universitaire Cochin - APHP	115
		CNRS - National Institute for Biology (INSB)	103
		Hopital Universitaire Pitie-Salpetriere - APHP	101
		Centre National de la Recherche Scientifique (CNRS)	94
		Institut Pasteur Paris	72
		Sanofi France	52
		Institut de Recherches Internationales Servier	36
		Hopital Universitaire Bichat-Claude Bernard - APHP	32

CLUSTER	COUNTRY	INSTITUTIONS	NUMBER OF PUBLICATIONS
		Assistance Publique Hopitaux Paris (APHP)	29
		Institut Curie	24
		Hopital Universitaire Bicetre - APHP	22
		Hopital Universitaire Saint-Louis - APHP	22
		Orsay Hosp	21
		Gustave Roussy	20
		Hopital Universitaire Necker-Enfants Malades - APHP	17
		Hopital Universitaire Europeen Georges-Pompidou - APHP	17
		CNRS - Institute of Chemistry (INC)	14
		Hopital Universitaire Saint-Antoine - APHP	14
		Universite Grenoble Alpes (UGA)	14
		Hopital Universitaire Beaujon - APHP	13
		Assistance Publique-Hopitaux de Marseille	12
		Hopital Universitaire Henri-Mondor - APHP	12
		Hopital Universitaire Paul-Brousse - APHP	12
		Hopital Universitaire Robert-Debre - APHP	11
		Museum National d'Histoire Naturelle (MNHN)	10
		CNRS - Institute of Ecology & Environment (INEE)	9
		Servier	7
		Hopital Universitaire Ambroise-Pare - APHP	6
		SOLEIL Synchrotron	6
		Univ Paris Est ComUE	6
		EURORDIS Rare Dis Europe	5
		Universite Paris 13	5
		Vaccine Res Inst	5
		Universite Paris Saclay	4
		Sanofi-Aventis	2
		Universite de Versailles Saint-Quentin-En-Yvelines	1
		Aix-Marseille Universite	1
Oxford	UK	University of Oxford	694
		Wellcome Centre for Human Genetics	100
		Oxford University Hospitals NHS Foundation Trust	30
		Diamond Light Source	26
		Ludwig Institute for Cancer Research	13

CLUSTER	COUNTRY	INSTITUTIONS	NUMBER OF PUBLICATIONS
		UK Research and Innovation, India	8
		Novo Nordisk Res Ctr Oxford	7
		P1vital Ltd	7
		Res Complex Harwell	6
		Medical Research Council UK (MRC)	5
		UK Research & Innovation (UKRI)	1

Table 6.1.6 INSTITUTIONS OF CONSTITUTING TOP-FIVE, BY NUMBER OF PUBLICATIONS, NORTH AMERICAN GEOGRAPHIC CLUSTERS OF IMI PROJECT RESEARCH, 2010-2021

CLUSTER	COUNTRY	INSTITUTIONS	NUMBER OF PUBLICATIONS
Boston	USA	Harvard University	140
		Harvard Medical School	113
		Marathwada Institute of Technology	80
		Harvard Univ Medical Affiliates	75
		Brigham & Women's Hospital	72
		Harvard T.H. Chan School of Public Health	70
		Broad Institute	63
		Pfizer	53
		Boston University	40
		Boston Children's Hospital	32
		Beth Israel Deaconess Medical Center	20
		Biogen	19
		Dana-Farber Cancer Institute	19
		Massachusetts General Hospital	15
		Framingham Heart Study	14
		Massachusetts Institute of Technology (MIT)	13
		IQVIA	9
		AstraZeneca	9
		NIH National Heart Lung & Blood Institute (NHLBI)	8
		Merck & Company	7
		Novartis	7
		CARB X	6

CLUSTER	COUNTRY	INSTITUTIONS	NUMBER OF PUBLICATIONS
		Tufts University	6
		Northeastern University	5
Toronto	Canada	University of Toronto	211
		Structural Genomics Consortium	163
		Princess Margaret Cancer Centre	81
		Hospital for Sick Children (SickKids)	81
		Baycrest	67
		Centre for Addiction & Mental Health - Canada	32
		Ontario Institute for Cancer Research	26
		Holland Bloorview Kids Rehabilitation Hospital	20
		University Health Network Toronto	19
		Lunenfeld Tanenbaum Research Institute	17
		Toronto General Hospital	8
		Saint Michaels Hospital Toronto	6
New York	USA	Icahn School of Medicine at Mount Sinai	79
		Columbia University	63
		Pfizer	46
		New York University	32
		Northwell Health	19
		Memorial Sloan Kettering Cancer Center	18
		Albert Einstein College of Medicine	17
		NewYork-Presbyterian Hospital	14
		NYU Langone Medical Center	8
		Yeshiva University	6
		Rutgers State University New Brunswick	4
Bethesda	USA	AstraZeneca	24
		NIH National Heart Lung & Blood Institute (NHLBI)	22
		National Institutes of Health (NIH) - USA	22
		NIH National Institute of Mental Health (NIMH)	17
		NIH National Institute of Allergy & Infectious Diseases (NIAID)	15
		NIH National Cancer Institute (NCI)	13
		US Food & Drug Administration (FDA)	12
		NIH National Institute on Aging (NIA)	11

CLUSTER	COUNTRY	INSTITUTIONS	NUMBER OF PUBLICATIONS
		NIH National Human Genome Research Institute (NHGRI)	10
		Medimmune	9
		NIH National Institute of Arthritis & Musculoskeletal & Skin Diseases (NIAMS)	8
		NIH National Institute of Neurological Disorders & Stroke (NINDS)	8
		NIH National Institute of Diabetes & Digestive & Kidney Diseases (NIDDK)	7
		George Washington University	6
		Naval Research Laboratory	5
		GlaxoSmithKline	5
Montreal	Canada	University of Montreal	92
		McGill University	81
		CHU St Justine	17

Table 6.1.7 FIVE JOURNAL SUBJECT CATEGORIES IN WHICH TOP-FIVE, BY NUMBER OF PUBLICATIONS, EUROPEAN GEOGRAPHIC CLUSTERS OF IMI PROJECT RESEARCH PUBLISHED MOST FREQUENTLY, 2010-2021

CLUSTER	COUNTRY	JOURNAL SUBJECT CATEGORY	NUMBER OF PUBLICATIONS
London	United Kingdom	Neurosciences	370
		Psychiatry	203
		Clinical Neurology	190
		Pharmacology & Pharmacy	158
		Immunology	130
Amsterdam	Netherlands	Pharmacology & Pharmacy	186
		Rheumatology	180
		Neurosciences	173
		Immunology	159
		Clinical Neurology	113
Stockholm	Sweden	Rheumatology	130
		Immunology	101
		Neurosciences	97
		Clinical Neurology	82
		Biochemistry & Molecular Biology	64

CLUSTER	COUNTRY	JOURNAL SUBJECT CATEGORY	NUMBER OF PUBLICATIONS
Paris	France	Neurosciences	145
		Psychiatry	70
		Pharmacology & Pharmacy	61
		Biochemistry & Molecular Biology	60
		Endocrinology & Metabolism	60
Oxford	UK	Biochemistry & Molecular Biology	145
		Neurosciences	104
		Endocrinology & Metabolism	68
		Cell Biology	64
		Chemistry, Medicinal	62

TABLE 6.1.8 FIVE JOURNAL SUBJECT CATEGORIES IN WHICH TOP-FIVE, BY NUMBER OF PUBLICATIONS, NORTH AMERICAN GEOGRAPHIC CLUSTERS OF IMI PROJECT RESEARCH PUBLISHED MOST FREQUENTLY, 2010-2021

CLUSTER	COUNTRY	JOURNAL SUBJECT CATEGORY	NUMBER OF PUBLICATIONS
Boston	USA	Neurosciences	52
		Genetics & Heredity	46
		Endocrinology & Metabolism	40
		Biochemistry & Molecular Biology	38
		Clinical Neurology	36
Toronto	Canada	Biochemistry & Molecular Biology	99
		Neurosciences	73
		Psychiatry	65
		Chemistry, Medicinal	41
		Cell Biology	38
New York	USA	Pharmacology & Pharmacy	44
		Neurosciences	39
		Psychiatry	37
		Genetics & Heredity	25
		Immunology	20

CLUSTER	COUNTRY	JOURNAL SUBJECT CATEGORY	NUMBER OF PUBLICATIONS
Bethesda	USA	Pharmacology & Pharmacy	32
		Immunology	26
		Neurosciences	23
		Psychiatry	21
		Public, Environmental & Occupational Health	21
Montreal	Canada	Neurosciences	46
		Psychiatry	44
		Biochemistry & Molecular Biology	19
		Psychology, Developmental	13
		Genetics & Heredity	13

7 COLLABORATION ANALYSIS FOR IMI RESEARCH

7.1 Collaboration analysis for IMI research

International research collaboration is increasing[16] and although the reasons for this have not been fully clarified they are likely to include increasing access to facilities, resources, knowledge, people and expertise. In addition, international collaboration has been shown to be associated with an increase in the number of citations received by research papers, although this does depend upon the partner countries involved.[17] Co-authorship is likely to be a good indicator of collaboration, although there will be research collaborations that do not result in co-authored papers, and co-authored papers which may have required limited collaboration. Alternative data-based approaches, for example using information about co-funding or international exchanges, have limitations in terms of both comprehensiveness and validity.

In this report, co-authorship of papers[18] is used as an indicator of collaboration between different sectors, institutions and countries.

In this analysis, different institutions/organisation are assigned to sectors with the following definitions:

[16] Adams J (2013) Collaborations: the fourth age of research. *Nature*, **497**, 557-560.
[17] Adams, J., Gurney, K., & Marshall, S. (2007). Patterns of international collaboration for the UK and leading partners. A report by *Evidence* Ltd to the UK Office of Science and Innovation. 27pp.
[18] In the collaboration analysis papers rather than publications are analysed as some publications, such as editorials do not communicate novel research finding so cannot be considered a product of research collaboration.

- **Medical:** Organisations with the primary function of providing patient care. Typical these are public, private and university hospitals, though we have included in this sector Chinese medicine hospitals and umbrella organisations such as hospital systems (e.g., Mt Sinai) or UK National Health Services Healthcare Trusts.

- **Corporate:** Private or public companies or enterprises that operate for-profit. For IMI projects most corporate organisations are pharmaceuticals, others manufacture medical devices or provide information technology services. Included in this sector are any organisation with a suffix indicating limited liability (e.g., AB, LTD, GmBH, SA, LLC, INC and AG). Other organisations were identified as corporate from their website. It can be challenging to assign smaller organisations, potential small and medium sized enterprises (SMEs) to this category as they may have a limited online presence and if a SME has spun out from a university it can be difficult to ascertain the current relationship between the spin out and academic institution.

- **Academic:** Public and private universities and university departments. This includes research institutes, that may not have a teaching remit but have a clear affiliation to one or more universities and programs of research spanning multiple academic institutions.

- **Government:** Includes state, regional or federally funded research institutions, laboratories and facilities such as NIH or the World Health Organization (WHO); country or regional funders that disperse public money to research (e.g., BBSRC in the UK); government departments and agencies.

- **Other:** Organisation that do not fit in any other sector but have a role in the healthcare or research infrastructure. For example, research institutions not attached to a government, university or hospital; non-governmental organisations like patient groups, advocacy groups, not-for profits and charities; professional associations for healthcare professionals; non-governmental funders; regulators and tissue sample banks.

- **Unknown:** If an organisation cannot be identified as belonging to any of the other sectors, then it is assigned as unknown.

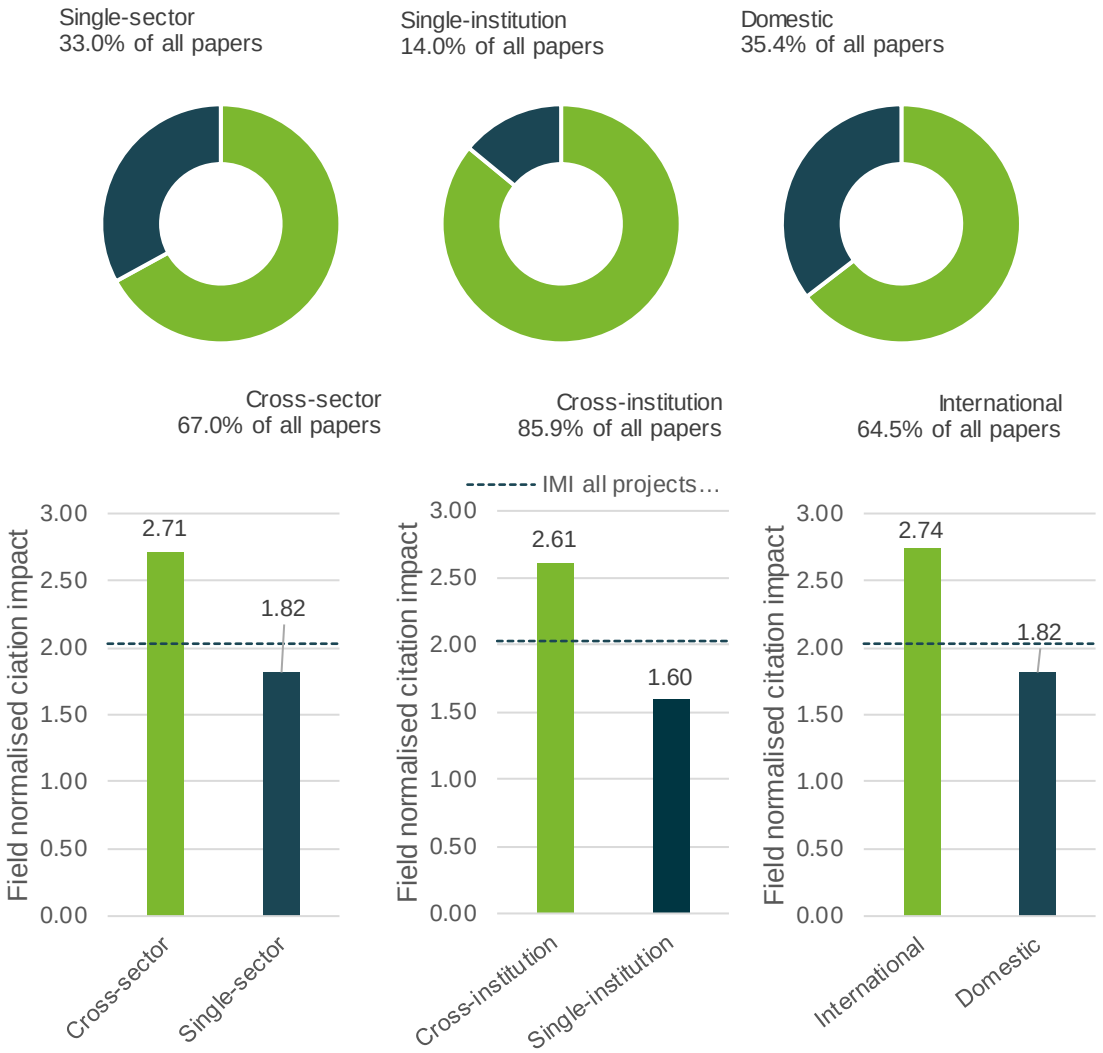
A paper is defined as cross-sector if the co-authors are affiliated to organisations that are assigned to different sectors. For example, if a paper has author addresses corresponding to the University of Copenhagen (academic) and the company Novartis (corporate), it would be classified as cross-sector. If a paper only has author addresses corresponding to the University of Cambridge (academic) and Utrecht University (academic), it would be classified as single-sector since both addresses are academic institutions, but it would be defined as cross-institution as more than one institution is listed in the addresses. A paper is defined as international if more than one country is listed in the addresses, or domestic if only a single country is listed.

The data in Table 7.1.1 compares the output and field-normalised citation impact of collaborative IMI project research with its non-collaborative research. Figure 7.1.1 presents the same data visually.

Table 7.1.1 CROSS-SECTOR, CROSS-INSTITUION AND INTERNATIONAL OUTPUT AND FIELD-NORMALISED CITATION IMPACT OF IMI PROJECT RESEARCH, 2010-2021

	NUMBER OF PAPERS	% OF PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
Cross-sector	5,261	67.0%	2.71
Single-sector	2,589	33.0%	1.82
Cross-institution	6,749	85.9%	2.61
Single-institution	1,102	14.0%	1.60
International	5,069	64.5%	2.74
Domestic	2,782	35.4%	1.82

Figure 7.1.1 FIELD-NORMALISED CITATION IMPACT AND PERCENTAGE OF CROSS-SECTOR, CROSS-INSTITUION AND INTERNATIONAL COLLABORATIVE PAPERS FROM IMI PROJECT RESEARCH, 2010-2021



- Nearly two-thirds of (67%) of all IMI project papers were published by co-authors working in different sectors.
- The majority (85.9%) of IMI project papers involved collaboration between different institutions.
- More than half (64.5%) of all IMI project papers involved international collaboration.
- Collaborative IMI project research was internationally influential with field-normalised citation impacts over 2.5-times the world average (1.00), regardless of the type of collaborations.
- IMI's collaborative research has an average field-normalised citation impact that is almost 50% higher than IMI's non-collaborative research and the non-collaborative research field-normalised citation impact was below average for IMI project research (2.03).

7.2 Collaboration analysis by IMI project

This section analyses the collaboration of IMI research at the individual project level.

Table 7.2.1 shows the number, percentage, and field-normalised citation impact of IMI research papers with co-authors from more than one country. Table 7.2.2 shows number, percentage, and field-normalised citation impact of IMI research papers with co-authors from more than one institution. Table 7.2.3 shows number, percentage, and field-normalised citation impact of IMI research papers with co-authors from more than one sector.

Figure 7.2.1 to Figure 7.2.5 are maps showing international collaboration for the five IMI projects with the highest number of papers: BTCURE, EU-AIMS, ULTRA-DD, EMIF, and NEWMEDS. The countries with the most frequent collaboration are the darkest shade of blue and gradually gets lighter the less collaboration there is.

It should be noted that the last column in Table 7.2.1 to Table 7.2.3 shows the field-normalised citation impact of those papers involving collaboration of the type being analysed, rather than for all papers belonging to a project. Therefore, in Table 7.2.1, the last column contains the field-normalised citation impact of only the internationally collaborative papers for each project. Similarly, the last column in Table 7.2.2 contains only the field-normalised citation impact of the papers with co-authors from more than one institution, and in Table 7.2.3, the last column contains only the field-normalised citation impact of cross-sector papers.

The key findings of Section 7.2 are:

- BTCURE had the highest number of papers with co-authors from more than one country, institution and sector (Table 7.1.1-Table 7.2.3). This may be due to BTCURE having the highest overall number of papers.
- EU-AIMS had the second highest number of papers with authors from more than one country, institution and sector (Table 7.1.1-Table 7.2.3). Again, this also may be due to EU-AIMS having the second highest overall number of papers
- For those projects with at least 100 papers, BigData@Heart has the highest percentage of its papers that are co-authors from more than one country (76.3%), institution (98.5%) and sector (90.4%).

- The majority of collaborative papers from the top five projects were co-authored with researchers from the United States (USA), Germany and the UK (Figure 7.2.1 to Figure 7.2.5).
- In general, there is a high level of collaboration within Europe for all of the top five projects. The most frequently collaborating European countries were the UK, Sweden, the Netherlands, France and Germany.
- EU-AIMS, NEWMEDS and ULTRA-DD had substantial input from Canadian researchers and ULTRA-DD had a noteworthy amount of collaboration from Chinese researchers (Figure 7.2.2-Figure 7.2.5).

Table 7.2.2 NUMBER, PERCENTAGE AND CITATION IMPACT[19] OF IMI-SUPPORTED RESEARCH PAPERS WITH AUTHORS FROM MORE THAN ONE COUNTRY, 2010-2021

PROJECT	NUMBER OF PAPERS	NUMBER OF INTERNATIONALLY COLLABORATIVE PAPERS	% OF INTERNATIONALLY COLLABORATIVE PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
BTCure	672	398	59.2%	2.11
EU-AIMS	546	388	71.1%	2.44
ULTRA-DD	425	318	74.8%	2.22
EMIF	310	232	74.8%	2.94
NEWMEDS	214	137	64.0%	2.42
AIMS-2-TRIALS	196	145	74.0%	4.32
EUROPAIN	181	77	42.5%	3.42
CANCER-ID	180	92	51.1%	4.12
ORBITO	168	94	56.0%	1.78
INNODIA	166	121	72.9%	2.16
TRANSLOCATION	164	93	56.7%	1.68
STEMBANCC	147	83	56.5%	2.22
IMIDIA	141	81	57.4%	1.95
SUMMIT	136	93	68.4%	1.74
BigData@Heart	135	103	76.3%	2.74
ELF	134	76	56.7%	1.11
RTCure	131	70	53.4%	4.13
CHEM21	128	46	35.9%	2.33
PreDiCT-TB	118	69	58.5%	1.47
SPRINTT	116	73	62.9%	2.06

[19] The last column is the citation impact of only the internationally collaborative papers.

PROJECT	NUMBER OF PAPERS	NUMBER OF INTERNATIONALLY COLLABORATIVE PAPERS	% OF INTERNATIONALLY COLLABORATIVE PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
MIP-DILI	108	57	52.8%	2.24
Quic-Concept	103	68	66.0%	6.74
EUbOPEN	101	64	63.4%	3.45
COMBACTE-NET	100	59	59.0%	1.30
PROTECT	99	71	71.7%	1.20
BEAT-DKD	98	74	75.5%	1.67
COMBACTE-MAGNET	97	65	67.0%	1.43
RHAPSODY	94	68	72.3%	2.79
U-BIOPRED	93	70	75.3%	3.03
eTOX	92	38	41.3%	1.91
COMPACT	91	50	54.9%	2.36
Pharma-Cog	88	71	80.7%	1.34
DIRECT	82	64	78.0%	4.66
ABIRISK	79	42	53.2%	1.30
DDMoRe	77	51	66.2%	1.27
PRISM	75	57	76.0%	4.26
AETIONOMY	71	37	52.1%	2.16
BioVacSafe	70	39	55.7%	1.39
Open PHACTS	70	43	61.4%	3.66
K4DD	68	40	58.8%	1.96
None	65	50	76.9%	3.87
Onco Track	65	32	49.2%	3.07
RADAR-CNS	64	50	78.1%	2.20
IMPRiND	63	42	66.7%	7.11
COMBACTE-CARE	61	43	70.5%	1.77
ZAPI	60	43	71.7%	5.80
MARCAR	60	30	50.0%	1.20
ENABLE	55	28	50.9%	1.28
EPAD	55	39	70.9%	1.68
DRIVE-AB	54	38	70.4%	1.39
APPROACH	54	46	85.2%	2.52
PRECISESADS	54	46	85.2%	1.54

PROJECT	NUMBER OF PAPERS	NUMBER OF INTERNATIONALLY COLLABORATIVE PAPERS	% OF INTERNATIONALLY COLLABORATIVE PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
AMYPAD	50	41	82.0%	2.49
LITMUS	49	34	69.4%	5.44
TransQST	47	35	74.5%	2.79
RAPP-ID	46	25	54.3%	0.89
Predect	45	33	73.3%	2.04
PHAGO	45	31	68.9%	3.71
INNODIA HARVEST	45	33	73.3%	2.14
eTRIKS	45	42	93.3%	2.37
FLUCOP	44	25	56.8%	1.29
RESCEU	43	33	76.7%	2.24
MOBILISE-D	43	29	67.4%	2.43
iPiE	41	13	31.7%	1.49
GETREAL	37	30	81.1%	1.55
iABC	33	24	72.7%	1.61
EBiSC	33	24	72.7%	1.65
EBOVAC1	32	22	68.8%	2.31
EHDEN	31	28	90.3%	2.72
PROACTIVE	29	25	86.2%	2.55
DRAGON	28	24	85.7%	4.88
ADAPTED	28	19	67.9%	3.93
ADVANCE	27	24	88.9%	1.30
PREFER	27	25	92.6%	1.64
EbolaMoDRAD	25	15	60.0%	1.43
Hypo-RESOLVE	24	20	83.3%	1.37
eTRANSAFE	23	12	52.2%	1.12
TRISTAN	23	13	56.5%	1.48
3TR	23	12	52.2%	5.00
ROADMAP	22	17	77.3%	0.66
SAFE-T	21	12	57.1%	2.01
VAC2VAC	20	13	65.0%	0.82
DRIVE	20	7	35.0%	1.81
IMI-PainCare	20	12	60.0%	1.68

PROJECT	NUMBER OF PAPERS	NUMBER OF INTERNATIONALLY COLLABORATIVE PAPERS	% OF INTERNATIONALLY COLLABORATIVE PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
EHR4CR	20	13	65.0%	1.40
EBOVAC2	19	11	57.9%	3.80
IM2PACT	19	10	52.6%	3.40
HARMONY	17	9	52.9%	0.99
PERISCOPE	17	7	41.2%	1.60
COMBACTE	16	2	12.5%	12.48
SOPHIA	16	10	62.5%	10.39
WEB-RADR	16	13	81.3%	1.50
BIOMAP	14	11	78.6%	4.75
CARDIATEAM	14	14	100.0%	3.54
VSV-EBOPLUS	13	11	84.6%	1.13
PD-MitoQUANT	13	7	53.8%	2.44
MOPEAD	13	11	84.6%	2.49
EU-PEARL	12	9	75.0%	1.58
TransBioLine	12	5	41.7%	2.00
ConcePTION	11	10	90.9%	1.01
VSV-EBOVAC	11	8	72.7%	1.06
ITCC-P4	11	9	81.8%	2.84
VALUE-Dx	10	9	90.0%	3.44
CARE	9	7	77.8%	9.23
VITAL	9	5	55.6%	0.32
c4c	9	9	100.0%	1.04
COMBACTE-CDI	9	9	100.0%	1.55
EQIPD	9	8	88.9%	3.04
MAD-CoV 2	8	8	100.0%	2.99
EBODAC	8	7	87.5%	2.39
ERA4TB	8	6	75.0%	2.78
RADAR-AD	8	4	50.0%	1.65
PARADIGM	7	6	85.7%	1.88
FAIRplus	7	2	28.6%	3.39
EUPATI	7	7	100.0%	0.75
EBOVAC3	7	7	100.0%	1.06

PROJECT	NUMBER OF PAPERS	NUMBER OF INTERNATIONALLY COLLABORATIVE PAPERS	% OF INTERNATIONALLY COLLABORATIVE PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
ReSOLUTE	7	3	42.9%	0.91
KRONO	7	1	14.3%	0.53
NECESSITY	6	5	83.3%	2.66
EBiSC2	6	6	100.0%	0.58
IDEA-FAST	6	6	100.0%	1.32
NeuroDeRisk	6	1	16.7%	0.24
MACUSTAR	6	4	66.7%	2.37
Immune-Image	5	5	100.0%	2.67
HIPPOCRATES	5	1	20.0%	11.00
iCONSENSUS	5	2	40.0%	1.25
EBOMAN	4	4	100.0%	3.88
MELLODDY	4	3	75.0%	0.57
DO->IT	4	4	100.0%	1.19
SafeSciMET	4	4	100.0%	0.89
ADAPT-SMART	4	2	50.0%	1.13
T2EVOLVE	3	1	33.3%	10.38
ND4BB	3	2	66.7%	1.65
IMMUCAN	3	2	66.7%	0.42
Eu2P	3	2	66.7%	0.06
imSAVAR	3	3	100.0%	5.01
ImmUniverse	3	2	66.7%	0.00
OPTIMA	2	1	50.0%	1.05
PIONEER	2	2	100.0%	1.26
COVID-RED	2	2	100.0%	0.44
STOPFOP	2	2	100.0%	2.17
NGN-PET	2	1	50.0%	1.05
Trials@Home	2	1	50.0%	2.41
Inno4Vac	2	1	50.0%	0.00
VHFMoDRAD	2	1	50.0%	0.38
PEVIA	2	2	100.0%	0.80
Impentri	1	1	100.0%	0.00
Pharmatrain	1	1	100.0%	0.10

PROJECT	NUMBER OF PAPERS	NUMBER OF INTERNATIONALLY COLLABORATIVE PAPERS	% OF INTERNATIONALLY COLLABORATIVE PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
EBOVAC	1	1	100.0%	3.27
EMTRAIN	1	1	100.0%	0.10
BIGPICTURE	1	1	100.0%	4.88
HARMONY PLUS	1	1	100.0%	11.67

Table 7.2.3 NUMBER, PERCENTAGE AND CITATION IMPACT[20] OF IMI-SUPPORTED RESEARCH PAPERS WITH AUTHORS FROM MORE THAN ONE INSTITUTION, 2010-2021

PROJECT	NUMBER OF PAPERS	NUMBER OF PAPERS FROM MORE THAN ONE INSTITUTION	% OF PAPERS FROM MORE THAN ONE INSTITUTION	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
BTCure	672	550	81.8%	1.99
EU-AIMS	546	510	93.4%	2.32
ULTRA-DD	425	384	90.4%	2.14
EMIF	310	291	93.9%	2.75
NEWMEDS	214	177	82.7%	2.33
AIMS-2-TRIALS	196	187	95.4%	3.84
EUROPAIN	181	125	69.1%	2.90
CANCER-ID	180	154	85.6%	3.53
ORBITO	168	132	78.6%	1.83
INNODIA	166	155	93.4%	1.95
TRANSLOCATION	164	117	71.3%	1.63
STEMBANCC	147	118	80.3%	2.17
IMIDIA	141	118	83.7%	1.76
SUMMIT	136	121	89.0%	1.58
BigData@Heart	135	133	98.5%	2.96
ELF	134	99	73.9%	1.19
RTCure	131	122	93.1%	3.72
CHEM21	128	68	53.1%	2.05
PreDiCT-TB	118	99	83.9%	1.22

[20] The last column in is only the citation impact of the papers from more than one institution.

PROJECT	NUMBER OF PAPERS	NUMBER OF PAPERS FROM MORE THAN ONE INSTITUTION	% OF PAPERS FROM MORE THAN ONE INSTITUTION	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
SPRINTT	116	100	86.2%	1.97
MIP-DILI	108	80	74.1%	1.97
Quic-Concept	103	98	95.1%	5.18
EUbOPEN	101	83	82.2%	3.17
COMBACTE-NET	100	90	90.0%	1.26
PROTECT	99	97	98.0%	1.05
BEAT-DKD	98	89	90.8%	2.55
COMBACTE-MAGNET	97	83	85.6%	1.46
RHAPSODY	94	81	86.2%	2.59
U-BIOPRED	93	83	89.2%	2.70
eTOX	92	52	56.5%	1.73
COMPACT	91	70	76.9%	2.05
Pharma-Cog	88	82	93.2%	1.26
DIRECT	82	79	96.3%	4.16
ABIRISK	79	68	86.1%	1.41
DDMoRe	77	64	83.1%	1.23
PRISM	75	70	93.3%	3.84
AETIONOMY	71	71	100.0%	1.83
BioVacSafe	70	43	61.4%	1.32
Open PHACTS	70	57	81.4%	3.67
K4DD	68	55	80.9%	1.77
None	65	60	92.3%	3.66
Onco Track	65	53	81.5%	2.36
RADAR-CNS	64	60	93.8%	2.43
IMPRiND	63	56	88.9%	5.84
COMBACTE-CARE	61	59	96.7%	1.72
ZAPI	60	49	81.7%	5.30
MARCAR	60	43	71.7%	1.19
ENABLE	55	50	90.9%	1.57
EPAD	55	47	85.5%	1.66
DRIVE-AB	54	48	88.9%	1.43
APPROACH	54	50	92.6%	2.40

PROJECT	NUMBER OF PAPERS	NUMBER OF PAPERS FROM MORE THAN ONE INSTITUTION	% OF PAPERS FROM MORE THAN ONE INSTITUTION	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
PRECISESADS	54	51	94.4%	1.53
AMYPAD	50	49	98.0%	2.47
LITMUS	49	44	89.8%	5.49
TransQST	47	40	85.1%	2.55
RAPP-ID	46	37	80.4%	0.91
Predect	45	36	80.0%	1.97
PHAGO	45	37	82.2%	4.98
INNODIA HARVEST	45	40	88.9%	2.11
eTRIKS	45	44	97.8%	2.32
FLUCOP	44	42	95.5%	1.89
RESCEU	43	40	93.0%	2.33
MOBILISE-D	43	42	97.7%	2.35
iPiE	41	34	82.9%	1.23
GETREAL	37	36	97.3%	1.71
iABC	33	29	87.9%	1.49
EBiSC	33	30	90.9%	5.16
EBOVAC1	32	25	78.1%	2.25
EHDEN	31	29	93.5%	2.72
PROACTIVE	29	29	100.0%	2.25
DRAGON	28	28	100.0%	5.29
ADAPTED	28	27	96.4%	3.67
ADVANCE	27	26	96.3%	1.43
PREFER	27	26	96.3%	1.62
EbolaMoDRAD	25	23	92.0%	1.39
Hypo-RESOLVE	24	21	87.5%	1.37
eTRANSAFE	23	15	65.2%	1.12
TRISTAN	23	21	91.3%	1.50
3TR	23	21	91.3%	3.29
ROADMAP	22	20	90.9%	0.97
SAFE-T	21	20	95.2%	1.79
VAC2VAC	20	17	85.0%	0.95
DRIVE	20	19	95.0%	1.31

PROJECT	NUMBER OF PAPERS	NUMBER OF PAPERS FROM MORE THAN ONE INSTITUTION	% OF PAPERS FROM MORE THAN ONE INSTITUTION	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
IMI-PainCare	20	18	90.0%	1.49
EHR4CR	20	19	95.0%	1.18
EBOVAC2	19	18	94.7%	2.57
IM2PACT	19	16	84.2%	3.31
HARMONY	17	14	82.4%	0.83
PERISCOPE	17	12	70.6%	1.35
COMBACTE	16	13	81.3%	3.31
SOPHIA	16	14	87.5%	8.89
WEB-RADR	16	14	87.5%	1.45
BIOMAP	14	13	92.9%	4.88
CARDIATEAM	14	14	100.0%	3.54
VSV-EBOPLUS	13	12	92.3%	1.06
PD-MitoQUANT	13	12	92.3%	2.18
MOPEAD	13	13	100.0%	2.81
EU-PEARL	12	11	91.7%	4.15
TransBioLine	12	12	100.0%	1.45
ConcePTION	11	11	100.0%	0.96
VSV-EBOVAC	11	9	81.8%	0.98
ITCC-P4	11	11	100.0%	2.48
VALUE-Dx	10	9	90.0%	3.44
CARE	9	8	88.9%	10.23
VITAL	9	7	77.8%	0.55
c4c	9	9	100.0%	1.04
COMBACTE-CDI	9	9	100.0%	1.55
EQIPD	9	8	88.9%	3.04
MAD-CoV 2	8	8	100.0%	2.99
EBODAC	8	8	100.0%	2.38
ERA4TB	8	7	87.5%	2.12
RADAR-AD	8	7	87.5%	1.20
PARADIGM	7	6	85.7%	1.88
FAIRplus	7	3	42.9%	2.93
EUPATI	7	7	100.0%	0.75

PROJECT	NUMBER OF PAPERS	NUMBER OF PAPERS FROM MORE THAN ONE INSTITUTION	% OF PAPERS FROM MORE THAN ONE INSTITUTION	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
EBOVAC3	7	7	100.0%	1.06
ReSOLUTE	7	5	71.4%	1.21
KRONO	7	6	85.7%	2.94
NECESSITY	6	6	100.0%	2.53
EBiSC2	6	6	100.0%	0.58
IDEA-FAST	6	6	100.0%	1.32
NeuroDeRisk	6	3	50.0%	0.12
MACUSTAR	6	5	83.3%	2.23
Immune-Image	5	5	100.0%	2.67
HIPPOCRATES	5	4	80.0%	5.41
iCONSENSUS	5	4	80.0%	2.10
EBOMAN	4	4	100.0%	3.88
MELLODDY	4	3	75.0%	0.57
DO->IT	4	4	100.0%	1.19
SafeSciMET	4	4	100.0%	0.89
DECISION	4	4	100.0%	2.60
ADAPT-SMART	4	3	75.0%	0.77
T2EVOLVE	3	3	100.0%	3.66
ND4BB	3	3	100.0%	1.36
IMMUCAN	3	3	100.0%	0.87
Eu2P	3	3	100.0%	2.01
imSAVAR	3	3	100.0%	5.01
ImmUniverse	3	3	100.0%	0.00
OPTIMA	2	2	100.0%	0.75
PIONEER	2	2	100.0%	1.26
COVID-RED	2	2	100.0%	0.44
STOPFOP	2	2	100.0%	2.17
NGN-PET	2	1	50.0%	1.05
Trials@Home	2	1	50.0%	2.41
Inno4Vac	2	2	100.0%	0.00
VHFMoDRAD	2	2	100.0%	0.38
PEVIA	2	2	100.0%	0.80

PROJECT	NUMBER OF PAPERS	NUMBER OF PAPERS FROM MORE THAN ONE INSTITUTION	% OF PAPERS FROM MORE THAN ONE INSTITUTION	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
Impentri	1	1	100.0%	0.00
Pharmatrain	1	1	100.0%	0.10
EBOVAC	1	1	100.0%	3.27
EMTRAIN	1	1	100.0%	0.10
BIGPICTURE	1	1	100.0%	4.88
HARMONY PLUS	1	1	100.0%	11.67
COMBINE	1	1	100.0%	0.07
PERSIST-SEQ	1	1	100.0%	0.00

Table 7.2.4 NUMBER, PERCENTAGE AND CITATION IMPACT[21] OF IMI-SUPPORTED RESEARCH PAPERS WITH AUTHORS FROM MORE THAN ONE SECTOR, 2010-2021

PROJECT	NUMBER OF PAPERS	NUMBER OF CROSS SECTOR PAPERS	% OF CROSS SECTOR PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
BTCure	672	434	64.6%	2.10
EU-AIMS	546	397	72.7%	2.41
ULTRA-DD	425	268	63.1%	2.49
EMIF	310	254	81.9%	2.61
NEWMEDS	214	133	62.1%	2.40
AIMS-2-TRIALS	196	140	71.4%	3.79
EUROPAIN	181	99	54.7%	3.06
CANCER-ID	180	135	75.0%	3.69
ORBITO	168	107	63.7%	1.95
INNODIA	166	134	80.7%	1.98
TRANSLOCATION	164	60	36.6%	1.77
STEMBANCC	147	74	50.3%	2.22
IMIDIA	141	75	53.2%	2.02
SUMMIT	136	102	75.0%	1.55
BigData@Heart	135	122	90.4%	3.10
ELF	134	46	34.3%	1.06

[21] The last column is only field-normalised citation impact for cross sector papers only.

PROJECT	NUMBER OF PAPERS	NUMBER OF CROSS SECTOR PAPERS	% OF CROSS SECTOR PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
RTCure	131	106	80.9%	4.06
CHEM21	128	30	23.4%	2.25
PreDiCT-TB	118	67	56.8%	1.21
SPRINTT	116	84	72.4%	2.00
MIP-DILI	108	72	66.7%	1.91
Quic-Concept	103	74	71.8%	3.95
EUbOPEN	101	59	58.4%	3.33
COMBACTE-NET	100	79	79.0%	1.34
PROTECT	99	96	97.0%	1.06
BEAT-DKD	98	70	71.4%	2.87
COMBACTE-MAGNET	97	68	70.1%	1.44
RHAPSODY	94	56	59.6%	2.32
U-BIOPRED	93	77	82.8%	2.83
eTOX	92	28	30.4%	2.15
COMPACT	91	22	24.2%	3.38
Pharma-Cog	88	75	85.2%	1.31
DIRECT	82	62	75.6%	4.63
ABIRISK	79	60	75.9%	1.45
DDMoRe	77	50	64.9%	1.35
PRISM	75	60	80.0%	4.32
AETIONOMY	71	46	64.8%	2.23
BioVacSafe	70	32	45.7%	1.32
Open PHACTS	70	42	60.0%	4.62
K4DD	68	37	54.4%	1.72
None	65	49	75.4%	4.09
Onco Track	65	41	63.1%	2.38
RADAR-CNS	64	40	62.5%	2.87
IMPRiND	63	42	66.7%	4.21
COMBACTE-CARE	61	56	91.8%	1.75
ZAPI	60	40	66.7%	5.61
MARCAR	60	25	41.7%	1.22
ENABLE	55	32	58.2%	1.43

PROJECT	NUMBER OF PAPERS	NUMBER OF CROSS SECTOR PAPERS	% OF CROSS SECTOR PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
EPAD	55	42	76.4%	1.76
DRIVE-AB	54	40	74.1%	1.39
APPROACH	54	44	81.5%	2.13
PRECISESADS	54	43	79.6%	1.68
AMYPAD	50	46	92.0%	2.51
LITMUS	49	41	83.7%	5.64
TransQST	47	28	59.6%	2.88
RAPP-ID	46	15	32.6%	1.09
Predect	45	31	68.9%	1.89
PHAGO	45	31	68.9%	5.45
INNODIA HARVEST	45	35	77.8%	2.05
eTRIKS	45	37	82.2%	2.51
FLUCOP	44	40	90.9%	1.93
RESCEU	43	36	83.7%	2.44
MOBILISE-D	43	33	76.7%	2.16
iPiE	41	21	51.2%	1.16
GETREAL	37	31	83.8%	1.87
iABC	33	28	84.8%	1.52
EBiSC	33	23	69.7%	6.07
EBOVAC1	32	23	71.9%	2.24
EHDEN	31	25	80.6%	2.93
PROACTIVE	29	29	100.0%	2.25
DRAGON	28	25	89.3%	5.14
ADAPTED	28	26	92.9%	3.83
ADVANCE	27	24	88.9%	1.38
PREFER	27	25	92.6%	1.69
EbolaMoDRAD	25	17	68.0%	1.50
Hypo-RESOLVE	24	14	58.3%	1.14
eTRANSAFE	23	11	47.8%	1.10
TRISTAN	23	19	82.6%	1.38
3TR	23	21	91.3%	3.29
ROADMAP	22	20	90.9%	0.97

PROJECT	NUMBER OF PAPERS	NUMBER OF CROSS SECTOR PAPERS	% OF CROSS SECTOR PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
SAFE-T	21	20	95.2%	1.79
VAC2VAC	20	14	70.0%	1.00
DRIVE	20	17	85.0%	1.33
IMI-PainCare	20	15	75.0%	1.57
EHR4CR	20	17	85.0%	1.19
EBOVAC2	19	10	52.6%	3.92
IM2PACT	19	11	57.9%	2.61
HARMONY	17	14	82.4%	0.83
PERISCOPE	17	6	35.3%	1.35
COMBACTE	16	8	50.0%	4.04
SOPHIA	16	11	68.8%	10.62
WEB-RADR	16	12	75.0%	1.35
BIOMAP	14	12	85.7%	5.28
CARDIATEAM	14	14	100.0%	3.54
VSV-EBOPLUS	13	9	69.2%	1.19
PD-MitoQUANT	13	9	69.2%	2.54
MOPEAD	13	13	100.0%	2.81
EU-PEARL	12	10	83.3%	4.15
TransBioLine	12	11	91.7%	1.56
ConcePTION	11	11	100.0%	0.96
VSV-EBOVAC	11	6	54.5%	1.04
ITCC-P4	11	11	100.0%	2.48
VALUE-Dx	10	7	70.0%	3.87
CARE	9	5	55.6%	12.00
VITAL	9	5	55.6%	0.30
c4c	9	9	100.0%	1.04
COMBACTE-CDI	9	9	100.0%	1.55
EQIPD	9	5	55.6%	3.94
MAD-CoV 2	8	7	87.5%	2.98
EBODAC	8	7	87.5%	2.59
ERA4TB	8	6	75.0%	2.12
RADAR-AD	8	7	87.5%	1.20

PROJECT	NUMBER OF PAPERS	NUMBER OF CROSS SECTOR PAPERS	% OF CROSS SECTOR PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
PARADIGM	7	6	85.7%	1.88
FAIRplus	7	1	14.3%	6.77
EUPATI	7	7	100.0%	0.75
EBOVAC3	7	4	57.1%	1.18
ReSOLUTE	7	4	57.1%	1.29
KRONO	7	4	57.1%	2.32
NECESSITY	6	6	100.0%	2.53
EBiSC2	6	6	100.0%	0.58
IDEA-FAST	6	2	33.3%	0.45
NeuroDeRisk	6	2	33.3%	0.12
MACUSTAR	6	5	83.3%	2.23
Immune-Image	5	5	100.0%	2.67
HIPPOCRATES	5	4	80.0%	5.41
iCONSENSUS	5	3	60.0%	1.25
EBOMAN	4	4	100.0%	3.88
MELLODDY	4	3	75.0%	0.57
DO->IT	4	3	75.0%	1.18
SafeSciMET	4	4	100.0%	0.89
DECISION	4	3	75.0%	2.91
ADAPT-SMART	4	3	75.0%	0.77
T2EVOLVE	3	2	66.7%	5.19
ND4BB	3	2	66.7%	1.32
IMMUCAN	3	2	66.7%	0.42
Eu2P	3	1	33.3%	0.00
imSAVAR	3	3	100.0%	5.01
ImmUniverse	3	3	100.0%	0.00
OPTIMA	2	2	100.0%	0.75
PIONEER	2	2	100.0%	1.26
COVID-RED	2	2	100.0%	0.44
STOPFOP	2	1	50.0%	3.81
NGN-PET	2	1	50.0%	1.05
Trials@Home	2	1	50.0%	2.41

PROJECT	NUMBER OF PAPERS	NUMBER OF CROSS SECTOR PAPERS	% OF CROSS SECTOR PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)
Inno4Vac	2	2	100.0%	0.00
VHFMoDRAD	2	2	100.0%	0.38
PEVIA	2	2	100.0%	0.80
Impentri	1	1	100.0%	0.00
Pharmatrain	1	1	100.0%	0.10
EBOVAC	1	1	100.0%	3.27
EMTRAIN	1	1	100.0%	0.10
BIGPICTURE	1	1	100.0%	4.88
HARMONY PLUS	1	1	100.0%	11.67
COMBINE	1	1	100.0%	0.07

Figure 7.2.2 INTERNATIONAL COLLABORATION BY COUNTRY, FOR IMI PROJECT: BTCURE, 2010-2021

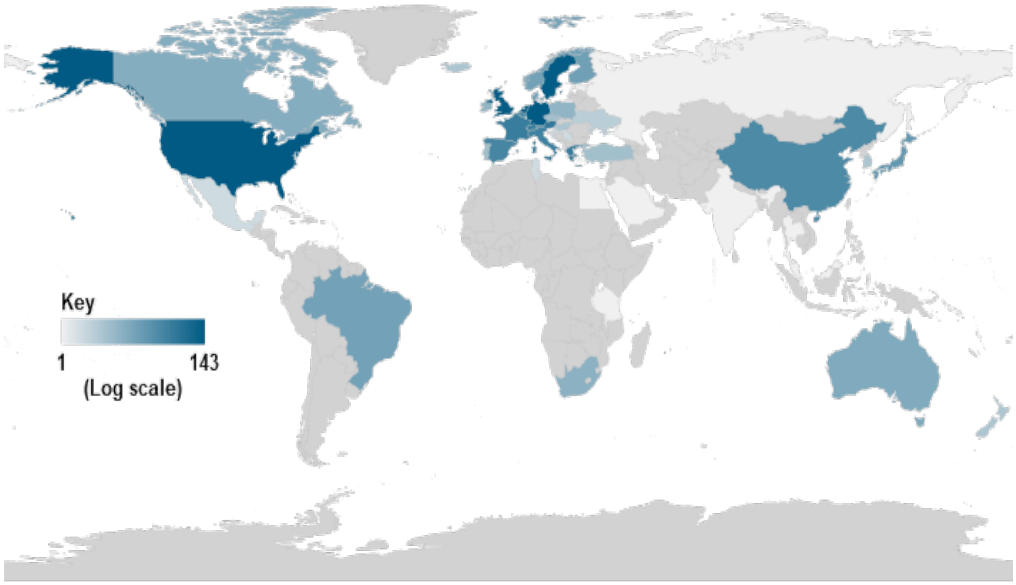


Figure 7.2.3 INTERNATIONAL COLLABORATION BY COUNTRY, FOR IMI PROJECT: EMIF, 2010-2021

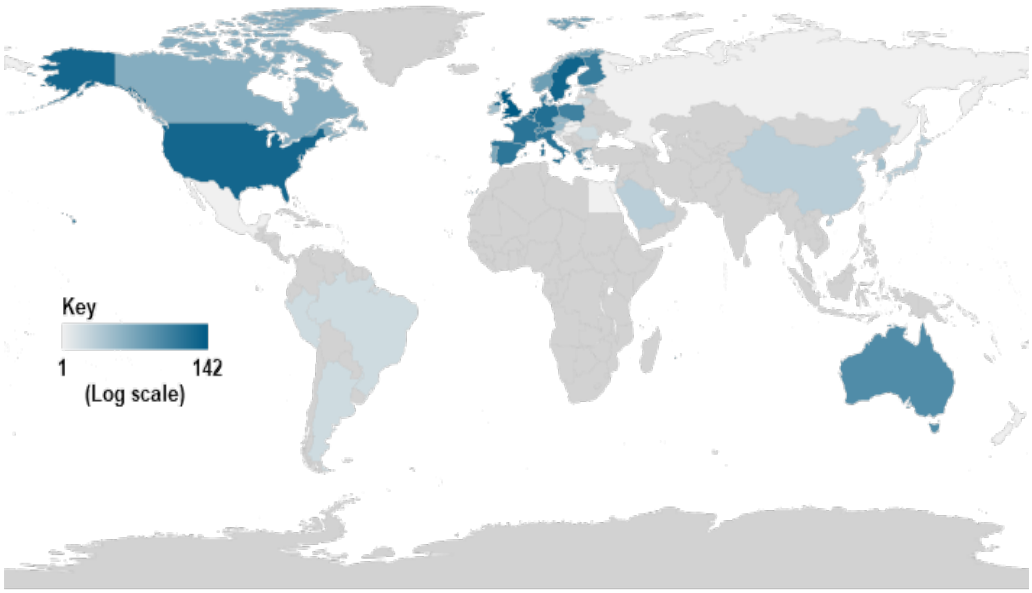


Figure 7.2.4 INTERNATIONAL COLLABORATION BY COUNTRY, FOR IMI PROJECT: EU-AIMS, 2010-2021

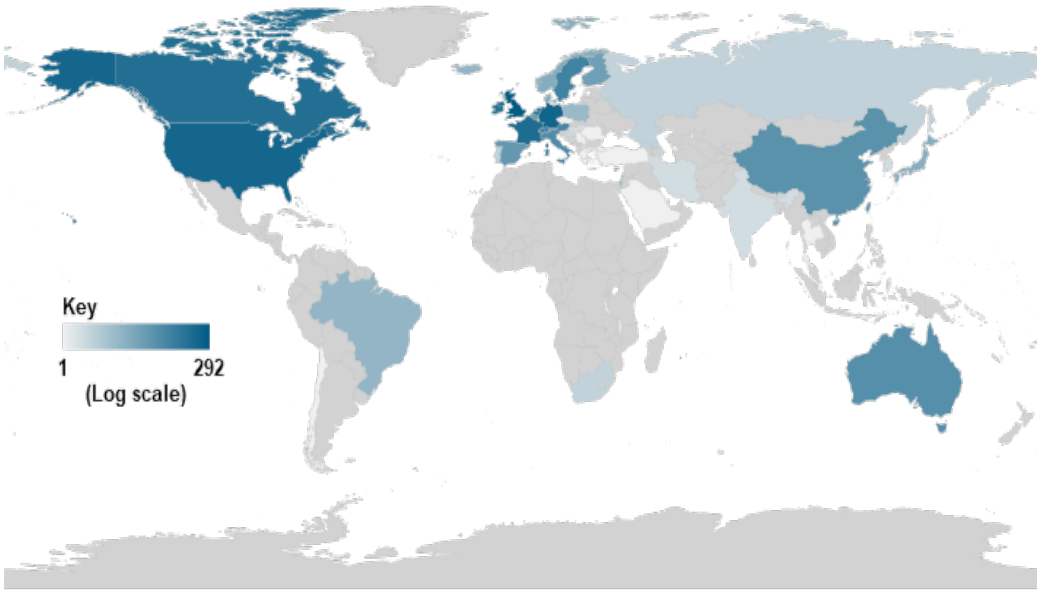


Figure 7.2.5 INTERNATIONAL COLLABORATION BY COUNTRY, FOR IMI PROJECT: NEWMEDS, 2010-2021

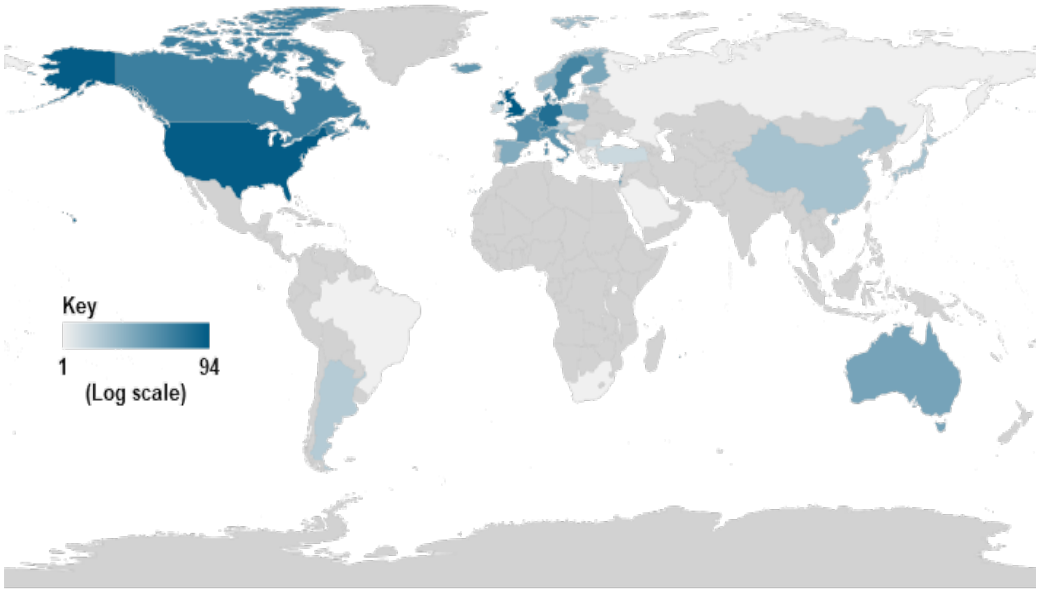
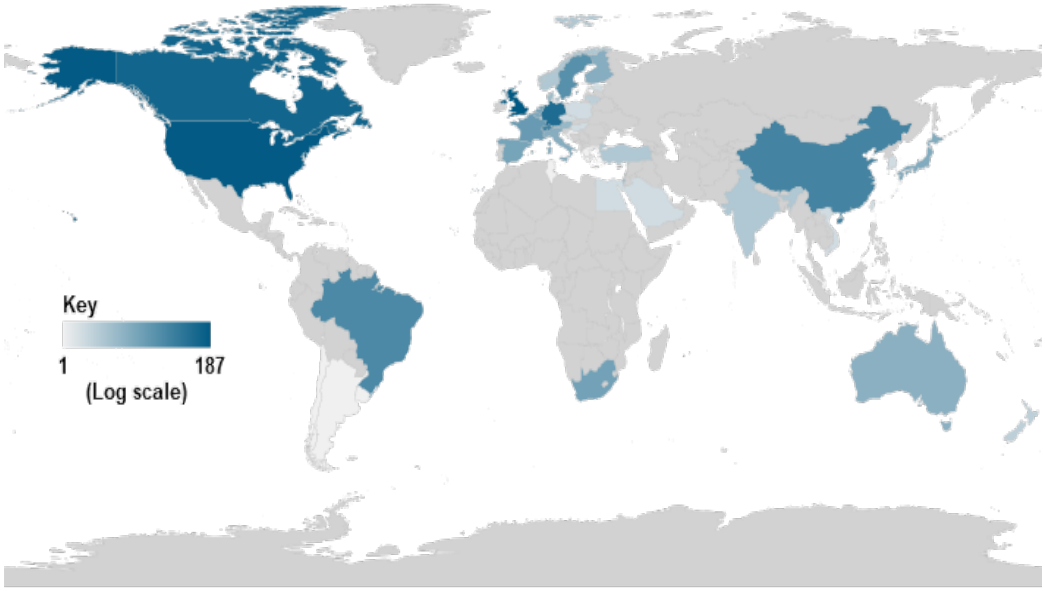


Figure 7.2.6 INTERNATIONAL COLLABORATION BY COUNTRY, FOR IMI PROJECT: ULTRA-DD, 2010-2021



7.3 Collaboration metrics for IMI research

This section of the report analyses the types of collaboration that occurred within each IMI project and examines the stability of institutional collaborations within each project.

In common with other metrics based on papers and citations, the indicators we present here work best with larger sample sizes. Indicators based on small numbers of papers will be less informative than those calculated for larger bodies of work. Therefore, the analysis presented in this section is for projects with at least 20 papers published between 2010 and 2021.

In the ninth (2018) and earlier versions of this report metric 3 indicated the intensity of international collaboration, in the tenth report (2019) it was updated to measure the stability of institutional collaborations which is what it shows in this report.

The results for all projects are shown in Annex 5.

Three metrics were used to evaluate the collaborative nature of IMI projects:

- Metric 1 (Cross-sector Score) – Fraction of "cross-sector" papers with co-authors affiliated to institutions in different sectors (Figure 7.3.7.1). The institutions affiliated with each author on an IMI project paper were manually assigned by Clarivate to the relevant sector. Author affiliations were obtained through the Web of Science.

- Metric 2 (International Score) – Percentage of internationally collaborative papers. In calculating the international score for each project, greater weighting is given to papers with multilateral collaboration (co-authors from more than two countries), compared to bilateral collaboration (co-authors from two countries) (Figure 7.3.8.1). The country location of each author was determined using author addresses extracted in the Web of Science.

- Metric 3 (Stability Score) – Stability of institutional collaboration over the lifetime of the project. The collaboration stability for pairs of collaborating institutions was calculated following the method proposed by Y. Bu et al.[22] A stable institutional collaboration has a stable output, i.e. pairs of institutions co-publish a similar volume of papers in consecutive years for the duration of a project. The stability score for each project is the mean average stability of all the collaborating institutional pairs that have contributed to that IMI project research.

Each metric is calculated for an IMI project and can take a value between 0 and 1, with 1 indicating more collaborative activity. The collaboration index is a sum of all three metrics and the maximum possible value for a project is 3.

7.3.1 Metric 1 (cross-sector score): fraction of cross sector collaborative papers

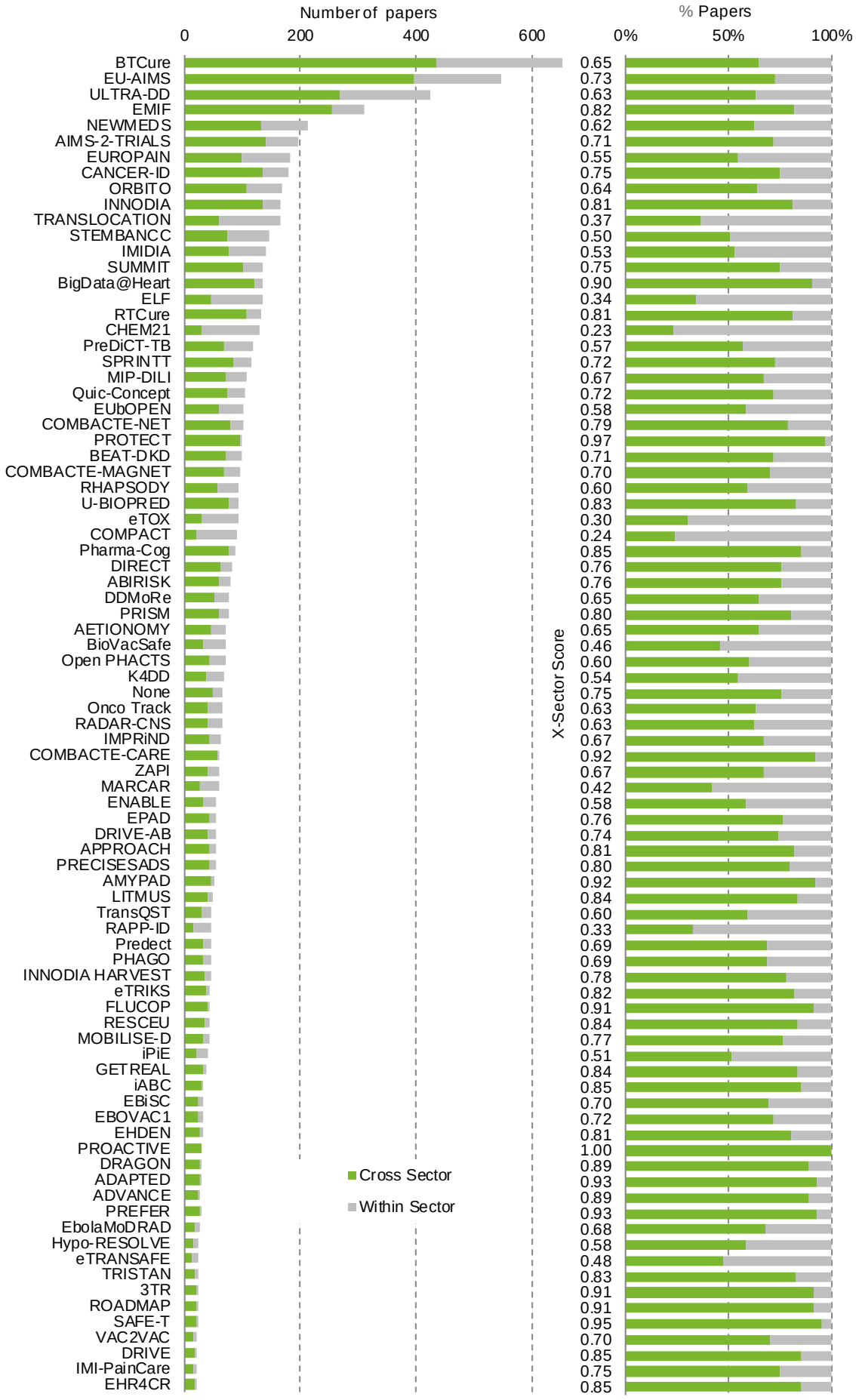
Authors institutional affiliations, as they appear on IMI project research were assigned to sectors. Sector assignments were then used to classify each paper as "within one sector", when all co-authors work within the same sector or "cross-sector" when co-authors work in two or more different sectors. The number and percentage of cross-sector papers for projects are presented in Table 7.2.3.

Figure 7.3.1.1 shows the total number of "within one sector" and "cross-sector" papers for each project. Projects are ordered by the number of cross-sector collaborative papers. The dark blue bars represent the number or fraction of "cross-sector" papers. The fraction of cross-sector papers in each project is referred to in the figure as "Cross-Sector Score". Only projects with more than 20 associated papers are shown.

- BTCURE had the greatest number of cross-sector collaborative papers, 434 out of a total of 672. PROACTIVE, PROTECT and SAFE-T had the highest percentage of cross-sector collaborative papers (100%, 97% and 95%, respectively).

[22] Bu, Y., Murray, D.S., Ding, Y. et al. (2018) Measuring the stability of scientific collaboration. *Scientometrics,* **114**, 463.

FIGURE 7.3.1.1 NUMBER AND FRACTION OF CROSS-SECTOR COLLABORATIVE PAPERS BY PROJECT, 2010-2021. ORDERED BY NUMBER OF CROSS-SECTOR PAPERS



7.3.2 Metric 2 (international score): fraction of internationally collaborative papers

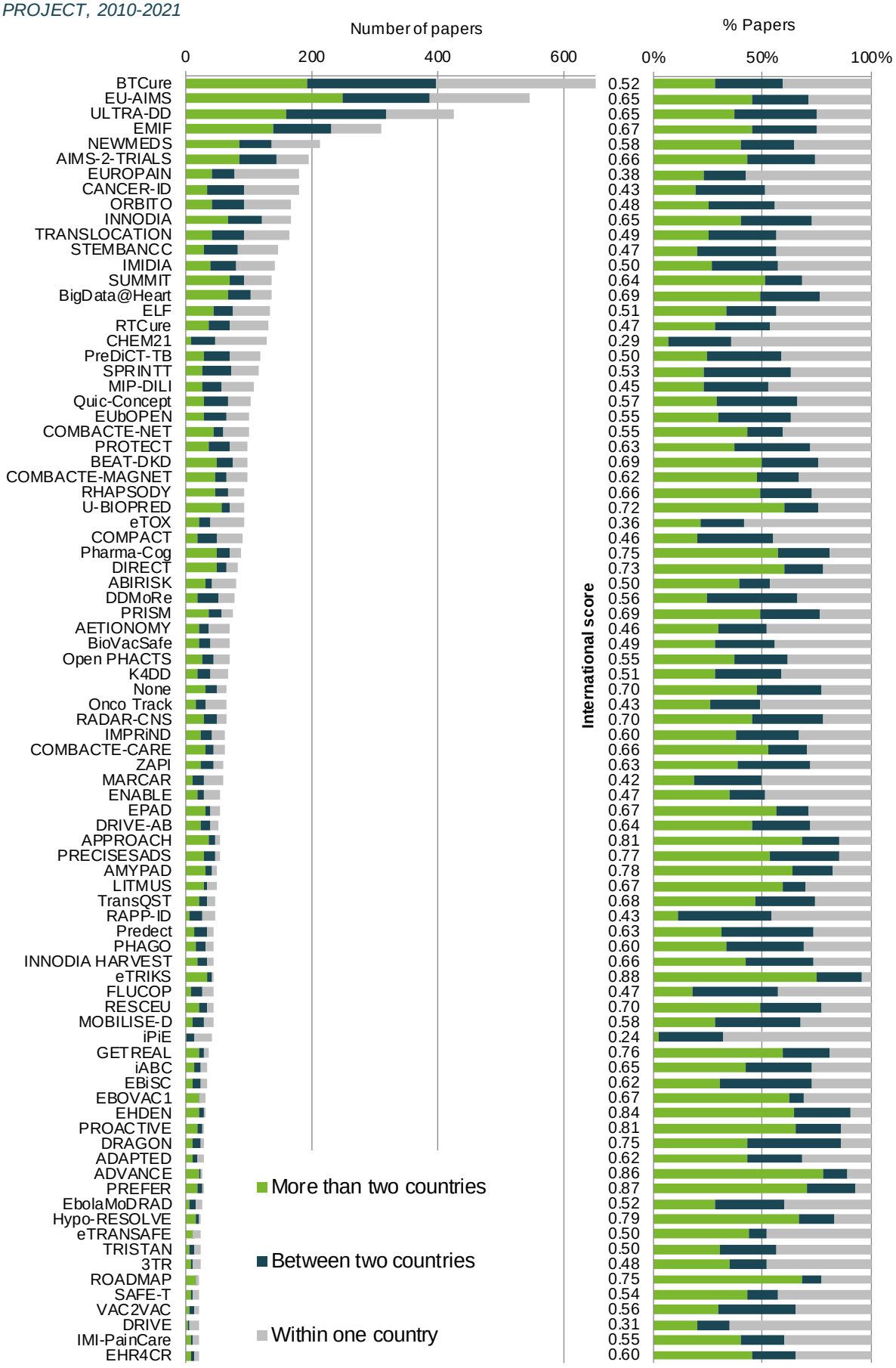
Author names and affiliations were extracted for all IMI project papers. The number of countries in the author affiliations for each paper was counted and used to classify the papers as “more than two countries”, “two countries” or “within one country” (same as domestic in the Section 7.1).

Figure 7.3.2.1 below shows the total number of papers for each project. Projects are ordered by the number of papers with author affiliations from more than one country. The bar colours reflect the fraction of papers that include international collaboration between “two countries” (bilateral) and “more than two countries” (multilateral). Only projects with more than 20 associated papers are shown.

The International Score was calculated by weighting each paper that involved only two countries by 0.75 and each paper that involved more than two countries by 1.00. The sum of the weighted papers was then divided by the total number of project papers. Total number of internationally collaborative papers for each project is shown in Table 7.2.1.

- BTCURE had the most internationally collaborative papers involving two or more countries (398 out of 672), with an International Score of 0.52.
- EU-AIMS had the most internationally collaborative papers involving more than two countries. (248 out of 546), with an international Score of 0.65.
- eTRICKS, PREFER, and ADVANCE had the highest International Scores (0.88, 0.87 and 0.86 respectively).

FIGURE 7.3.2.1 NUMBER AND FRACTION OF INTERNATIONALLY COLLABORATIVE PAPERS BY PROJECT, 2010-2021

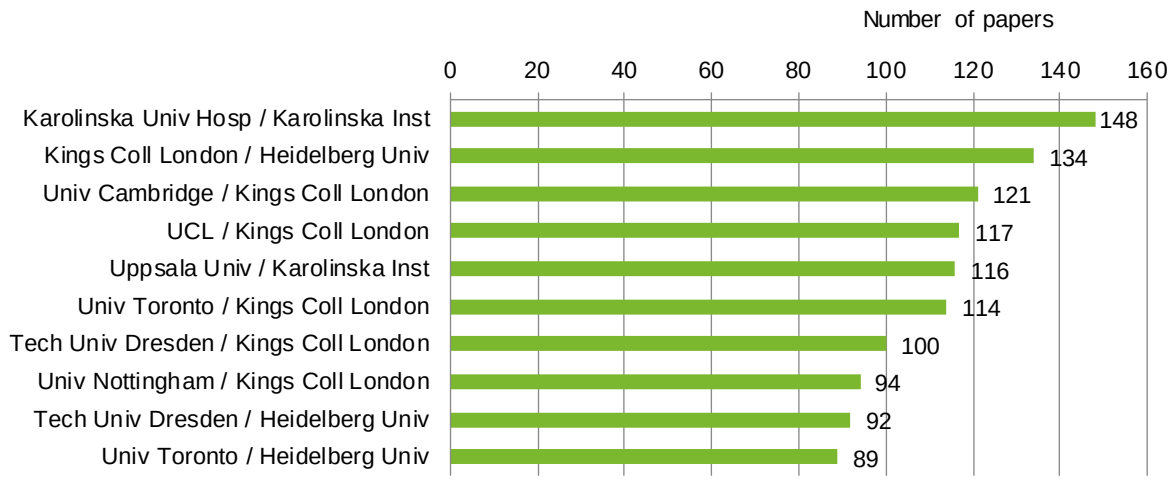


7.3.3 Metric 3 (stability score): stability of institutional collaboration

This section looks in depth at institutional collaboration activities in IMI funded research. Figure 7.3.3.1 shows the ten most productive, collaborating institution pairs, by total number of collaborative papers. Figure 7.3.3.2 shows the ten institutions that collaborate with the highest number of other institutions. Figure 7.3.3.3 shows the distribution of Metric 3 scores for IMI projects. Table 7.3.3.1 is an expansion of the data in Figure 7.3.3.3, showing the Metric 3 score for all projects with at least 20 papers and the number of collaborating institution pairs. The number and proportion of papers with authors from more than one institution for each project is shown in Table 7.2.2.

A project's Metric 3 is the mean average stability of collaborations between pairs of institutions that have co-authored papers that belong to that project. Pairs of institutions must have published two or more papers together as part of the same IMI project to be considered. A second requirement is that the IMI projects must have started in, or before, 2019. If a project started after 2019, too little time has elapsed for most pairs of institutions to have published more than one paper.

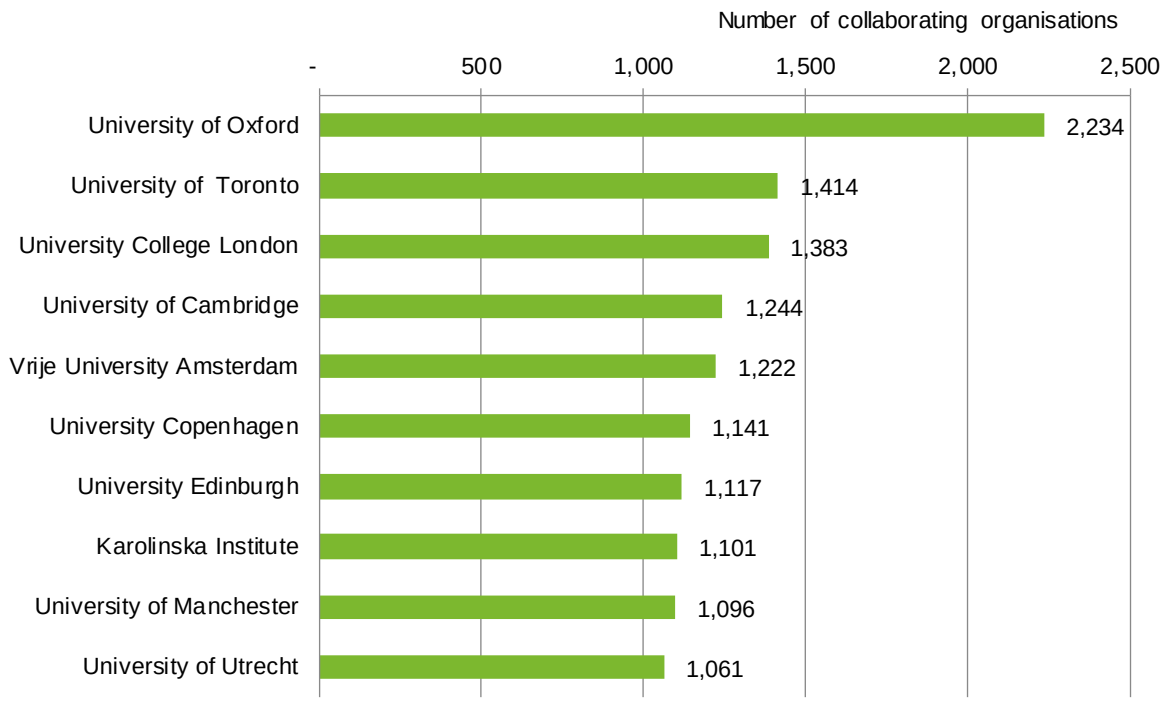
FIGURE 7.3.3.1 THE TEN MOST PRODUCTIVE PAIRS OF COLLABORATING INSTITUTIONS, 2010-2021



- The institutions that collaborated most frequently on IMI project papers were Karolinska University Hospital and Karolinska Institute, researchers at these institutions together, co-authored 148 publications. This is a change from last year's report where Kings College London and Heidelberg University were the top collaborating pair, now second.

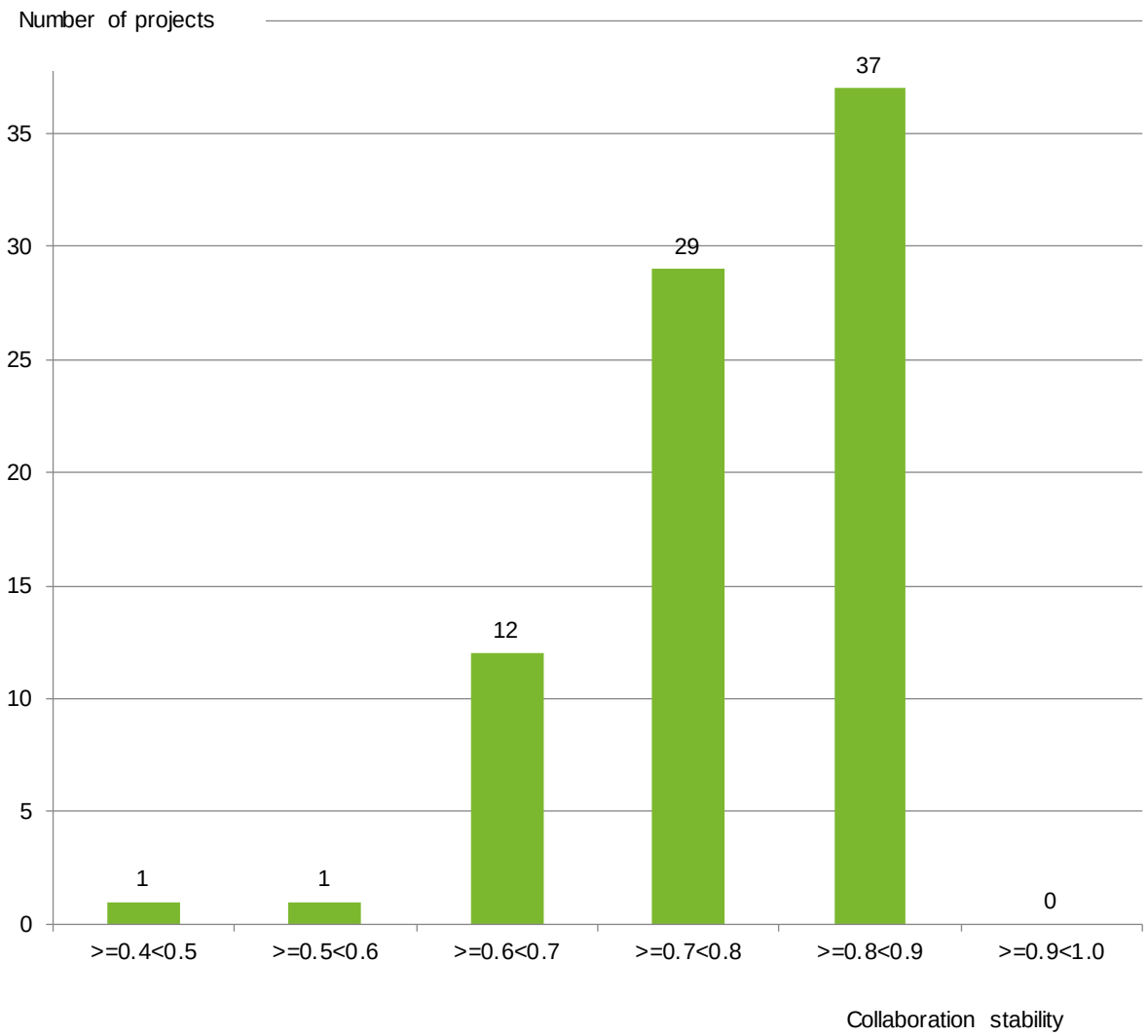
- Kings College London is part of six out of ten pairs of the most productive collaborative institutions.

FIGURE 7.3.3.2 THE TEN INSTITUTIONS THAT HAVE COLLABORATED WITH THE GREATEST NUMBER OF OTHER INSTITUTIONS, 2010-2021



- The University of Oxford has collaborated with 2,234 other institutions on IMI project papers, the most of any of the other institutions.
- The University of Utrecht is new to the top 10 collaborating organisations, replacing the University of Amsterdam.
- Half of the ten most collaborative institutions are located in the United Kingdom.

FIGURE 7.3.3.3 METRIC 3: STABILITY SCORE DISTRIBUTION, 2010-2021



- Most IMI projects have a stability score of between 0.70 and 0.90 indicating that most of the collaboration between institutions is relatively stable.

Table 7.3.5 STABILITY SCORE FOR IMI PROJECTS, NUMBER OF COLLABORATING INSTITUTION PAIRS, TOTAL NUMBER OF PAPERS AND PROJECT START YEAR FOR ALL PROJECTS WITH AT LEAST 20 PAPERS THAT STARTED IN OR BEFORE 2019, 2010-2021

PROJECT	STABILITY SCORE (METRIC 3)	NUMBER OF COLLABORATING INSTITUTION PAIRS	NUMBER OF PAPERS	PROJECT START YEAR
BTCure	0.84	1,128	672	2011
EU-AIMS	0.82	3,763	546	2012
ULTRA-DD	0.77	410	425	2015
EMIF	0.84	2,933	310	2012
NEWMEDS	0.83	865	214	2010
AIMS-2-TRIALS	0.69	946	196	2018
EUROPAIN	0.85	345	181	2010
CANCER-ID	0.75	241	180	2015
ORBITO	0.76	351	168	2013
INNODIA	0.87	431	166	2010
TRANSLOCATION	0.81	78	164	2013
STEMBANCC	0.82	64	147	2013
IMIDIA	0.84	159	141	2010
SUMMIT	0.83	7,004	136	2011
BigData@Heart	0.69	4,090	135	2017
ELF	0.77	49	134	2014
RTCure	0.70	242	131	2017
CHEM21	0.80	22	128	2013
PreDiCT-TB	0.81	67	118	2013
SPRINTT	0.80	277	116	2014
MIP-DILI	0.82	145	108	2012
Quic-Concept	0.81	157	103	2012
COMBACTE-NET	0.89	672	100	2013
PROTECT	0.86	300	99	2010
BEAT-DKD	0.70	335	98	2017
COMBACTE-MAGNET	0.86	625	97	2015
RHAPSODY	0.81	428	94	2016
U-BIOPRED	0.86	1,019	93	2010
eTOX	0.86	126	92	2010
COMPACT	0.75	41	91	2014

PROJECT	STABILITY SCORE (METRIC 3)	NUMBER OF COLLABORATING INSTITUTION PAIRS	NUMBER OF PAPERS	PROJECT START YEAR
Pharma-Cog	0.85	1,066	88	2010
DIRECT	0.84	1,299	82	2012
ABIRISK	0.84	492	79	2012
DDMoRe	0.81	59	77	2012
PRISM	0.75	222	75	2017
AETIONOMY	0.80	96	71	2014
BioVacSafe	0.81	26	70	2012
Open PHACTS	0.76	63	70	2011
K4DD	0.80	38	68	2013
Onco Track	0.83	87	65	2011
RADAR-CNS	0.82	178	64	2016
IMPRiND	0.75	46	63	2017
COMBACTE-CARE	0.80	690	61	2015
MARCAR	0.84	39	60	2011
ZAPI	0.77	62	60	2015
ENABLE	0.83	46	55	2015
EPAD	0.81	217	55	2015
APPROACH	0.81	109	54	2015
DRIVE-AB	0.75	84	54	2015
PRECISESADS	0.75	226	54	2015
AMYPAD	0.77	349	50	2017
LITMUS	0.75	204	49	2018
TransQST	0.76	23	47	2017
RAPP-ID	0.85	14	46	2011
eTRIKS	0.75	714	45	2014
PHAGO	0.72	61	45	2017
Predect	0.79	26	45	2012
FLUCOP	0.73	37	44	2015
RESCEU	0.69	491	43	2018
iPiE	0.76	22	41	2016
GETREAL	0.78	37	37	2015
EBiSC	0.77	17	33	2015
iABC	0.82	129	33	2015

PROJECT	STABILITY SCORE (METRIC 3)	NUMBER OF COLLABORATING INSTITUTION PAIRS	NUMBER OF PAPERS	PROJECT START YEAR
EBOVAC1	0.82	53	32	2015
EHDEN	0.63	896	31	2019
PROACTIVE	0.85	199	29	2011
ADAPTED	0.68	1,210	28	2017
ADVANCE	0.77	300	27	2015
PREFER	0.71	135	27	2017
EbolaMoDRAD	0.55	33	25	2016
Hypo-RESOLVE	0.64	56	24	2019
eTRANSAFE	0.66	10	23	2018
TRISTAN	0.64	25	23	2017
ROADMAP	0.66	75	22	2017
SAFE-T	0.86	21	21	2011
DRIVE	0.79	8	20	2018
EHR4CR	0.78	51	20	2012
IMI-PainCare	0.67	50	20	2019
VAC2VAC	0.69	6	20	2018

- COMBACTE-NET has the highest stability score (0.89) while EbolaMoDRAD has the lowest (0.55).

- There is considerable variation in the number collaborating institution pairs that does not appear to be proportional to the number of project papers or dependent on the project start year. For example, BTCure started in 2011 and has the highest output of papers (672), only has 1,128 institution pairs compared with SUMMIT that started in the same year, has only produced 136 papers but has 7,004 institution pairs. This suggests that SUMMIT publishes papers with many authors from multiple institutions. In fact, one of SUMMIT's papers has 267 affiliations.

7.4 Collaboration index

The cross-sector score (Metrics 1) and international score (Metric 2) (described above) measure different types of collaboration. The first measures the fraction of papers that involve cross-sector collaborations, and the second reflects the fraction of papers that involve multilateral and bilateral international collaborations. Metric 3 or stability score is based on the collaboration stability of pairs of institutional collaborators that contribute to IMI project research. We compute a "collaboration index" across IMI projects as the sum of all three of the metrics. These data are shown in Table 7.4.1 for all IMI projects with 20 or more papers.

This year's collaboration index is not comparable with the collaboration index in the ninth (2018) and earlier versions of this report as Metric 3 was updated in the tenth report (2019) to indicate the stability of institutional collaboration rather than intensity.

- PROACTIVE had the highest overall collaboration index score (2.62) followed by ADVANCE (2.58).

Table 7.4.6 SUMMARY SCORE FOR COLLABORATION METRICS, TOTAL NUMBER OF PAPERS AND FIELD-NORMALISED CITATION IMPACT FOR IMI PROJECTS WITH AT LEAST 20 PAPERS, 2010-2021

PROJECT	CROSS-SECTOR SCORE (METRIC 1)	INTERNATIONAL SCORE (METRIC 2)	STABILITY SCORE (METRIC 3)[23]	COLLABORATION INDEX	NUMBER OF PAPERS	CITATION IMPACT (FIELD-NORMALISED)
BTCure	0.65	0.52	0.84	2.00	672	1.81
EU-AIMS	0.73	0.65	0.82	2.19	546	2.06
ULTRA-DD	0.63	0.65	0.77	2.06	425	1.91
EMIF	0.82	0.67	0.84	2.34	310	2.49
NEWMEDS	0.62	0.58	0.83	2.03	214	2.06
AIMS-2-TRIALS	0.71	0.66	0.69	2.07	196	2.67
EUROPAIN	0.55	0.38	0.85	1.78	181	2.55
CANCER-ID	0.75	0.43	0.75	1.93	180	3.27
ORBITO	0.64	0.48	0.76	1.88	168	1.70
INNODIA	0.81	0.65	0.87	2.32	166	1.62
TRANSLOCATION	0.37	0.49	0.81	1.66	164	1.35
STEMBANCC	0.50	0.47	0.82	1.79	147	1.94
IMIDIA	0.53	0.50	0.84	1.87	141	1.65
SUMMIT	0.75	0.64	0.83	2.22	136	1.42
BigData@Heart	0.90	0.69	0.69	2.29	135	2.05
ELF	0.34	0.51	0.77	1.62	134	1.11
RTCure	0.81	0.47	0.70	1.98	131	2.86
CHEM21	0.23	0.29	0.80	1.33	128	1.70
PreDiCT-TB	0.57	0.50	0.81	1.88	118	1.16
SPRINTT	0.72	0.53	0.80	2.05	116	1.83
MIP-DILI	0.67	0.45	0.82	1.94	108	1.77
Quic-Concept	0.72	0.57	0.81	2.09	103	4.76
EUbOPEN	0.58	0.55	n/a	n/a	101	1.85

23 Some projects do not have a Stability score due to the project not being active for at least 3 years. The Collaboration Index was not calculated for projects with no Stability Score.

PROJECT	CROSS-SECTOR SCORE (METRIC 1)	INTERNATIONAL SCORE (METRIC 2)	STABILITY SCORE (METRIC 3)[23]	COLLABORATION INDEX	NUMBER OF PAPERS	CITATION IMPACT (FIELD-NORMALISED)
COMBACTE-NET	0.79	0.55	0.89	2.23	100	1.17
PROTECT	0.97	0.63	0.86	2.46	99	1.03
BEAT-DKD	0.71	0.69	0.70	2.11	98	2.17
COMBACTE-MAGNET	0.70	0.62	0.86	2.18	97	1.28
RHAPSODY	0.60	0.66	0.81	2.07	94	1.97
U-BIOPRED	0.83	0.72	0.86	2.41	93	2.49
eTOX	0.30	0.36	0.86	1.53	92	1.76
COMPACT	0.24	0.46	0.75	1.46	91	1.90
Pharma-Cog	0.85	0.75	0.85	2.45	88	1.13
DIRECT	0.76	0.73	0.84	2.33	82	3.93
ABIRISK	0.76	0.50	0.84	2.10	79	1.25
DDMoRe	0.65	0.56	0.81	2.02	77	1.21
PRISM	0.80	0.69	0.75	2.25	75	2.70
AETIONOMY	0.65	0.46	0.80	1.91	71	1.77
Open PHACTS	0.60	0.55	0.76	1.92	70	3.57
BioVacSafe	0.46	0.49	0.81	1.76	70	1.20
K4DD	0.54	0.51	0.80	1.86	68	1.53
None	0.75	0.70	0.49	1.94	65	3.50
Onco Track	0.63	0.43	0.83	1.90	65	2.19
RADAR-CNS	0.63	0.70	0.82	2.15	64	1.94
IMPRiND	0.67	0.60	0.75	2.01	63	4.96
COMBACTE-CARE	0.92	0.66	0.80	2.37	61	1.59
ZAPI	0.67	0.63	0.77	2.07	60	4.34
MARCAR	0.42	0.42	0.84	1.68	60	1.04
EPAD	0.76	0.67	0.81	2.25	55	1.35
ENABLE	0.58	0.47	0.83	1.88	55	1.45
APPROACH	0.81	0.81	0.81	2.43	54	2.07
PRECISESADS	0.80	0.77	0.75	2.32	54	1.38
DRIVE-AB	0.74	0.64	0.75	2.13	54	1.30
AMYPAD	0.92	0.78	0.77	2.47	50	1.96
LITMUS	0.84	0.67	0.75	2.25	49	3.85
TransQST	0.60	0.68	0.76	2.03	47	3.09
RAPP-ID	0.33	0.43	0.85	1.61	46	0.86
eTRIKS	0.82	0.88	0.75	2.46	45	2.04

PROJECT	CROSS-SECTOR SCORE (METRIC 1)	INTERNATIONAL SCORE (METRIC 2)	STABILITY SCORE (METRIC 3)[23]	COLLABORATION INDEX	NUMBER OF PAPERS	CITATION IMPACT (FIELD-NORMALISED)
Predect	0.69	0.63	0.79	2.11	45	2.67
INNODIA HARVEST	0.78	0.66	n/a	n/a	45	1.37
PHAGO	0.69	0.60	0.72	2.01	45	4.02
FLUCOP	0.91	0.47	0.73	2.11	44	1.58
RESCEU	0.84	0.70	0.69	2.22	43	1.91
MOBILISE-D	0.77	0.58	n/a	n/a	43	1.57
iPiE	0.51	0.24	0.76	1.51	41	1.13
GETREAL	0.84	0.76	0.78	2.37	37	1.65
iABC	0.85	0.65	0.82	2.32	33	1.19
EBiSC	0.70	0.62	0.77	2.09	33	5.61
EBOVAC1	0.72	0.67	0.82	2.21	32	2.07
EHDEN	0.81	0.84	0.63	2.27	31	2.19
PROACTIVE	1.00	0.81	0.85	2.66	29	2.22
DRAGON	0.89	0.75	n/a	n/a	28	3.78
ADAPTED	0.93	0.62	0.68	2.23	28	2.89
PREFER	0.93	0.87	0.71	2.51	27	1.29
ADVANCE	0.89	0.86	0.77	2.52	27	1.36
EbolaMoDRAD	0.68	0.52	0.55	1.75	25	1.34
Hypo-RESOLVE	0.58	0.79	0.64	2.02	24	0.71
TRISTAN	0.83	0.50	0.64	1.97	23	1.22
eTRANSAFE	0.48	0.50	0.66	1.64	23	3.15
3TR	0.91	0.48	n/a	n/a	23	2.60
ROADMAP	0.91	0.75	0.66	2.32	22	0.91
SAFE-T	0.95	0.54	0.86	2.35	21	1.73
VAC2VAC	0.70	0.56	0.69	1.96	20	0.60
EHR4CR	0.85	0.60	0.78	2.23	20	1.11
IMI-PainCare	0.75	0.55	0.67	1.97	20	1.22
DRIVE	0.85	0.31	0.79	1.95	20	0.79

8 BENCHMARKING ANALYSIS – IMI PROJECT RESEARCH AGAINST RESEARCH FROM SELECTED COMPARATORS

This section of the report analyses the output and citation impact of IMI project research benchmarked against research supported by other Public-Private Partnerships, and funders of biomedical research across Europe, Asia, Australia, and North America.

The publications funded by each comparator were identified using specific searches of the funding acknowledgment data provided by authors and extracted in Web of Science. This is the same process by which IMI project publications have been identified. Authors may not always acknowledge their sources of funding and may not always do so correctly. Therefore, the coverage of the datasets used in these analyses may not be complete and may not be entirely accurate; however, the sample represented by these datasets is sufficient to allow a comparison to be made.

8.1 Identifying comparators

The seven funders listed in Table 8.1.1 are used as comparators for IMI in this report. They are the same comparators as in the previous twelfth report produced in 2021. Each comparator had sufficient publications to allow a meaningful analysis.

Table 8.1.1 SUMMARY OF INFORMATION OF IMI-SELECTED COMPARATORS, 2010-2021

COMPARATOR	NUMBER OF PUBLICATIONS (2010-2021)	NUMBER OF PAPERS (2010-2021)	COUNTRY	REGION
Critical Path (C-Path)	568	528	USA	North America
Commonwealth Scientific and Industrial Research Organisation (CSIRO) [24]	1,036	1,003	Australia	Australia
Foundation for the National Institutes of Health (FNIH)	5,070	4,782	USA	North America
Grand Challenges in Global Health (GCGH)	890	889	USA	North America
Indian Council of Medical Research (ICMR)	17,852	17,323	India	Asia
Medical Research Council (MRC)	141,230	126,335	UK	Europe
Wellcome Trust (WT)	96,581	89,768	UK	Europe

[24] The dataset containing all publications attributed to CSIRO between 2010 and 2021 has been reduced to include only medically related publications for these analyses. A list of Web of Science journal categories which capture medically related publications is given in Annex 2.

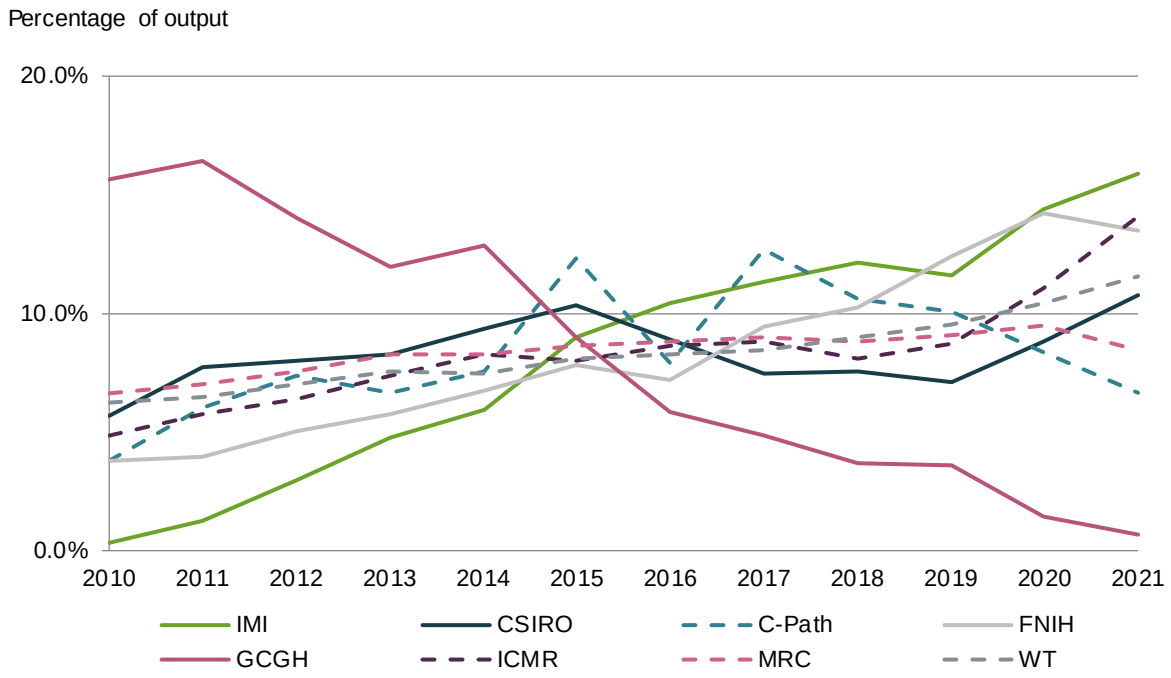
8.2 Trends in output: IMI project research compared with selected comparators

This section of the report analyses trends in the performance of IMI project research and the selected comparators.

8.2.1 Trends in output: IMI project research compared with selected comparators

The output of IMI and the comparators varies widely (some produced many papers and some relatively few), therefore a visual comparison of absolute paper counts would not provide an understanding of their growth relative to one another. To provide a more easily interpretable comparison, Figure 8.2.1.1 shows the percentage of each organisation's total paper count between 2010 and 2021 published in each year. Table 8.2.1.1 shows the same data as in Figure 8.2.1.1 and Table 8.2.1.2 show the number of papers per year for IMI and the selected comparators.

Figure 8.2.1.1 TRENDS IN OUTPUT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- Most of IMI's research output was published in the last four years 2018-2021, accounting for more than half of its paper output.
- IMI has experienced the most rapid increase in percentage of output, only in 2019 seeing a slight decrease.
- GCGH has sustained a decreasing percentage of output since 2011. Similarly, C-path has been on a downward trend since 2017.
- After peaking in 2015, CSIRO was on a steady decrease in percentage of output but has seen a shift upwards since 2019.

FIGURE 8.2.1.2 COMPARING PERCENTAGE OUTPUT IN THE FIRST FIVE YEARS (2010–2015) TO MOST RECENT FIVE YEARS (2016-2021) – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

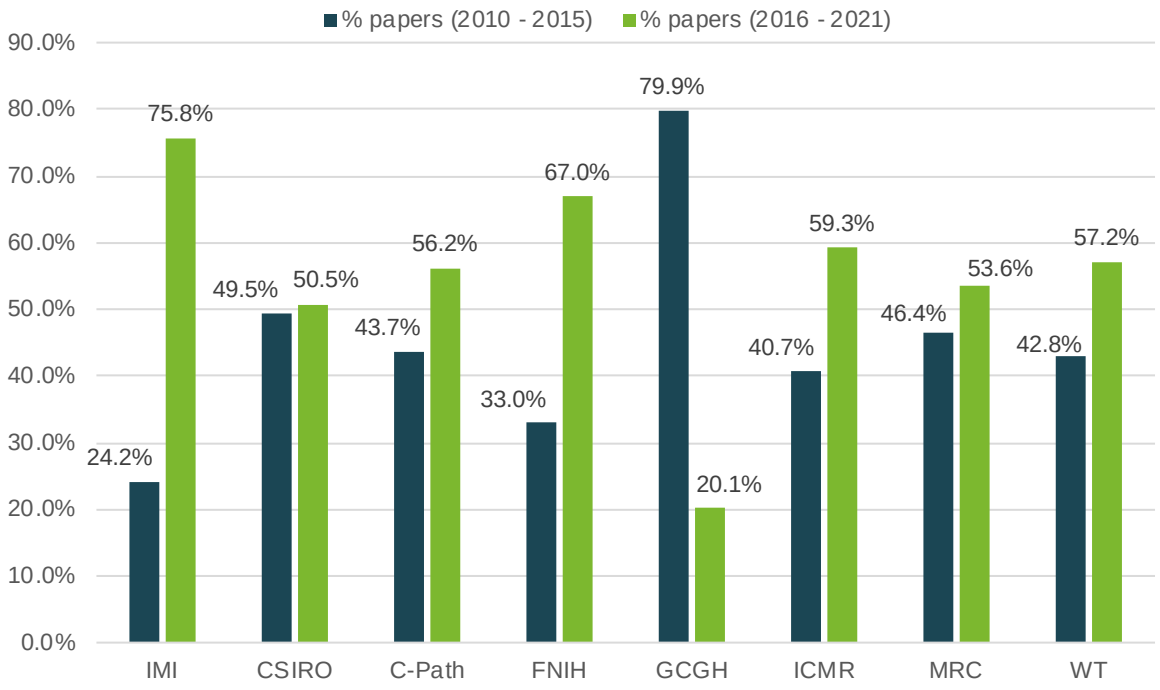


TABLE 8.2.1.1 SHARE OF OUTPUT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

YEAR	IMI	CSIRO	C-PATH	FNIH	GCGH	ICMR	MRC	WT
2010	0.3%	5.7%	3.8%	3.8%	15.6%	4.8%	6.6%	6.2%
2011	1.2%	7.8%	6.1%	3.9%	16.4%	5.7%	7.0%	6.4%
2012	3.0%	8.0%	7.4%	5.0%	14.1%	6.4%	7.6%	7.0%
2013	4.7%	8.3%	6.6%	5.7%	11.9%	7.4%	8.3%	7.5%
2014	6.0%	9.4%	7.6%	6.7%	12.8%	8.3%	8.3%	7.5%
2015	9.0%	10.4%	12.3%	7.8%	9.0%	8.0%	8.6%	8.1%
2016	10.4%	8.9%	8.0%	7.2%	5.8%	8.6%	8.8%	8.3%
2017	11.3%	7.5%	12.7%	9.4%	4.8%	8.8%	9.0%	8.4%
2018	12.2%	7.6%	10.6%	10.2%	3.7%	8.1%	8.8%	9.0%
2019	11.6%	7.1%	10.0%	12.4%	3.6%	8.7%	9.1%	9.5%
2020	14.4%	8.8%	8.3%	14.2%	1.5%	11.1%	9.5%	10.4%
2021	15.9%	10.8%	6.6%	13.4%	0.7%	14.1%	8.4%	11.6%

TABLE 8.2.1.2 NUMBER OF PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

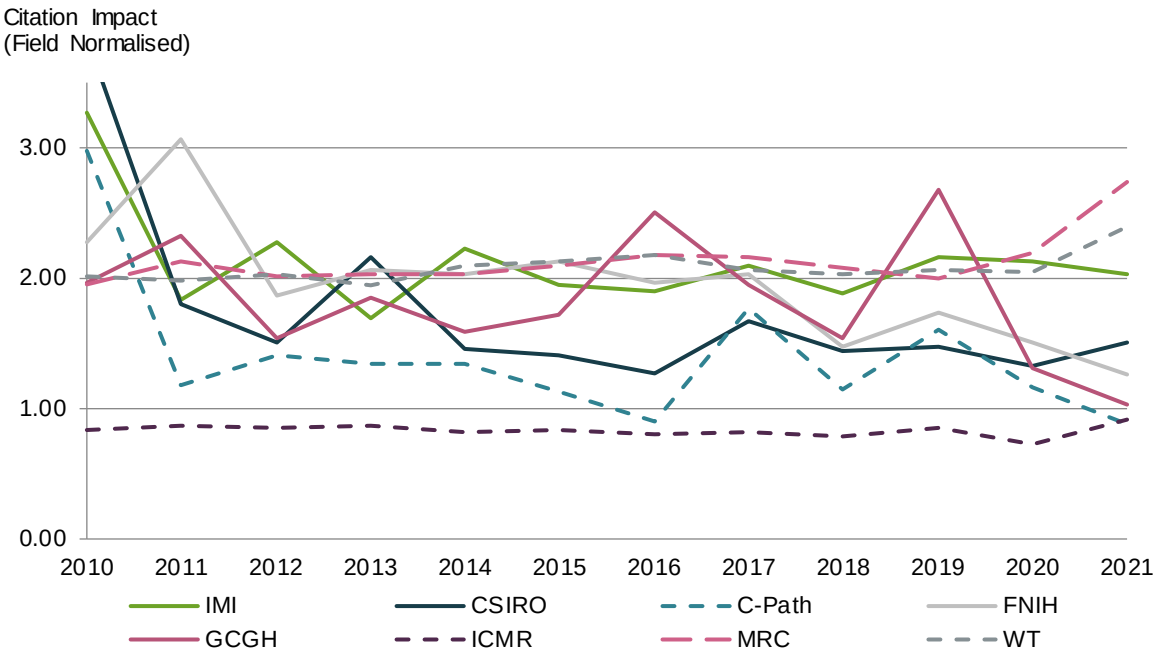
YEAR	IMI	CSIRO	C-PATH	FNIH	GCGH	ICMR	MRC	WT
2010	26	57	20	181	139	840	8,375	5,603
2011	97	78	32	188	146	993	8,824	5,782
2012	235	80	39	240	125	1,101	9,566	6,302
2013	371	83	35	274	106	1,284	10,427	6,774
2014	468	94	40	321	114	1,432	10,466	6,732
2015	707	104	65	373	80	1,393	10,923	7,245
2016	816	89	42	346	52	1,494	11,102	7,424
2017	889	75	67	451	43	1,522	11,351	7,584
2018	957	76	56	490	33	1,402	11,167	8,051
2019	913	71	53	595	32	1,507	11,513	8,520
2020	1,129	88	44	680	13	1,915	11,985	9,374
2021	1,248	108	35	643	6	2,440	10,636	10,377
Total	**7,856**	**1,003**	**528**	**4,782**	**889**	**17,323**	**126,335**	**89,768**

8.2.2 Trends in field-normalised citation impact: IMI project research compared with selected comparators

As discussed in Section 3, citations accumulate over time at a rate that is dependent upon the field of research. Therefore, it is standard bibliometric practice to normalise citation counts for these two factors. In this report, field-normalised citation impact has been calculated by dividing the citations received by each publication by the world average citations per publication for the relevant year and field.

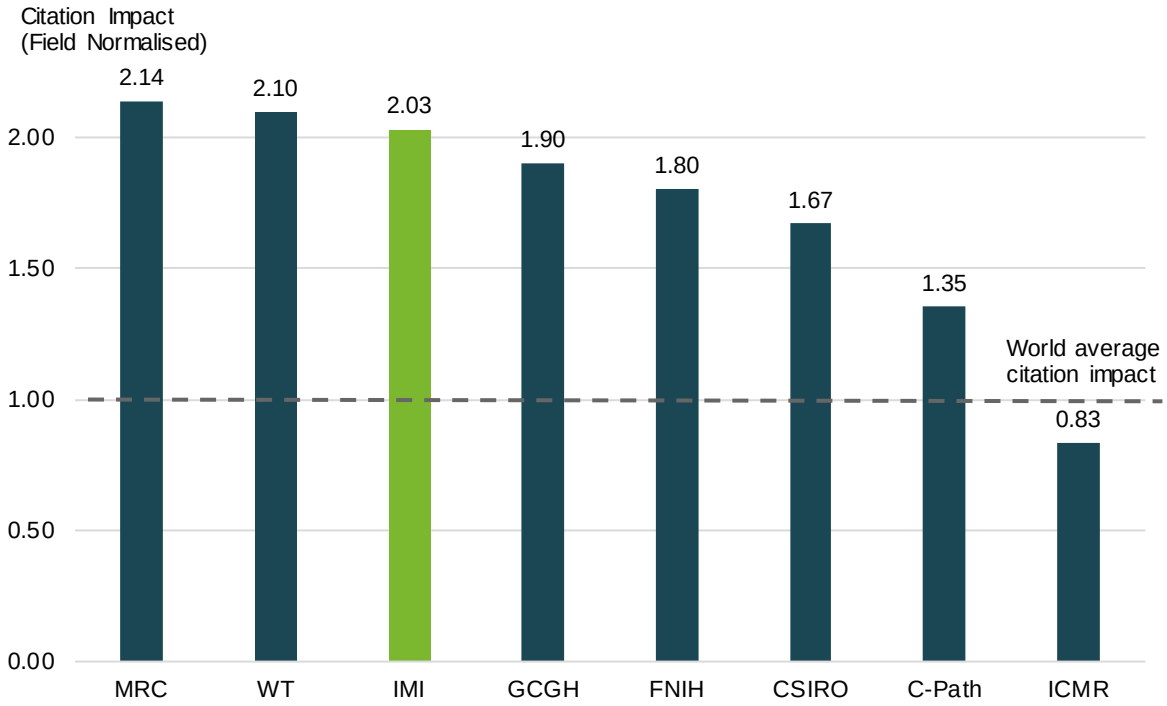
Figure 8.2.2.1 shows the annual trends in field-normalised citation impact of IMI and the comparators between 2010 and 2021 and Figure 8.2.2.2 shows the average field-normalised citation impact of IMI and the comparators between 2010 and 2021. Table 8.2.2.1 has the same data as in Figure 8.2.2.1 and Figure 8.2.2.2.

FIGURE 8.2.2.1 TRENDS IN FIELD-NORMALISED CITATION IMPACT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- The field-normalised citation impact of IMI, MRC and the WT were stable at close to twice the world average between 2010 and 2021, indicating highly cited, internationally significant research.
- The exceptionally high field-normalised citation impact of IMI, CSIRO, and C-Path project research in 2010 was driven by a small number of highly cited papers.
- ICMR has consistently underperformed in comparison to the world average between 2010-2021.
- In last year's report CSIRO's field normalized citation impact had dropped significantly in 2020, However, in this year's report we see that the field normalized citation impact for 2020 is similar to previous years supporting last year's conclusion that it was likely due to a significant amount of CSIRO's papers not having enough time to be cited. For 2021, CSIRO's citation impact (1.51) is slightly higher than 2020 (1.33).

Figure 8.2.2.2 AVERAGE FIELD-NORMALISED CITATION IMPACT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- The average field-normalised citation impact of IMI project research (2.03) between 2010 and 2021 was two times the world average and was comparable to MRC's and WT's citation impact and ahead of all other comparators.
- Only ICMR's average field-normalised citation impact (0.83) was below world average (1.00).

Table 8.2.2.1 FIELD-NORMALISED CITATION IMPACT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

YEAR	IMI	CSIRO	C-PATH	FNIH	GCGH	ICMR	MRC	WT
2010	3.27	3.84	2.98	2.28	1.96	0.84	1.95	2.02
2011	1.83	1.79	1.17	3.07	2.32	0.86	2.13	1.98
2012	2.27	1.51	1.41	1.87	1.54	0.85	2.01	2.03
2013	1.69	2.16	1.35	2.06	1.85	0.86	2.03	1.95
2014	2.22	1.46	1.35	2.04	1.59	0.82	2.02	2.10
2015	1.95	1.41	1.12	2.12	1.71	0.84	2.10	2.13
2016	1.89	1.27	0.90	1.96	2.51	0.80	2.17	2.17
2017	2.09	1.67	1.77	2.03	1.95	0.82	2.16	2.07
2018	1.89	1.43	1.15	1.47	1.54	0.79	2.08	2.02
2019	2.16	1.47	1.60	1.73	2.68	0.86	2.00	2.06
2020	2.13	1.33	1.17	1.50	1.31	0.73	2.20	2.05
2021	2.04	1.51	0.88	1.26	1.03	0.92	2.74	2.39
Average	**2.03**	**1.67**	**1.35**	**1.80**	**1.90**	**0.83**	**2.14**	**2.10**

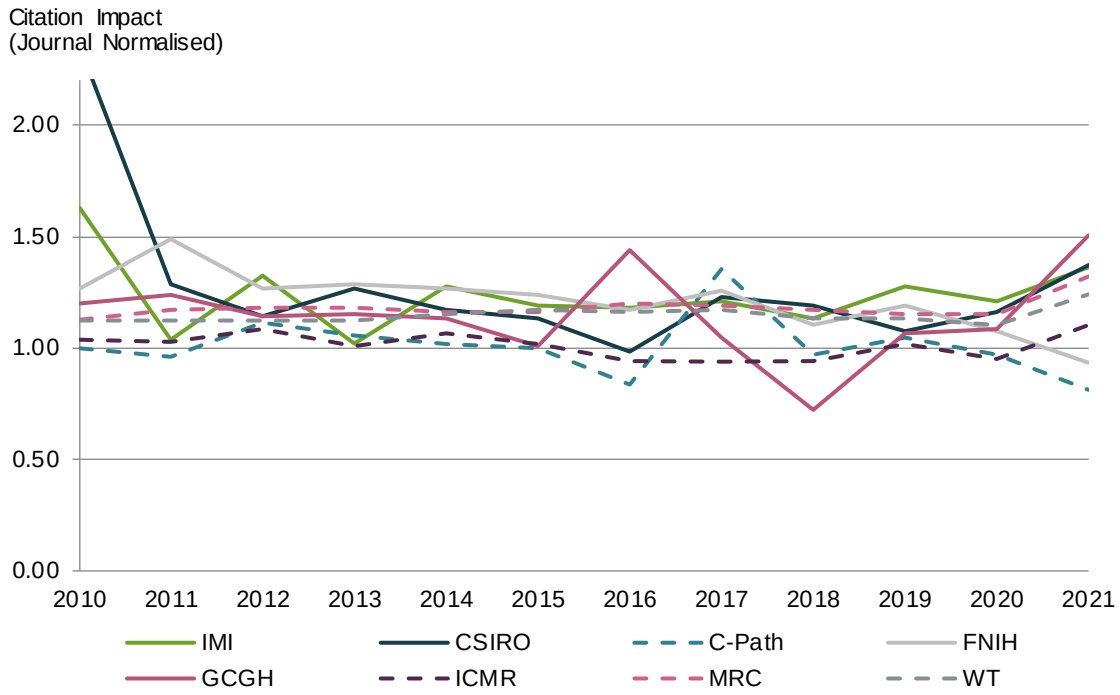
- In 2012 and 2014 IMI had the highest field-normalised citation impact (2.27 and 2.22 respectively) of the funding organisations analysed and since 2017 has remained in the Top 3.

8.2.3 Trends in journal-normalised citation impact: IMI project research compared with selected comparators

As discussed in Section 3, an alternative indicator to field-normalised citation impact is citation impact normalised at the journal level. The journal-normalised citation impact is calculated by dividing the number of citations a paper received by the average number of citations for the year and the journal in which the paper is published. As for the field-normalised citation impact, the world average for journal-normalised citation impact is 1.00.

Figure 8.2.3.1 shows the annual trends in journal-normalised citation impact of IMI and the comparators between 2010 and 2021. Figure 8.2.2.2 shows the average field-normalised citation impact of IMI and the comparators between 2010 and 2021. Table 8.2.3.1 shows the same data as in Figure 8.2.3.1 and Figure 8.2.3.2.

FIGURE 8.2.3.1 TRENDS IN JOURNAL NORMALISED CITATION IMPACT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- IMI project research has a journal-normalised citation impact has remained above the world average between 2010 and 2021 indicating that IMI research performs well in the journals they are published.
- IMI projects had the highest journal normalised citation impact for 2012, 2014, 2019 and 2020.
- The journal-normalised citation impact of ICMR, MRC and WT remained relatively stable between 2010 and 2021, while that of the other comparators such as CSIRO and GCGH showed greater variability. This is to be expected given the smaller number of papers funded by CSIRO and GCGH relative to the output of research institutions like the MRC and WT.

FIGURE 8.2.3.2 AVERAGE JOURNAL-NORMALISED CITATION IMPACT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

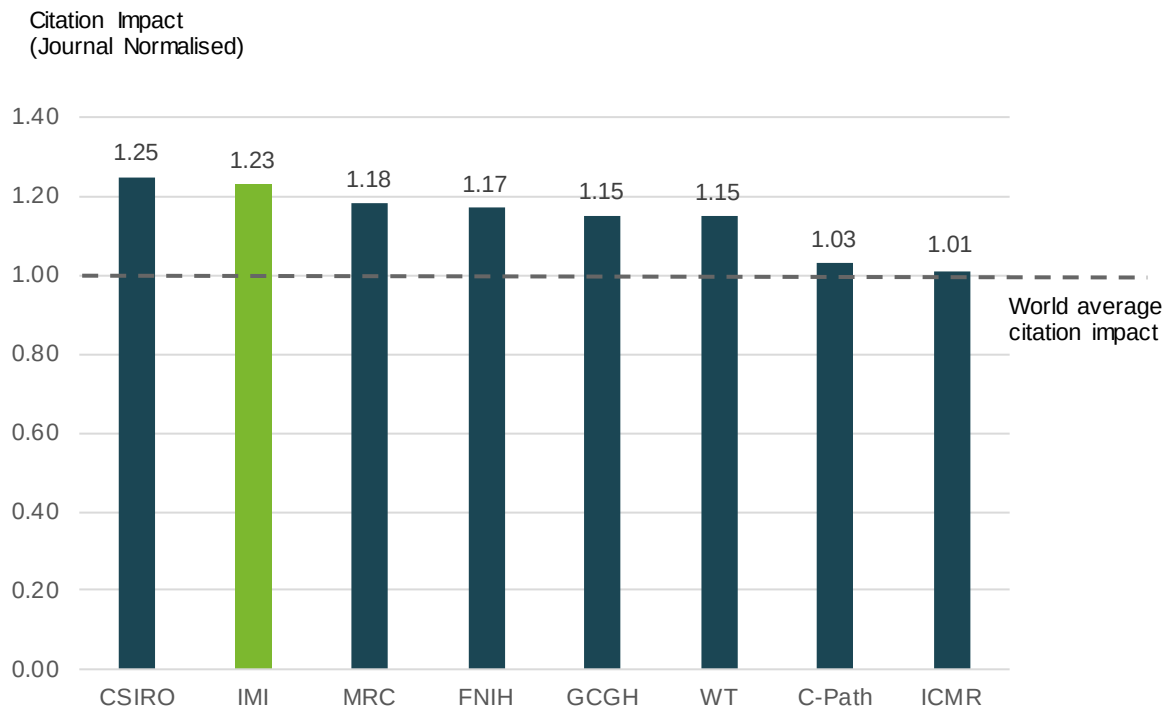


TABLE 8.2.3.1 JOURNAL-NORMALISED CITATION IMPACT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

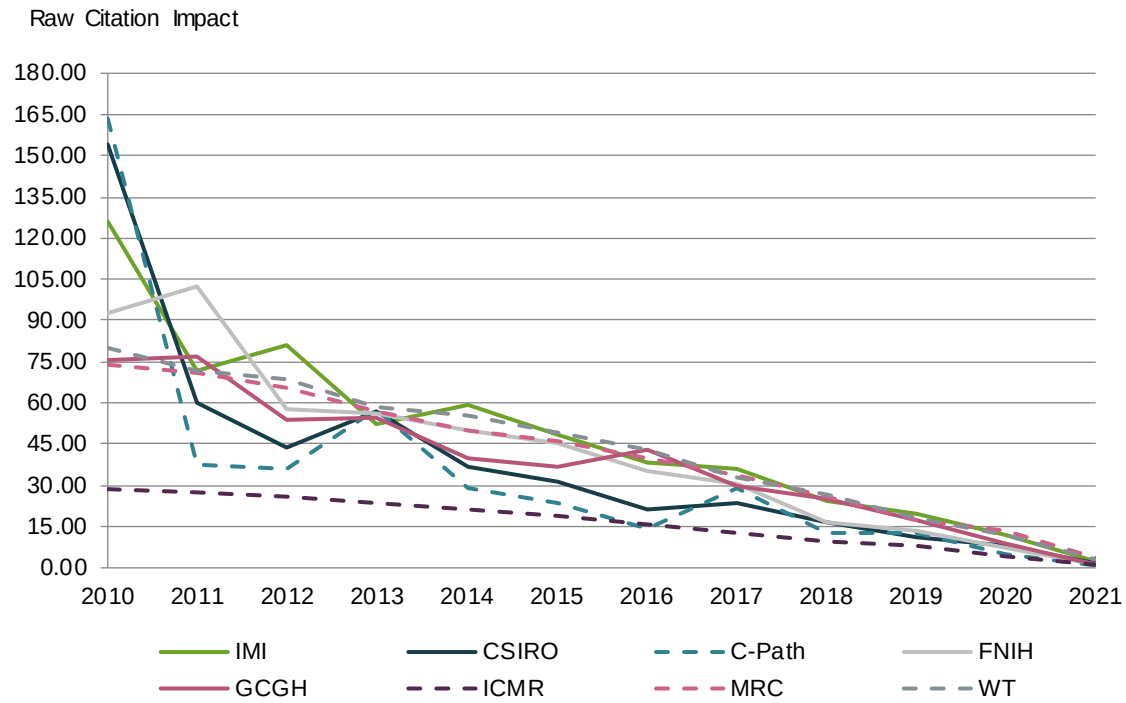
YEAR	IMI	CSIRO	C-PATH	FNIH	GCGH	ICMR	MRC	WT
2010	1.63	2.35	1.00	1.26	1.20	1.04	1.13	1.12
2011	1.03	1.28	0.96	1.49	1.24	1.02	1.17	1.13
2012	1.32	1.14	1.11	1.26	1.14	1.08	1.18	1.12
2013	1.02	1.27	1.06	1.29	1.16	1.01	1.18	1.12
2014	1.28	1.17	1.02	1.27	1.14	1.06	1.16	1.15
2015	1.19	1.13	1.00	1.24	1.00	1.02	1.16	1.17
2016	1.18	0.98	0.84	1.17	1.43	0.95	1.20	1.16
2017	1.21	1.22	1.35	1.25	1.05	0.94	1.19	1.17
2018	1.13	1.19	0.97	1.10	0.72	0.94	1.17	1.13
2019	1.28	1.07	1.04	1.19	1.06	1.02	1.15	1.13
2020	1.21	1.16	0.97	1.08	1.08	0.95	1.15	1.10
2021	1.36	1.37	0.81	0.93	1.50	1.10	1.32	1.24
Average	**1.23**	**1.25**	**1.03**	**1.17**	**1.15**	**1.01**	**1.18**	**1.15**

8.2.4 Trends in raw citation impact: IMI project research compared with selected comparators

The raw (un-normalised) citation impact of a group of papers is calculated by dividing the sum of citations by the total number of papers published. As such it is the mean average number of citations to a paper. This indicator must be used with caution as it is not normalised to field or year.

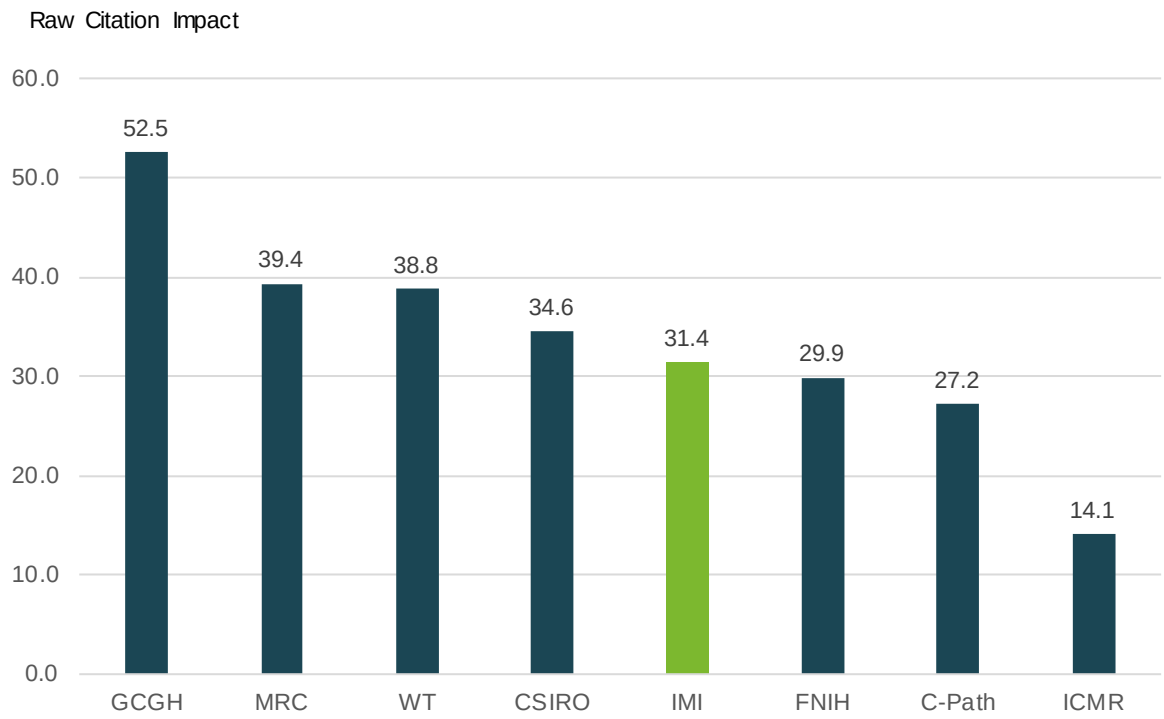
Figure 8.2.4.1 shows the annual trends in average raw citation impact of IMI and the comparators for papers published each year between 2010 and 2021. Figure 8.2.4.2 shows the average raw citation impact of IMI and the comparators for papers published between 2010 and 2021. Table 8.2.4.1 has the same data as in Figure 8.2.4.1 and Figure 8.2.4.2.

FIGURE 8.2.4.1 TRENDS IN RAW CITATION IMPACT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- The raw citation impact of all organisations in the most recent years between 2010 to 2021 are lower in comparison to previous years. This is expected as more recent publications have had less time to accumulate citations, and the raw citation impact is not normalised.
- IMI's 2021 raw citation impact (2.35) is higher than all comparators raw citation impacts except for WT and MRC

FIGURE 8.2.4.2 AVERAGE RAW CITATION IMPACT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- IMI's average raw citation impact between 2010 and 2021 (31.4) is higher than three out of the seven comparators (C-Path (27.2) ICMR (14.1) and FNIH (29.9).
- IMI's Raw Citation impact increased the most (15%) from last year, relative to the comparators.
- GCGH had the highest raw citation impact (52.5).

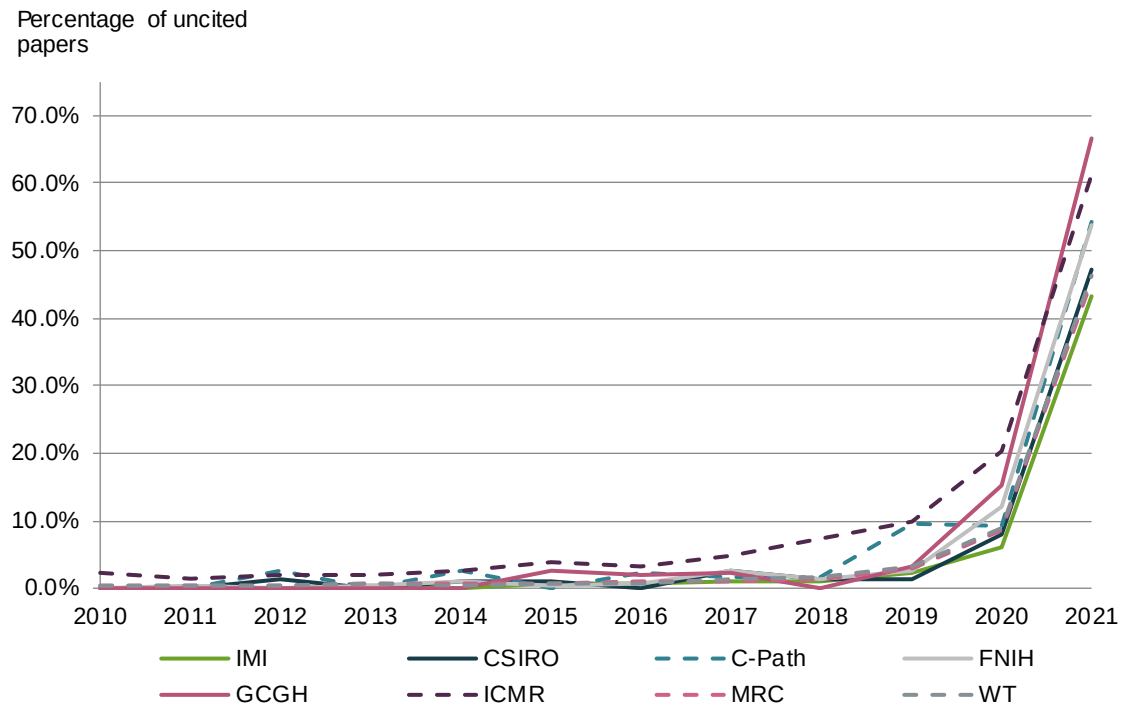
TABLE 8.2.4.1 RAW CITATION IMPACT – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

YEAR	IMI	CSIRO	C-PATH	FNIH	GCGH	ICMR	MRC	WT
2010	126.04	154.09	163.48	92.82	75.41	28.64	73.92	80.03
2011	71.50	59.85	37.78	102.42	76.90	27.52	71.34	71.73
2012	80.79	43.63	36.25	57.78	53.75	25.79	65.37	68.87
2013	52.54	57.10	57.49	56.23	54.45	23.81	56.74	58.86
2014	59.05	36.82	28.95	50.28	40.18	21.58	50.33	55.43
2015	48.75	31.42	23.62	45.38	36.55	18.59	45.73	49.05
2016	38.29	21.40	13.93	34.89	42.60	15.44	39.57	42.82
2017	36.12	23.74	28.81	30.53	30.05	12.77	33.36	33.06
2018	24.16	16.46	12.78	16.75	24.88	9.71	25.68	26.56
2019	19.33	11.51	12.65	13.51	17.41	7.93	17.29	17.87
2020	12.24	7.68	4.63	7.15	8.77	4.48	13.11	12.29
2021	2.35	1.62	0.87	1.26	1.17	1.15	3.63	3.02
Average	**31.4**	**34.6**	**27.2**	**29.9**	**52.5**	**14.1**	**39.4**	**38.8**

8.2.5 Trends in uncited research: IMI project research compared with selected comparators

Most publication datasets will include papers which have no citations. Figure 8.2.5.1 shows the percentage of uncited papers between 2010 and 2021 for IMI and the selected comparators. Figure 8.2.5.1 shows the trend in average percentage of uncited papers between 2010 and 2021 for IMI and the selected comparators. Figure 8.2.5.2 shows the average percentage of uncited papers between 2010 and 2021 for IMI and the selected comparators. Table 8.2.5.1 has the same data as in Figure 8.2.5.1 and Figure 8.2.5.2.

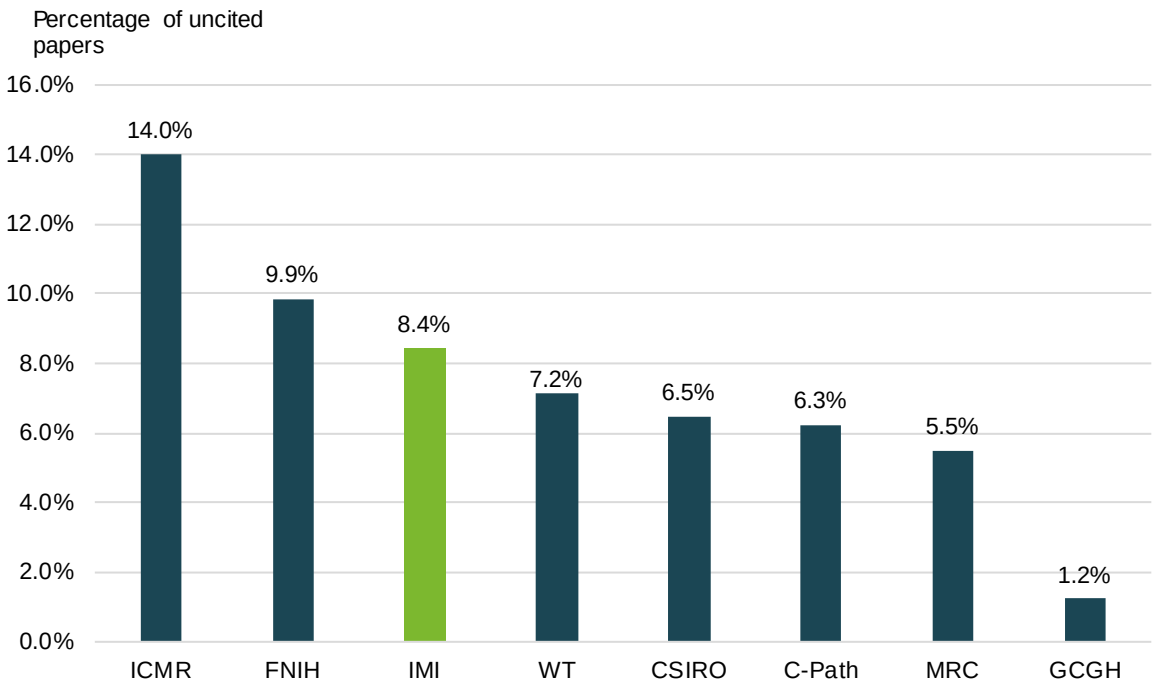
FIGURE 8.2.5.1 TRENDS IN UNCITED PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- The similar trends in uncited papers indicate the similar citation life-cycle for biomedical research funded across all the benchmarking organisations. More recent publications are less likely to be cited than older publications. Therefore, the higher percentage of uncited papers in most recent years should not be taken as evidence that these articles are more likely to remain uncited.

- IMI has the lowest percentage of uncited papers in 2021. While ICMR has most often had one of the highest. This helps explain ICMR's lower than average citation impact.

FIGURE 8.2.5.1 AVERAGE PERCENTAGE OF UNCITED PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- Around 8% of IMI project papers remained uncited between 2010 and 2021
- C-Paths percentage of uncited papers has decreased by nearly 4% since last year's report. The largest change of all the comparators.
- GCGH has the lowest percentage of uncited papers, around 2% of its papers uncited

TABLE 8.2.5.1 PERCENTAGE OF UNCITED PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

YEAR	IMI	CSIRO	C-PATH	FNIH	GCGH	ICMR	MRC	WT
2010	0.0%	0.0%	0.0%	0.0%	0.0%	2.3%	0.4%	0.4%
2011	0.0%	0.0%	0.0%	0.5%	0.0%	1.4%	0.5%	0.4%
2012	0.0%	1.3%	2.6%	0.0%	0.0%	2.0%	0.4%	0.4%
2013	0.5%	0.0%	0.0%	0.4%	0.0%	2.1%	0.6%	0.6%
2014	0.0%	1.1%	2.5%	0.9%	0.0%	2.4%	0.7%	0.4%
2015	0.7%	1.0%	0.0%	0.3%	2.5%	3.9%	0.7%	0.8%
2016	0.6%	0.0%	2.4%	0.6%	1.9%	3.3%	1.0%	0.8%
2017	1.1%	2.7%	1.5%	2.7%	2.3%	4.8%	1.2%	1.3%
2018	0.9%	1.3%	1.8%	1.4%	0.0%	7.4%	1.5%	1.6%
2019	2.4%	1.4%	9.4%	2.7%	3.1%	9.9%	2.8%	3.3%
2020	6.1%	8.0%	9.1%	12.2%	15.4%	20.2%	8.7%	9.0%
2021	43.3%	47.2%	54.3%	53.8%	66.7%	61.3%	45.6%	46.3%
Total	**8.4%**	**6.5%**	**6.3%**	**9.9%**	**1.2%**	**14.0%**	**5.5%**	**7.2%**

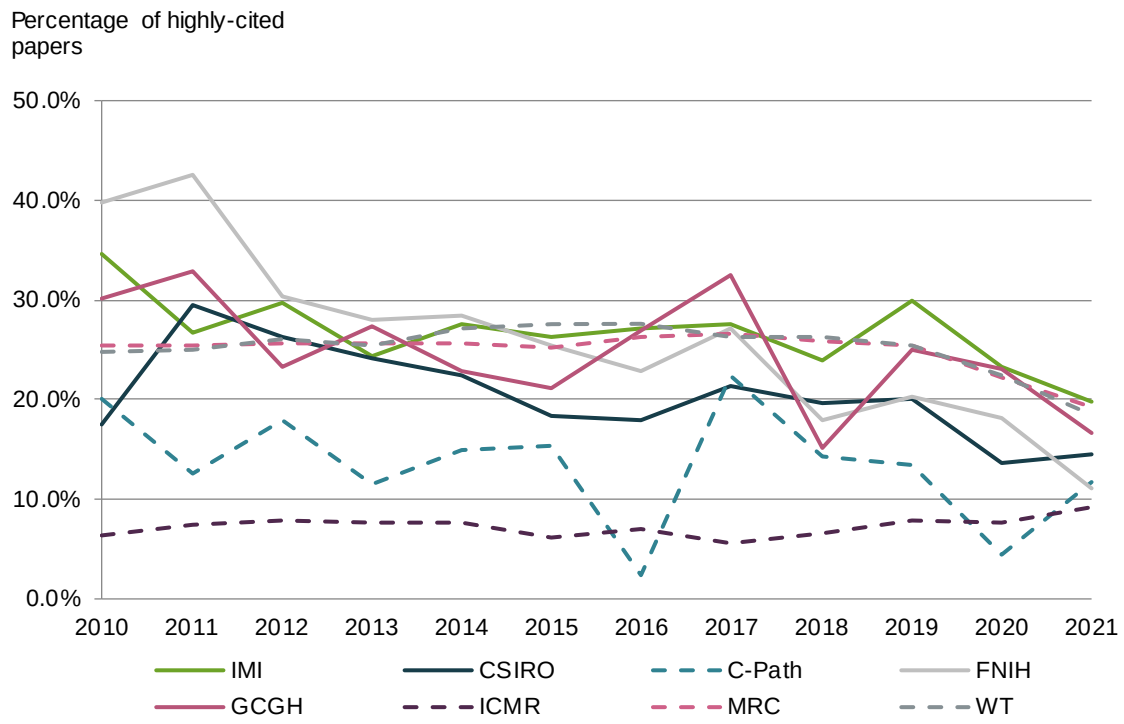
- No IMI project papers published between 2010 and 2012 or in 2014 are uncited.

8.2.6 Trends in highly cited research: IMI project research compared with selected comparators

As discussed in Section 3, highly cited work is recognised as having a greater impact, and citation counts have been correlated with other qualitative evaluations of research performance, such as peer review. For institutional research evaluation, we have found that the world's top 10% of most highly cited papers is often a suitable definition of highly cited work. Therefore, if more than 10% of an entity's publications are in the top 10% of the world's most highly cited papers, then it has performed better than expected.

Figure 8.2.6.1 shows the annual trends in percentage of highly cited papers between 2010 and 2021 for IMI and the selected comparators. Figure 8.2.6.2 shows the total percentage of highly cited papers between 2010 and 2021 for IMI and the selected comparators. Table 8.2.6.1 has the same data as in Figure 8.2.6.1 and Figure 8.2.6.2.

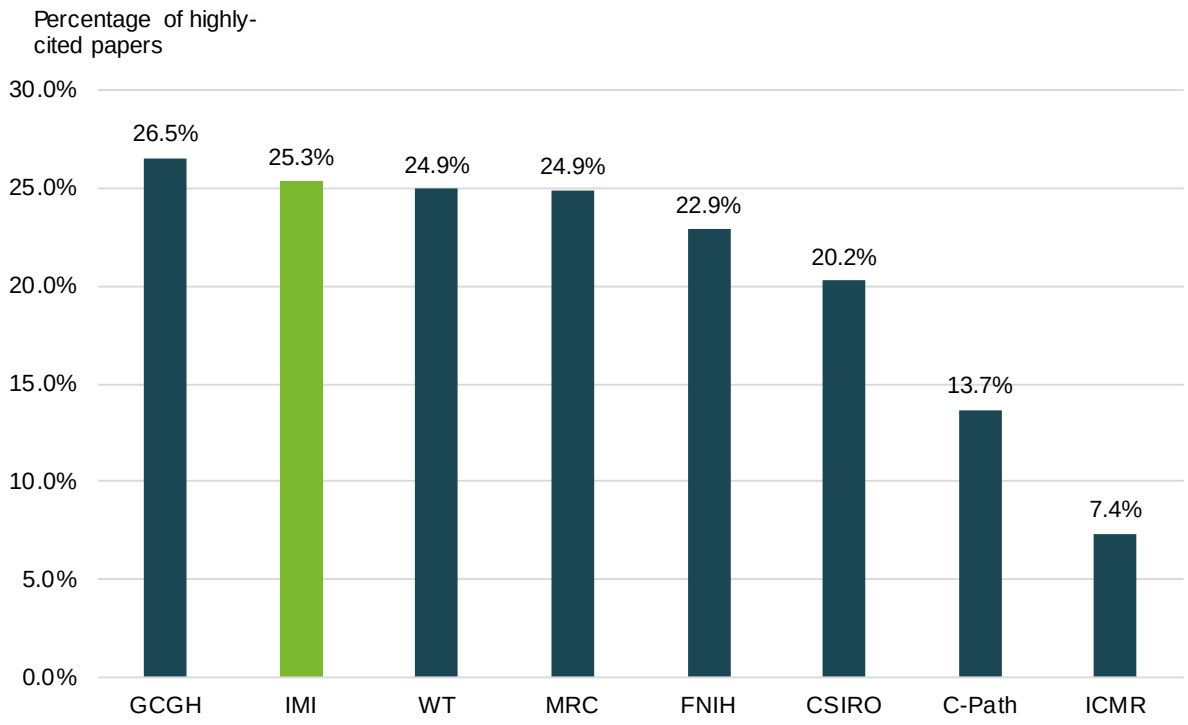
FIGURE 8.2.6.1 TRENDS IN HIGHLY CITED PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- Between 2010 and 2021, IMI and most of the comparators had an above average percentage (10%) of highly cited papers the exceptions being ICMR, which was consistently below the world average, and C-Path, which was below average in 2016 and 2020.

- In most years, IMI is among the organisations with the highest percentage of highly cited papers. IMI has had the highest percentage of highly-cited papers since 2019.

FIGURE 8.2.6.2 PERCENTAGE OF HIGHLY CITED PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- IMI ranks second in comparison to the comparators for percentage of highly-cited papers, with only GCGH outperforming IMI.
- Around a quarter of papers published by IMI and the comparators between 2010 and 2021 were highly cited. C-Path had a comparatively lower proportions of highly cited papers (13.7%) while ICMR was well below world average performance (7.4%).

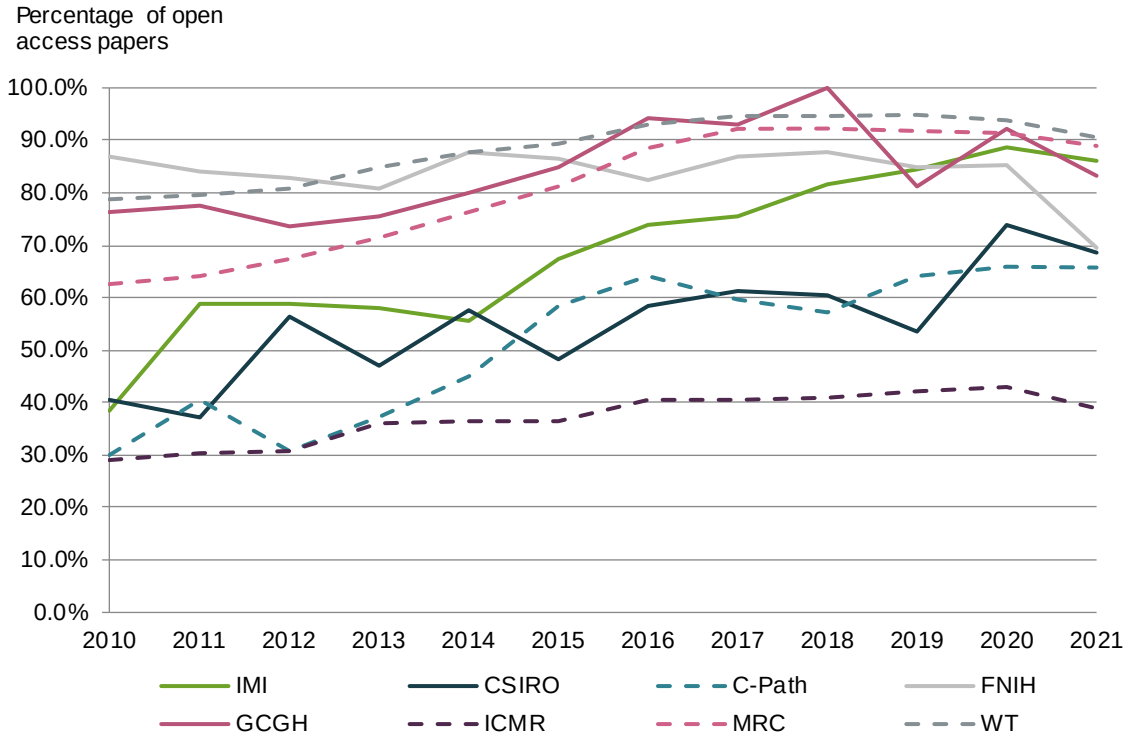
TABLE 8.2.6.1 PERCENTAGE OF HIGHLY CITED PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

YEAR	IMI	CSIRO	C-PATH	FNIH	GCGH	ICMR	MRC	WT
2010	34.6%	17.5%	20.0%	39.8%	30.2%	6.4%	25.4%	24.9%
2011	26.8%	29.5%	12.5%	42.6%	32.9%	7.4%	25.5%	25.0%
2012	29.8%	26.3%	17.9%	30.4%	23.2%	7.8%	25.7%	26.0%
2013	24.3%	24.1%	11.4%	28.1%	27.4%	7.6%	25.7%	25.4%
2014	27.6%	22.3%	15.0%	28.3%	22.8%	7.6%	25.7%	27.2%
2015	26.3%	18.3%	15.4%	25.5%	21.2%	6.2%	25.2%	27.5%
2016	27.2%	18.0%	2.4%	22.8%	26.9%	7.1%	26.3%	27.6%
2017	27.7%	21.3%	22.4%	27.1%	32.6%	5.6%	26.6%	26.3%
2018	24.0%	19.7%	14.3%	18.0%	15.2%	6.5%	25.9%	26.2%
2019	29.9%	20.0%	13.5%	20.4%	25.0%	7.9%	25.5%	25.4%
2020	23.2%	13.6%	4.5%	18.2%	23.1%	7.7%	22.2%	22.3%
2021	19.8%	14.4%	11.8%	11.1%	16.7%	9.2%	19.3%	18.5%
Total	**25.3%**	**20.2%**	**13.7%**	**22.9%**	**26.5%**	**7.4%**	**24.9%**	**24.9%**

8.2.7 Trends in open access research: IMI project research compared with selected comparators

Figure 8.2.7.1 shows annual trends in the percentage of open access papers between 2010 and 2021 for IMI and the selected comparators. Figure 8.2.7.2 shows the total percentage of open access papers between 2010 and 2021 for IMI and the selected comparators. Table 8.2.7.1 shows the same data as in Figure 8.2.7.1 and Figure 8.2.7.2.[25]

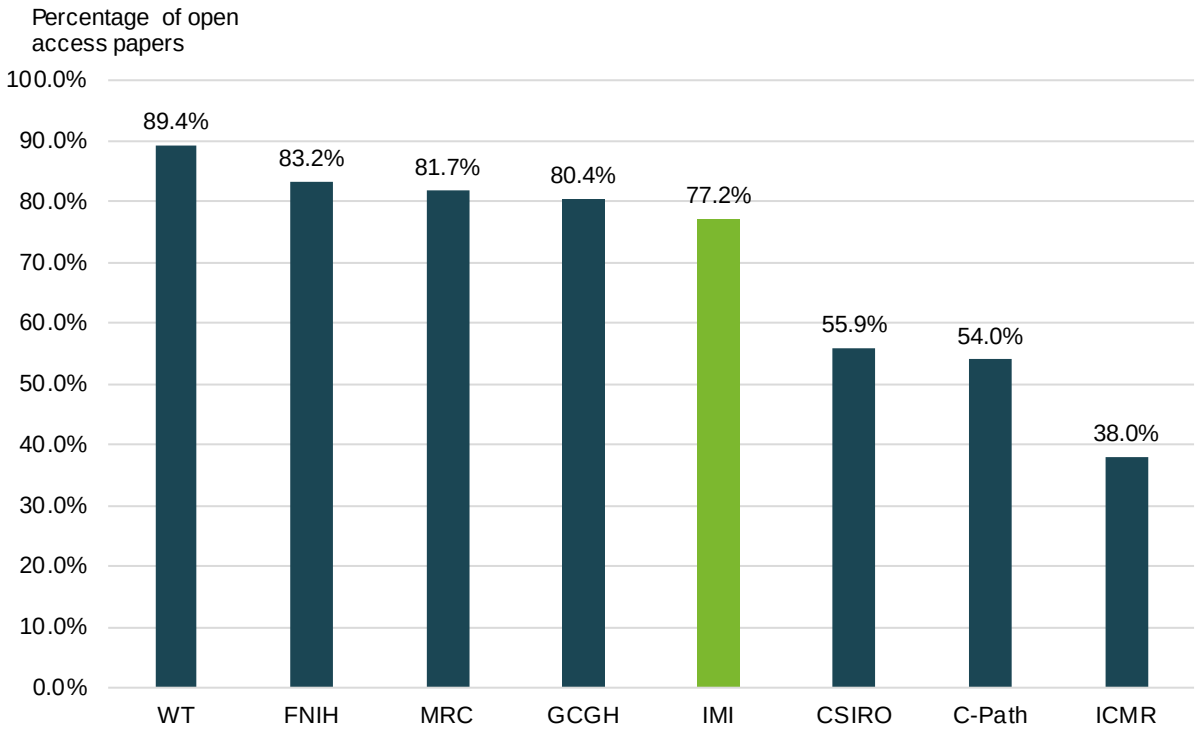
FIGURE 8.2.7.1 TRENDS IN OPEN ACCESS PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- IMI and most of the comparators have increased their output of open access papers between 2010 and 2021, except for FNIH which is trending downward.
- IMI increased its percentage of open access papers at a faster rate than any of the comparators.

[25] The Web of Science open access data come from the Directory of Open Access Journals (DOAJ) and collaborations with Impact Story and Our Research's Unpaywall services. The Web of Science therefore provides unrivalled coverage of open access publications that are published through DOAJ Gold, Other Gold, Green Published, Green Accepted or Bronze routes. It is also possible that some publishers make publications available without following a recognised open access route. In these cases publications will not be indexed as open access in the Web of Science or in this report.

FIGURE 8.2.7.2 TOTAL PERCENTAGE OF OPEN ACCESS PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021



- Most organisations, including IMI, have published more than half of their publications as open access. IMI had a lower share of open access papers compared to FNIH, GCGH, MRC, and WT.
- WT has the highest total percentage of open access papers (89.4%) between 2010 and 2021. In contrast ICMR, had the lowest percentage of open access papers (38.0%).

TABLE 8.2.7.1 PERCENTAGE OF OPEN ACCESS PAPERS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

YEAR	IMI	CSIRO	C-PATH	FNIH	GCGH	ICMR	MRC	WT
2010	38.5%	40.4%	30.0%	86.7%	76.3%	29.0%	62.6%	78.8%
2011	58.8%	37.2%	40.6%	84.0%	77.4%	30.2%	64.1%	79.4%
2012	58.7%	56.3%	30.8%	82.9%	73.6%	30.6%	67.5%	80.9%
2013	58.0%	47.0%	37.1%	80.7%	75.5%	35.9%	71.5%	84.8%
2014	55.6%	57.4%	45.0%	87.5%	79.8%	36.6%	76.3%	87.7%
2015	67.2%	48.1%	58.5%	86.3%	85.0%	36.3%	81.3%	89.4%
2016	73.9%	58.4%	64.3%	82.4%	94.2%	40.6%	88.7%	93.1%
2017	75.6%	61.3%	59.7%	86.9%	93.0%	40.5%	92.1%	94.6%
2018	81.8%	60.5%	57.1%	87.8%	100.0%	40.8%	92.3%	94.5%
2019	84.7%	53.5%	64.2%	84.9%	81.3%	42.3%	91.7%	94.9%
2020	88.7%	73.9%	65.9%	85.3%	92.3%	43.0%	91.5%	93.9%
2021	86.1%	68.5%	65.7%	69.5%	83.3%	38.9%	88.9%	90.7%
Total	**77.2%**	**55.9%**	**54.0%**	**83.2%**	**80.4%**	**38.0%**	**81.7%**	**89.4%**

8.3 Summary of bibliometric indicators: IMI project research compared with selected comparators

Although IMI has only been funding research for just over a decade, its performance is on par with well-established funding bodies that have been operating for much longer, like the MRC and the Wellcome Trust, as indicated by comparable citation impacts, and percentages of highly cited papers (Table 8.3.1).

Table 8.3.2 SUMMARY OF BIBLIOMETRIC INDICATORS – IMI PROJECT RESEARCH COMPARED WITH SELECTED COMPARATORS, 2010-2021

PROJECT	NUMBER OF PAPERS	CITATION IMPACT (NORMALISED AT FIELD LEVEL)	PERCENTAGE OF UNCITED PAPERS	PERCENTAGE OF HIGHLY CITED PAPERS
IMI	7,856	2.03	8.4%	25.3%
C-Path	528	1.35	6.3%	13.7%
CSIRO	1,003	1.67	6.5%	20.2%
FNIH	4,782	1.80	9.9%	22.9%
GCGH	889	1.90	1.2%	26.5%
ICMR	17,323	0.83	14.0%	7.4%
MRC	126,335	2.14	5.5%	24.9%
WT	89,768	2.10	7.2%	24.9%

ANNEX 1: Bibliometrics and citation analysis

Bibliometrics are about publications and their citations. The academic field emerged from 'information science' and now usually refers to the methods used to study and index texts and information.

Publications cite other publications. These citation links grow into networks, and their numbers are likely to be related to the significance or impact of the publication. The meaning of the publication is determined from keywords and content. Citation analysis and content analysis have therefore become a common part of bibliometric methodology. Historically, bibliometric methods were used to trace relationships amongst academic journal citations. Now, bibliometrics are important in indexing research performance.

Bibliometric data have particular characteristics of which the user should be aware, and these are considered here.

Journal papers (publications, sources) report research work. Papers refer to or 'cite' earlier work relevant to the material being reported. New papers are cited in their turn. Papers that accumulate more citations are thought of as having greater 'impact', which is interpreted as significance or influence on their field. Citation counts are therefore recognised as a measure of impact, which can be used to index the excellence of the research from a particular group, institution or country.

The origins of citation analysis as a tool that could be applied to research performance can be traced to the mid-1950s, when Eugene Garfield proposed the concept of citation indexing and introduced the Science Citation Index, the Social Sciences Citation Index and the Arts & Humanities Citation Index, produced by the Institute of Scientific Information (now Clarivate).[26]

We can count citations, but they are only 'indicators' of impact or quality – not metrics. Most impact indicators use average citation counts from groups of papers, because some individual papers may have unusual or misleading citation profiles. These outliers are diluted in larger samples.

Data source

The data we use come from the Clarivate Web of Science databases which give access not only to journals but also to conference proceedings, books, patents, websites, and chemical structures, compounds and reactions. It has a unified structure that integrates all data and search terms together and therefore provides a level of comparability not found in other databases. It is widely acknowledged to be the world's leading source of citation and bibliometric data. The Clarivate Web of Science Core Collection is part of the Web of Science and focuses on research published in journals and conferences in science, medicine, arts, humanities and social sciences.

The Web of Science was originally created as an awareness and information retrieval tool but it has acquired an important primary use as a tool for research evaluation, using citation analysis and bibliometrics. Data coverage is both current and retrospective in the sciences, social sciences, arts and humanities, in some cases back to 1900. Within the research community this data source was previously referred to by the acronym 'ISI'.

Unlike other databases, the Web of Science and underlying databases are selective, that is: the journals abstracted are selected using rigorous editorial and quality criteria. The authoritative,

[26] Garfield, E (1955) Citation Indexes for Science – New dimension in documentation through association of ideas. *Science*: **122**, 108-111.

multidisciplinary content covers over 12,000 of the highest impact journals worldwide, including open access journals, and over 150,000 conference proceedings. The abstracted journals encompass the majority of significant, frequently cited scientific reports and, more importantly, an even greater proportion of the scientific research output which is cited. This selective process ensures that the citation counts remain relatively stable in given research fields and do not fluctuate unduly from year to year, which increases the usability of such data for performance evaluation.

Clarivate has extensive experience with databases on research inputs, activity and outputs and has developed innovative analytical approaches for benchmarking and interpreting international, national and institutional research impact.

Database categories

The source data can be grouped in various classification systems. Most of these are based on groups of journals that have a relatively high cross-citation linkage and naturally cluster together. Custom classifications use subject maps in third-party data such as the OECD categories set out in the Frascati manual.

Clarivate frequently uses the broader field categories in the InCites: Essential Science Indicators™ and the finer journal categories in the Web of Science. There are 22 fields in Essential Science Indicators and 254 fields in Web of Science. In either case, our bibliometric analyses draw on the full range of data available in the underlying database, so analyses in our reports will differ slightly from anything created 'on the fly' from data in the web interface.

The lists of journal categories in these systems are attached at the end of this document.

Most analyses start with an overall view across the data, then move to a view across broad categories and only then focus in at a finer level in the areas of greatest interest to policy, programme or organisational purpose.

Assigning papers to addresses

A paper is assigned to each country and each organisation whose address appears at least once for any author on that paper. One paper counts once and only once for each assignment, however many address variants occur for the country or organisation. No weighting is applied.

For example, a paper has five authors, thus:

AUTHOR	ORGANISATION	COUNTRY		
Gurney, KA	Univ Leeds	UK	**Counts for Univ Leeds**	**Counts for UK**
Adams, J	Univ Leeds	UK	No gain for Univ Leeds	No gain for UK
Kochalko, D	Univ C San Diego	USA	**Counts for UCSD**	**Counts for USA**
Munshi, S	Gujarat Univ	India	**Counts for Gujarat Univ**	**Counts for India**
Pendlebury, D	Univ Oregon	USA	**Counts for Univ Oregon**	No gain for USA

So this one paper with five authors would be included once in the tallies for each of four universities and once in the tallies for each of three countries.

Work carried out within Clarivate, and research published elsewhere, indicates that fractional weighting based on the balance of authors by organisation and country makes little difference to the conclusions of an analysis at an aggregate level. Such fractional analysis can introduce unforeseen errors in the attempt to create a detailed but uncertain assignment. Partitioning credit would make a greater difference at a detailed, group level but the analysis can then be manually validated.

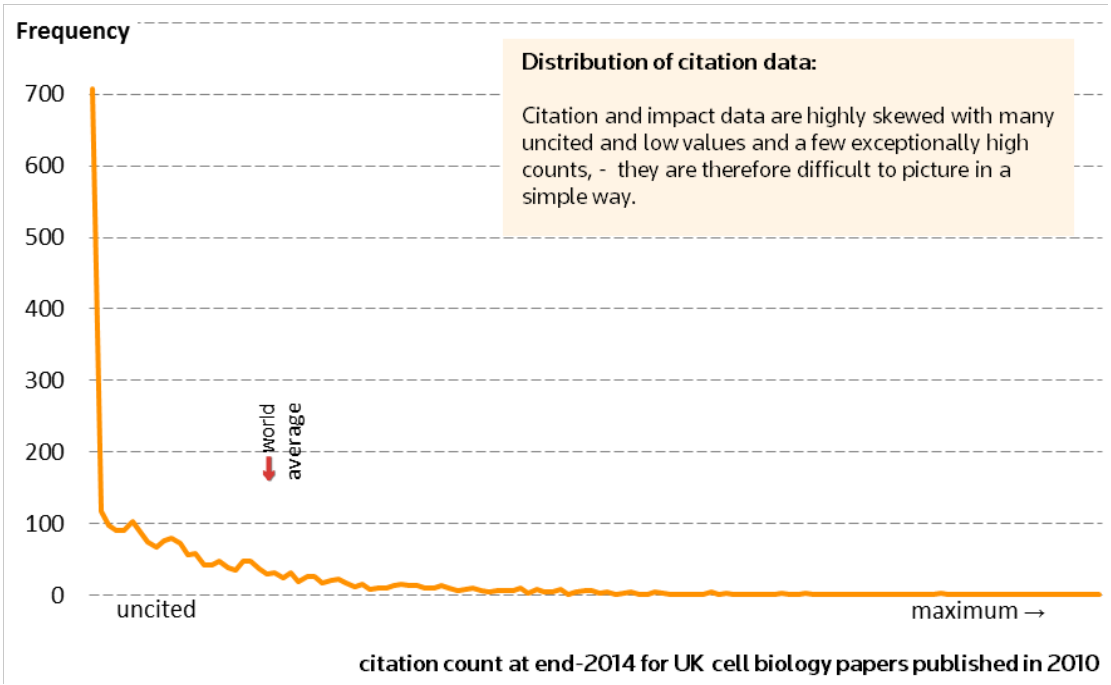
Citation counts

A publication accumulates citation counts when it is referred to by more recent publications. Some papers get cited frequently and many get cited rarely or never, so the distribution of citations is highly skewed.

Why are many papers never cited? Certainly some papers remain uncited because their content is of little or no impact, but that is not the only reason. It might be because they have been published in a journal not read by researchers to whom the paper might be interesting. It might be that they represent important but 'negative' work reporting a blind alley to be avoided by others. The publication may be a commentary in an editorial, rather than a normal journal article and thus of general rather than research interest. Or it might be that the work is a 'sleeping beauty' that has yet to be recognised for its significance.

Other papers can be very highly cited: hundreds, even thousands of times. Again, there are multiple reasons for this. Most frequently cited work is being recognised for its innovative significance and impact on the research field of which it speaks. Impact here is a good reflection of quality: it is an indicator of excellence. But there are other papers which are frequently cited because their significance is slightly different: they describe key methodology; they are a thoughtful and wide-ranging review of a field; or they represent contentious views which others seek to refute.

Citation analysis cannot make value judgments about why an article is uncited nor about why it is highly cited. The analysis can only report the citation impact that the publication has achieved. We normally assume, based on many other studies linking bibliometric and peer judgments, that high citation counts correlate on average with the quality of the research.



The figure shows the skewed distribution of more or less frequently cited papers from a sample of UK authored publications in cell biology. The skew in the distribution varies from field to field. It is to compensate for such factors that actual citation counts must be normalised, or rebased, against a world baseline.

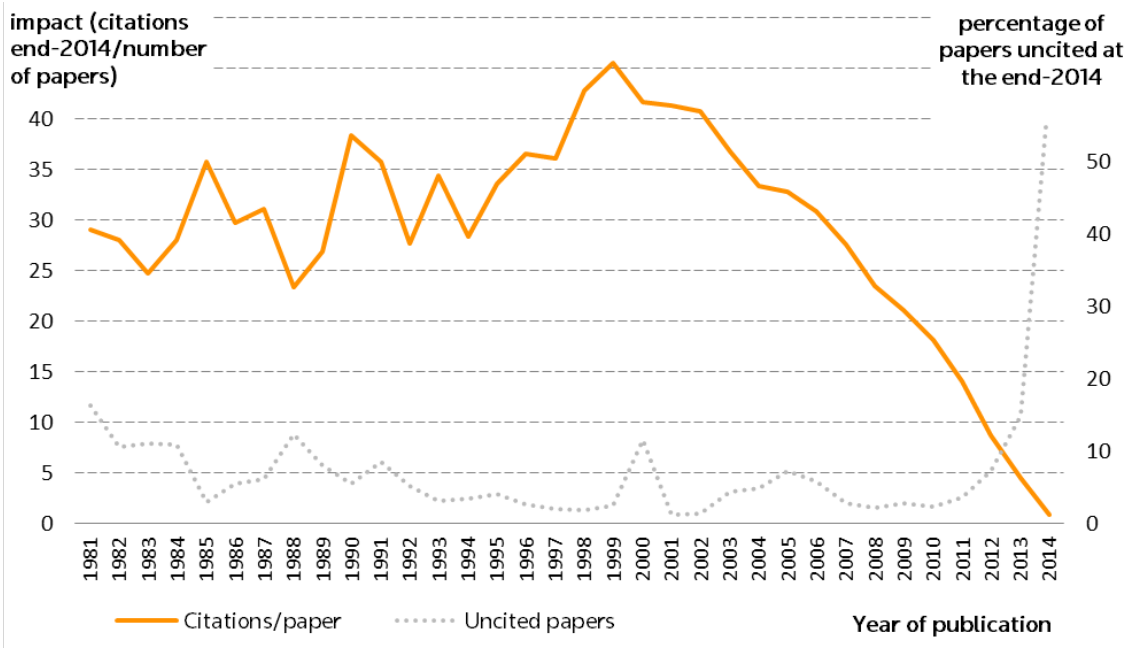
We do not seek to account separately for the effect of self-citation. If the citation count is significantly affected by self-citation then the paper is likely to have been infrequently cited. This is therefore only of consequence for low impact activity. Studies show that for large samples at national and organisational level the effect of self-citation has little or no effect on the analytical outcomes and would not alter interpretation of the results.

Time factors

Citations accumulate over time. Older papers therefore have, on average, more citations than more recent work. The graph below shows the pattern of citation accumulation for a set of 33 journals in the journal category ***Materials Science, Biomaterials***. Papers less than eight years old are, on average, still accumulating additional citations. The citation count goes on to reach a plateau for older sources.

The graph shows that the percentage of papers that have never been cited drops over about five years. Beyond five years, between 5% and 10% or more of papers remain uncited.

Account must be taken of these time factors in comparing current research with historical patterns. For these reasons, it is sometimes more appropriate to use a fixed five-year window of papers and citations to compare two periods than to look at the longer term profile of citations and of uncitedness for a recent year and an historical year.



Discipline factors

Citation rates vary between disciplines and fields. For the UK science base as a whole, ten years produces a general plateau beyond which few additional citations would be expected. On the whole, citations accumulate more rapidly and plateau at a higher level in biological sciences than physical sciences, and natural sciences generally cite at a higher rate than social sciences.

Papers are assigned to disciplines (journal categories or research fields) by Clarivate, bringing cognate research areas together. The journal category classification scheme has been recently revised and updated. Before 2007, journals were assigned to the older, well established Current Contents categories which were informed by extensive work by Thomson and with the research community since the early 1960s. This scheme has been superseded by the 252 Web of Science journal categories which allow for greater disaggregation for the growing volume of research which is published and abstracted.

Papers are allocated according to the journal in which the paper is published. Some journals may be considered to be part of the publication record for more than one research field. As the example below illustrates, the journal *Acta Biomaterialia* is assigned to two journal categories: ***Materials Science, Biomaterials and Engineering, Biomedical.***

Very few papers are not assigned to any research field and as such will not be included in specific analyses using normalised citation impact data. The journals included in the Clarivate databases and how they are selected are detailed here: mjl.clarivate.com/ .

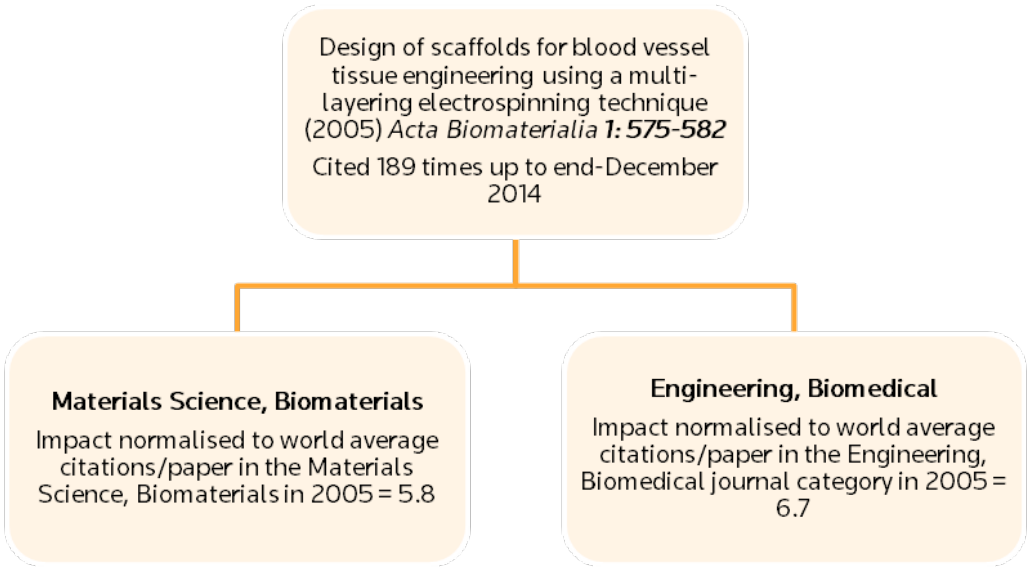
Some journals with a very diverse content, including the prestigious journals *Nature and Science* were classified as ***Multidisciplinary*** in databases created prior to 2007. The papers from these ***Multidisciplinary*** journals are now re-assigned to more specific research fields using an algorithm based on the research area(s) of the references cited by the article.

Normalised citation impact

Because citations accumulate over time at a rate that is dependent upon the field of research, all analyses must take both field and year into account. In other words, because the absolute citation count for a specific article is influenced by its field and by the year it was published, we can only make comparisons of indexed data after normalising with reference to these two variables.

We only use citation counts for reviews and articles in calculations of impact, because document type influences the citation count. For example, a review will often be cited more frequently than an article in the same field, but editorials and meeting abstracts are rarely cited and citation rates for conference proceedings are extremely variable. The most common normalisation factors are the average citations per paper for (1) the year and (2) either the field or the journal in which the paper was published. This normalisation is also referred to as ‘rebasing’ the citation count.

Impact is therefore most commonly analysed in terms of ‘normalised impact’, or NCI. The following schematic illustrates how the normalised citation impact is calculated at paper level and journal category level.



This article in the journal *Acta Biomaterialia* is assigned to two journal categories: ***Materials Science, Biomaterials*** and ***Engineering, Biomedical***. The world average baselines for, as an example, ***Materials science, Biomaterials*** are calculated by summing the citations to all the articles and reviews published worldwide in the journal *Acta Biomaterialia* and the other 32 journals assigned to this category for each year and dividing this by the total number of articles and reviews published in the journal category. This gives the category-specific normalised citation impact (in the above example the category-specific field-normalised citation impact for ***Materials Science, Biomaterials*** is 5.8 and the category-specific field-normalised citation impact for ***Engineering, Biomedical*** is higher at 6.7). Most papers (nearly two-thirds) are assigned to a single journal category whilst a minority are assigned to more than 5.

Citation data provided by Clarivate are assigned on an annual census date referred to as the Article Time Period. For the majority of publications, the Article Time Period is the same as the year of publication, but for a few publications (especially those published at the end of the calendar year in less main-stream journals) the Article Time Period may vary from the actual year of publication.

World average impact data are sourced from the Clarivate National Science Indicators baseline data for 2016.

Mean normalised citation impact

Research performance has historically been indexed by using average citation impact, usually compared to a world average that accounts for time and discipline. As noted, however, the distribution of citations amongst papers is highly skewed because many papers are never cited while a few papers accumulate very large citation counts. That means that an average may be misleading if assumptions are made about the distribution of the underlying data.

In fact, almost all research activity metrics are skewed: for research income, PhD numbers and publications there are many low activity values and a few exceptionally high values. In reality, therefore, the skewed distribution means that average impact tends to be greater than and often significantly different from either the median or mode in the distribution. This should be borne in mind when reviewing analytical outcomes.

The average (normalised) citation impact can be calculated at an individual paper level where it can be associated with more than one journal category. It can also be calculated for a set of papers at any level from a single country to an individual researcher's output. In the example above, the average citation impact of the Acta Biomaterialia paper can be expressed as ((5.8 + 6.7)/2) = 6.3.

What are uncited papers?

It may be a surprise that some journal papers are never subsequently cited after publication, even by their authors. This accounts for about half the total global output for a typical, recent 10-year period. We cannot tell why papers are not cited. It is likely that a significant proportion of papers remain uncited because they are reporting negative results which are an essential matter of record in their field but make the content less likely to be referenced in other papers. Inevitably, other papers are uncited because their content is trivial or marginal to the mainstream. However, it should not be assumed that this is the case for all such papers.

There is variation in non-citation between countries and between fields. For example, relatively more engineering papers tend to remain uncited than papers in other sciences, indicative of a disciplinary factor but not a quality factor. While there is also an obvious increase in the likelihood of citation over time, most papers that are going to be cited will be cited within a few years of publication.

Journal category systems used in our analyses.

WEB OF SCIENCE

Acoustics
Agricultural economics & policy
Agricultural engineering
Agriculture, dairy & animal science
Agriculture, multidisciplinary
Agriculture, soil science
Agronomy
Allergy
Anatomy & morphology
Andrology
Anesthesiology
Anthropology
Applied linguistics
Archaeology
Architecture
Area studies
Art
Asian studies
Astronomy & astrophysics
Automation & control systems
Behavioral sciences
Biochemical research methods
Biochemistry & molecular biology
Biodiversity conservation
Biology
Biology, miscellaneous
Biophysics
Biotechnology & applied microbiology
Business
Business, finance
Cardiac & cardiovascular systems
Cell biology
Chemistry, analytical
Chemistry, applied
Chemistry, inorganic & nuclear
Chemistry, medicinal
Chemistry, multidisciplinary
Chemistry, organic
Chemistry, physical
International relations
Language & linguistics
Classics
Clinical neurology
Communication
Computer science, artificial intelligence
Computer science, cybernetics
Computer science, hardware & architecture
Computer science, information systems
Computer science, interdisciplinary applications
Computer science, software engineering
Computer science, theory & methods
Construction & building technology
Criminology & penology
Critical care medicine
Crystallography
Dance
Demography
Dentistry, oral surgery & medicine
Dermatology
Developmental biology
Ecology
Economics
Education & educational research
Education, scientific disciplines
Education, special
Electrochemistry
Emergency medicine
Endocrinology & metabolism
Energy & fuels
Engineering, aerospace
Engineering, biomedical
Engineering, chemical
Engineering, civil
Engineering, electrical & electronic
Engineering, environmental
Engineering, geological
Engineering, industrial
Engineering, manufacturing
Engineering, marine
Engineering, mechanical
Mining & mineral processing
Multidisciplinary sciences
Engineering, multidisciplinary
Engineering, ocean
Engineering, petroleum
Entomology
Environmental sciences
Environmental studies
Ergonomics
Ethics
Ethnic studies
Evolutionary biology
Family studies
Film, radio, television
Fisheries
Folklore
Food science & technology
Forestry
Gastroenterology & hepatology
Genetics & heredity
Geochemistry & geophysics
Geography
Geography, physical
Geology
Geosciences, multidisciplinary
Geriatrics & gerontology
Health care sciences & services
Health policy & services
Hematology
History
History & philosophy of science
History of social sciences
Horticulture
Humanities, multidisciplinary
Imaging science & photographic technology
Immunology
Industrial relations & labor
Infectious diseases
Information & library science
Instruments & instrumentation
Integrative & complementary medicine
Psychology
Psychology, applied

Language & linguistics theory
Law
Limnology
Linguistics
Literary reviews
Literary theory & criticism
Literature
Literature, African, Australian, Canadian
Literature, American
Literature, British Isles
Literature, German, Dutch, Scandinavian
Literature, romance
Literature, Slavic
Management
Marine & freshwater biology
Materials science, biomaterials
Materials science, ceramics
Materials science, characterization & testing
Materials science, coatings & films
Materials science, composites
Materials science, multidisciplinary
Materials science, paper & wood
Materials science, textiles
Math & computational biology
Mathematics
Mathematics, applied
Mathematics, interdisciplinary applications
Mechanics
Medical ethics
Medical informatics
Medical laboratory technology
Medicine, general & internal
Medicine, legal
Medicine, research & experimental
Medieval & renaissance studies
Metallurgy & metallurgical engineering
Meteorology & atmospheric sci
Microbiology
Microscopy
Mineralogy
Urban studies
Urology & nephrology
Veterinary
Veterinary sciences
Virology
Water resources
Music
Mycology
Nanoscience & nanotechnology
Neuroimaging
Neurosciences
Nuclear science & technology
Nursing
Nutrition & dietetics
Obstetrics & gynecology
Oceanography
Oncology
Operations research & management science
Ophthalmology
Optics
Ornithology
Orthopedics
Otorhinolaryngology
Paleontology
Parasitology
Pathology
Pediatrics
Peripheral vascular disease
Pharmacology & pharmacy
Philosophy
Physics, applied
Physics, atomic, molecular & chemical
Physics, condensed matter
Physics, fluids & plasmas
Physics, mathematical
Physics, multidisciplinary
Physics, nuclear
Physics, particles & fields
Physiology
Planning & development
Plant sciences
Poetry
Political science
Polymer science
Psychiatry
Psychology, biological
Psychology, clinical
Psychology, developmental
Psychology, educational
Psychology, experimental
Psychology, mathematical
Psychology, multidisciplinary
Psychology, psychoanalysis
Psychology, social
Public administration
Public, environmental & occupational health
Radiology, nuclear medicine & medical imaging
Rehabilitation
Religion
Remote sensing
Reproductive biology
Respiratory system
Rheumatology
Robotics
Social issues
Social sciences, biomedical
Social sci, interdisciplinary
Social sci, mathematical methods
Social work
Sociology
Soil science
Spectroscopy
Sport sciences
Statistics & probability
Substance abuse
Surgery
Telecommunications
Theater
Thermodynamics
Toxicology
Transplantation
Transportation
Transportation science & technology
Tropical medicine

Women's studies
Zoology

ESSENTIAL SCIENCE INDICATORS

Agricultural Sciences	Geosciences	Pharmacology
Biology & Biochemistry	Immunology	Physics
Chemistry	Law	Plant & Animal Science
Clinical Medicine	Materials Science	Psychology/Psychiatry
Computer Science	Mathematics	Social Sciences, general
Ecology/Environment	Microbiology	Space Science
Economics & Business	Molecular Biology & Genetics	
Education	Multidisciplinary	
Engineering	Neurosciences & Behaviour	

ANNEX 2: Biomedically related journal categories

This Annex lists the Web of Science journal categories which capture biomedically related publications.

Allergy
Anaesthesiology
Anatomy & Morphology
Andrology
Audiology & Speech-Language Pathology
Behavioural Sciences
Cardiac & Cardiovascular Systems
Cell & Tissue Engineering
Clinical Neurology
Critical Care Medicine
Dentistry, Oral Surgery & Medicine
Dermatology
Emergency Medicine
Endocrinology & Metabolism
Ergonomics
Gastroenterology & Hepatology
Geriatrics & Gerontology
Gerontology
Haematology
Health Care Sciences & Services
Health Policy & Services
Immunology
Infectious Diseases
Integrative & Complementary Medicine
Medical Ethics
Medical Informatics
Medical Laboratory Technology
Medicine, General & Internal
Medicine, Legal
Medicine, Research & Experimental
Neuroimaging
Neurosciences
Nursing
Nutrition & Dietetics
Obstetrics & Gynaecology
Oncology
Ophthalmology
Orthopaedics
Otorhinolaryngology
Paediatrics
Pathology
Peripheral Vascular Disease
Pharmacology & Pharmacy
Physiology
Primary Health Care
Psychiatry
Psychology
Psychology, Applied
Psychology, Biological
Psychology, Clinical
Psychology, Developmental
Psychology, Educational
Psychology, Experimental
Psychology, Mathematical
Psychology, Psychoanalysis
Psychology, Social
Public, Environmental & Occupational Health
Radiology, Nuclear Medicine & Medical Imaging
Rehabilitation
Reproductive Biology
Respiratory System
Rheumatology
Substance Abuse
Surgery
Transplantation
Tropical Medicine
Urology & Nephrology
Virology

ANNEX 3: Total number of Web of Science Publications from IMI projects between 2010 and 2021 by country

COUNTRY	NUMBER OF PUBLICATIONS
UK	3,684
Germany	2,756
Netherlands	2,108
USA	2,066
Sweden	1,418
France	1,382
Italy	1,235
Spain	1,061
Switzerland	1,049
Belgium	867
Denmark	633
Canada	568
Austria	508
Finland	402
Australia	313
Peoples R China	286
Greece	249
Norway	225
Ireland	203
Poland	172
Japan	155
Portugal	150
Brazil	137
Israel	120
Singapore	91
Hungary	89
South Africa	80
Estonia	70
Czech Republic	70
Luxembourg	70
India	61

COUNTRY	NUMBER OF PUBLICATIONS
South Korea	52
Saudi Arabia	50
Iceland	48
Turkey	46
Taiwan	46
Lithuania	41
Slovenia	38
New Zealand	38
Cyprus	35
Egypt	34
Croatia	32
Argentina	28
Romania	26
Russia	23
Serbia	21
Thailand	20
Qatar	18
Kenya	17
Iran	16
Chile	16
Latvia	15
Palestine	11
Vietnam	10
Lebanon	10
Mexico	9
Tanzania	9
Bulgaria	9
Colombia	8
Ukraine	8
Malta	7
Uganda	7
Sierra Leone	7
Pakistan	6
Georgia	6

COUNTRY	NUMBER OF PUBLICATIONS
Liechtenstein	6
Tunisia	6
Uruguay	6
Nigeria	6
U Arab Emirates	5
Kuwait	5
Slovakia	5
Peru	5
Jordan	5
DEM REP CONGO	5
Gabon	5
Philippines	5
Iraq	5
Guinea	5
Mozambique	4
Malaysia	4
Mali	4
Gambia	4
Burkina Faso	3
Bangladesh	3
BELARUS	3
Malawi	3
Senegal	3
Oman	2
Nepal	2
Monaco	2
Moldova	2
Macedonia	2
Liberia	2
Guatemala	2
Ghana	2
Sri Lanka	2
Ethiopia	2
Cote Ivoire	2

COUNTRY	NUMBER OF PUBLICATIONS
Bosnia & Herceg	2
Kosovo	1
Kazakhstan	1
Indonesia	1
Benin	1
Armenia	1
Uzbekistan	1
Algeria	1
Ecuador	1
Zambia	1
Cook Islands	1
Cameroon	1
Cambodia	1
Niger	1
Burundi	1
Morocco	1
Mongolia	1
Albania	1
Rwanda	1
Botswana	1
Zimbabwe	1
North Macedonia	1

ANNEX 4: Total number of Web of Science Publications, papers and open access papers between 2010 and 2021 by Project

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	NUMBER OF OPEN ACCESS PAPERS	% OF OPEN ACCESS PAPERS
BTCure	719	672	487	72.5%
EU-AIMS	565	546	453	83.0%
ULTRA-DD	434	425	362	85.2%
EMIF	331	310	261	84.2%
NEWMEDS	220	214	124	57.9%
AIMS-2-TRIALS	210	196	182	92.9%
CANCER-ID	208	180	132	73.3%
INNODIA	203	166	146	88.0%
EUROPAIN	183	181	73	40.3%
ORBITO	171	168	61	36.3%
TRANSLOCATION	164	164	110	67.1%
BigData@Heart	157	135	125	92.6%
STEMBANCC	153	147	120	81.6%
IMIDIA	151	141	121	85.8%
U-BIOPRED	148	93	68	73.1%
RTCure	146	131	112	85.5%
SUMMIT	141	136	106	77.9%
ELF	135	134	108	80.6%
CHEM21	131	128	64	50.0%
PreDiCT-TB	124	118	109	92.4%
SPRINTT	123	116	67	57.8%
MIP-DILI	116	108	70	64.8%
RHAPSODY	115	94	87	92.6%
COMBACTE-NET	109	100	85	85.0%
DIRECT	109	82	71	86.6%
COMBACTE-MAGNET	108	97	82	84.5%
BEAT-DKD	106	98	86	87.8%
Quic-Concept	104	103	88	85.4%
EUbOPEN	102	101	78	77.2%

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	NUMBER OF OPEN ACCESS PAPERS	% OF OPEN ACCESS PAPERS
PROTECT	101	99	46	46.5%
ABIRISK	100	79	51	64.6%
eTOX	97	92	64	69.6%
Pharma-Cog	94	88	39	44.3%
COMPACT	91	91	49	53.8%
None	89	65	55	84.6%
PRISM	87	75	62	82.7%
RADAR-CNS	87	64	55	85.9%
DDMoRe	82	77	54	70.1%
AETIONOMY	74	71	58	81.7%
PRECISESADS	74	54	34	63.0%
Open PHACTS	73	70	63	90.0%
BioVacSafe	73	70	56	80.0%
K4DD	70	68	51	75.0%
Onco Track	69	65	46	70.8%
APPROACH	67	54	39	72.2%
COMBACTE-CARE	66	61	53	86.9%
IMPRiND	66	63	56	88.9%
ZAPI	63	60	57	95.0%
MARCAR	61	60	44	73.3%
DRIVE-AB	60	54	45	83.3%
EPAD	59	55	48	87.3%
LITMUS	59	49	40	81.6%
ENABLE	56	55	47	85.5%
AMYPAD	56	50	47	94.0%
eTRIKS	56	45	43	95.6%
INNODIA HARVEST	53	45	44	97.8%
TransQST	52	47	39	83.0%
iABC	51	33	25	75.8%
Predect	49	45	38	84.4%
MOBILISE-D	48	43	38	88.4%
RAPP-ID	47	46	33	71.7%
PHAGO	46	45	45	100.0%

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	NUMBER OF OPEN ACCESS PAPERS	% OF OPEN ACCESS PAPERS
FLUCOP	45	44	37	84.1%
RESCEU	45	43	43	100.0%
GETREAL	43	37	30	81.1%
iPiE	42	41	29	70.7%
EHDEN	41	31	29	93.5%
PREFER	41	27	27	100.0%
EBiSC	36	33	31	93.9%
EBOVAC1	34	32	32	100.0%
PROACTIVE	34	29	26	89.7%
Hypo-RESOLVE	33	24	21	87.5%
DRAGON	32	28	26	92.9%
ADAPTED	30	28	26	92.9%
eTRANSAFE	30	23	21	91.3%
HARMONY	30	17	15	88.2%
ROADMAP	28	22	22	100.0%
ADVANCE	28	27	25	92.6%
IMI-PainCare	27	20	14	70.0%
EbolaMoDRAD	26	25	18	72.0%
3TR	25	23	18	78.3%
EHR4CR	23	20	16	80.0%
SAFE-T	23	21	8	38.1%
TRISTAN	23	23	22	95.7%
DRIVE	21	20	18	90.0%
VAC2VAC	20	20	19	95.0%
IM2PACT	19	19	16	84.2%
EBOVAC2	19	19	19	100.0%
BIOMAP	18	14	11	78.6%
PERISCOPE	18	17	17	100.0%
COMBACTE	17	16	10	62.5%
IDEA-FAST	17	6	5	83.3%
SOPHIA	17	16	14	87.5%
WEB-RADR	17	16	14	87.5%
CARDIATEAM	16	14	14	100.0%

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	NUMBER OF OPEN ACCESS PAPERS	% OF OPEN ACCESS PAPERS
EQIPD	15	9	8	88.9%
VSV-EBOPLUS	14	13	11	84.6%
EU-PEARL	14	12	8	66.7%
MOPEAD	13	13	13	100.0%
PD-MitoQUANT	13	13	12	92.3%
RADAR-AD	12	8	8	100.0%
ConcePTION	12	11	9	81.8%
TransBioLine	12	12	11	91.7%
MACUSTAR	12	6	6	100.0%
VSV-EBOVAC	12	11	8	72.7%
ITCC-P4	11	11	9	81.8%
c4c	11	9	6	66.7%
COMBACTE-CDI	11	9	7	77.8%
CARE	11	9	9	100.0%
VALUE-Dx	10	10	10	100.0%
KRONO	10	7	7	100.0%
MAD-CoV 2	9	8	8	100.0%
VITAL	9	9	9	100.0%
ReSOLUTE	9	7	7	100.0%
ERA4TB	8	8	8	100.0%
EBODAC	8	8	8	100.0%
FAIRplus	8	7	7	100.0%
EUPATI	8	7	7	100.0%
NeuroDeRisk	7	6	5	83.3%
EBOVAC3	7	7	7	100.0%
NECESSITY	7	6	5	83.3%
PARADIGM	7	7	7	100.0%
HIPPOCRATES	6	5	5	100.0%
EBiSC2	6	6	6	100.0%
DECISION	6	4	4	100.0%
MELLODDY	6	4	4	100.0%
iCONSENSUS	5	5	4	80.0%
SafeSciMET	5	4	2	50.0%

PROJECT	NUMBER OF PUBLICATIONS	NUMBER OF PAPERS	NUMBER OF OPEN ACCESS PAPERS	% OF OPEN ACCESS PAPERS
Immune-Image	5	5	4	80.0%
imSAVAR	4	3	3	100.0%
ADAPT-SMART	4	4	2	50.0%
DO->IT	4	4	4	100.0%
EBOMAN	4	4	4	100.0%
T2EVOLVE	3	3	2	66.7%
ND4BB	3	3	3	100.0%
ImmUniverse	3	3	3	100.0%
IMMUCAN	3	3	3	100.0%
PEVIA	3	2	2	100.0%
PIONEER	3	2	2	100.0%
Eu2P	3	3	2	66.7%
COVID-RED	3	2	2	100.0%
Trials@Home	3	2	2	100.0%
HARMONY PLUS	2	1	1	100.0%
VHFMoDRAD	2	2	2	100.0%
EMTRAIN	2	1	0	0.0%
OPTIMA	2	2	2	100.0%
Inno4Vac	2	2	2	100.0%
NGN-PET	2	2	1	50.0%
STOPFOP	2	2	2	100.0%
BIGPICTURE	1	1	1	100.0%
Pharmatrain	1	1	1	100.0%
PERSIST-SEQ	1	1	0	0.0%
Impentri	1	1	1	100.0%
UNITE4TB	1	0	0	0.0%
RespiriTB	1	1	1	100.0%
RespiriNTM	1	1	1	100.0%
COMBINE	1	1	1	100.0%
EBOVAC	1	1	1	100.0%
FILODIAG	1	0	0	0.0%
Screen4Care	1	1	1	100.0%

ANNEX 5: Collaboration index for all IMI supported research projects

This Annex provides the calculation of the collaboration indicators for all IMI supported research projects with at least one paper. Collaboration index only calculated for projects with a Stability score and at least 20 papers.

PROJECT	CROSS-SECTOR SCORE	INTERNATIONAL SCORE	STABILITY SCORE	COLLABORATION INDEX	TOTAL PAPERS	CITATION IMPACT (FIELD-NORMALISED)
BTCure	0.65	0.52	0.84	2.00	672	1.81
EU-AIMS	0.73	0.65	0.82	2.19	546	2.06
ULTRA-DD	0.63	0.65	0.77	2.06	425	1.91
EMIF	0.82	0.67	0.84	2.34	310	2.49
NEWMEDS	0.62	0.58	0.83	2.03	214	2.06
AIMS-2-TRIALS	0.71	0.66	0.69	2.07	196	2.67
EUROPAIN	0.55	0.38	0.85	1.78	181	2.55
CANCER-ID	0.75	0.43	0.75	1.93	180	3.27
ORBITO	0.64	0.48	0.76	1.88	168	1.70
INNODIA	0.81	0.65	0.87	2.32	166	1.62
TRANSLOCATION	0.37	0.49	0.81	1.66	164	1.35
STEMBANCC	0.50	0.47	0.82	1.79	147	1.94
IMIDIA	0.53	0.50	0.84	1.87	141	1.65
SUMMIT	0.75	0.64	0.83	2.22	136	1.42
BigData@Heart	0.90	0.69	0.69	2.29	135	2.05
ELF	0.34	0.51	0.77	1.62	134	1.11
RTCure	0.81	0.47	0.70	1.98	131	2.86
CHEM21	0.23	0.29	0.80	1.33	128	1.70
PreDiCT-TB	0.57	0.50	0.81	1.88	118	1.16
SPRINTT	0.72	0.53	0.80	2.05	116	1.83
MIP-DILI	0.67	0.45	0.82	1.94	108	1.77
Quic-Concept	0.72	0.57	0.81	2.09	103	4.76
EUbOPEN	0.58	0.55	0.00	1.13	101	1.85
COMBACTE-NET	0.79	0.55	0.89	2.23	100	1.17
PROTECT	0.97	0.63	0.86	2.46	99	1.03
BEAT-DKD	0.71	0.69	0.70	2.11	98	2.17
COMBACTE-MAGNET	0.70	0.62	0.86	2.18	97	1.28
RHAPSODY	0.60	0.66	0.81	2.07	94	1.97
U-BIOPRED	0.83	0.72	0.86	2.41	93	2.49
eTOX	0.30	0.36	0.86	1.53	92	1.76

PROJECT	CROSS-SECTOR SCORE	INTERNATIONAL SCORE	STABILITY SCORE	COLLABORATION INDEX	TOTAL PAPERS	CITATION IMPACT (FIELD-NORMALISED)
COMPACT	0.24	0.46	0.75	1.46	91	1.90
Pharma-Cog	0.85	0.75	0.85	2.45	88	1.13
DIRECT	0.76	0.73	0.84	2.33	82	3.93
ABIRISK	0.76	0.50	0.84	2.10	79	1.25
DDMoRe	0.65	0.56	0.81	2.02	77	1.21
PRISM	0.80	0.69	0.75	2.25	75	2.70
AETIONOMY	0.65	0.46	0.80	1.91	71	1.77
Open PHACTS	0.60	0.55	0.76	1.92	70	3.57
BioVacSafe	0.46	0.49	0.81	1.76	70	1.20
K4DD	0.54	0.51	0.80	1.86	68	1.53
None	0.75	0.70	0.49	1.94	65	3.50
Onco Track	0.63	0.43	0.83	1.90	65	2.19
RADAR-CNS	0.63	0.70	0.82	2.15	64	1.94
IMPRiND	0.67	0.60	0.75	2.01	63	4.96
COMBACTE-CARE	0.92	0.66	0.80	2.37	61	1.59
ZAPI	0.67	0.63	0.77	2.07	60	4.34
MARCAR	0.42	0.42	0.84	1.68	60	1.04
ENABLE	0.58	0.47	0.83	1.88	55	1.45
EPAD	0.76	0.67	0.81	2.25	55	1.35
DRIVE-AB	0.74	0.64	0.75	2.13	54	1.30
PRECISESADS	0.80	0.77	0.75	2.32	54	1.38
APPROACH	0.81	0.81	0.81	2.43	54	2.07
AMYPAD	0.92	0.78	0.77	2.47	50	1.96
LITMUS	0.84	0.67	0.75	2.25	49	3.85
TransQST	0.60	0.68	0.76	2.03	47	3.09
RAPP-ID	0.33	0.43	0.85	1.61	46	0.86
Predect	0.69	0.63	0.79	2.11	45	2.67
INNODIA HARVEST	0.78	0.66	0.00	1.43	45	1.37
eTRIKS	0.82	0.88	0.75	2.46	45	2.04
PHAGO	0.69	0.60	0.72	2.01	45	4.02
FLUCOP	0.91	0.47	0.73	2.11	44	1.58
MOBILISE-D	0.77	0.58	0.00	1.34	43	1.57
RESCEU	0.84	0.70	0.69	2.22	43	1.91
iPiE	0.51	0.24	0.76	1.51	41	1.13
GETREAL	0.84	0.76	0.78	2.37	37	1.65

PROJECT	CROSS-SECTOR SCORE	INTERNATIONAL SCORE	STABILITY SCORE	COLLABORATION INDEX	TOTAL PAPERS	CITATION IMPACT (FIELD-NORMALISED)
iABC	0.85	0.65	0.82	2.32	33	1.19
EBiSC	0.70	0.62	0.77	2.09	33	5.61
EBOVAC1	0.72	0.67	0.82	2.21	32	2.07
EHDEN	0.81	0.84	0.63	2.27	31	2.19
PROACTIVE	1.00	0.81	0.85	2.66	29	2.22
DRAGON	0.89	0.75	#N/A	#N/A	28	3.78
ADAPTED	0.93	0.62	#N/A	#N/A	28	2.89
PREFER	0.93	0.87	#N/A	#N/A	27	1.29
ADVANCE	0.89	0.86	#N/A	#N/A	27	1.36
EbolaMoDRAD	0.68	0.52	#N/A	#N/A	25	1.34
Hypo-RESOLVE	0.58	0.79	#N/A	#N/A	24	0.71
3TR	0.91	0.48	#N/A	#N/A	23	2.60
eTRANSAFE	0.48	0.50	#N/A	#N/A	23	3.15
TRISTAN	0.83	0.50	#N/A	#N/A	23	1.22
ROADMAP	0.91	0.75	#N/A	#N/A	22	0.91
SAFE-T	0.95	0.54	#N/A	#N/A	21	1.73
VAC2VAC	0.70	0.56	#N/A	#N/A	20	0.60
DRIVE	0.85	0.31	#N/A	#N/A	20	0.79
IMI-PainCare	0.75	0.55	#N/A	#N/A	20	1.22
EHR4CR	0.85	0.60	#N/A	#N/A	20	1.11
EBOVAC2	0.53	0.51	#N/A	#N/A	19	2.45
IM2PACT	0.58	0.43	#N/A	#N/A	19	1.62
PERISCOPE	0.35	0.38	#N/A	#N/A	17	1.57
HARMONY	0.82	0.47	#N/A	#N/A	17	0.70
COMBACTE	0.50	0.11	#N/A	#N/A	16	3.01
WEB-RADR	0.75	0.75	#N/A	#N/A	16	1.40
SOPHIA	0.69	0.55	#N/A	#N/A	16	3.45
BIOMAP	0.86	0.73	#N/A	#N/A	14	4.64
CARDIATEAM	1.00	0.95	#N/A	#N/A	14	3.03
PD-MitoQUANT	0.69	0.46	#N/A	#N/A	13	2.08
MOPEAD	1.00	0.81	#N/A	#N/A	13	1.73
VSV-EBOPLUS	0.69	0.77	#N/A	#N/A	13	1.02
EU-PEARL	0.83	0.73	#N/A	#N/A	12	2.42
TransBioLine	0.92	0.40	#N/A	#N/A	12	1.09
ConcePTION	1.00	0.91	#N/A	#N/A	11	0.79
ITCC-P4	1.00	0.75	#N/A	#N/A	11	2.48

PROJECT	CROSS-SECTOR SCORE	INTERNATIONAL SCORE	STABILITY SCORE	COLLABORATION INDEX	TOTAL PAPERS	CITATION IMPACT (FIELD-NORMALISED)
VSV-EBOVAC	0.55	0.64	#N/A	#N/A	11	0.94
VALUE-Dx	0.70	0.82	#N/A	#N/A	10	2.75
c4c	1.00	0.92	#N/A	#N/A	9	0.69
COMBACTE-CDI	1.00	0.94	#N/A	#N/A	9	1.38
CARE	0.56	0.64	#N/A	#N/A	9	9.09
VITAL	0.56	0.53	#N/A	#N/A	9	0.36
EQIPD	0.56	0.78	#N/A	#N/A	9	2.38
RADAR-AD	0.88	0.50	#N/A	#N/A	8	1.51
MAD-CoV 2	0.88	0.88	#N/A	#N/A	8	2.99
ERA4TB	0.75	0.66	#N/A	#N/A	8	1.11
EBODAC	0.88	0.81	#N/A	#N/A	8	2.38
EUPATI	1.00	0.96	#N/A	#N/A	7	0.75
FAIRplus	0.14	0.25	#N/A	#N/A	7	1.45
PARADIGM	0.86	0.82	#N/A	#N/A	7	1.61
EBOVAC3	0.57	0.89	#N/A	#N/A	7	0.60
ReSOLUTE	0.57	0.36	#N/A	#N/A	7	1.00
KRONO	0.57	0.14	#N/A	#N/A	7	2.52
IDEA-FAST	0.33	0.79	#N/A	#N/A	6	1.10
NeuroDeRisk	0.33	0.17	#N/A	#N/A	6	0.12
EBiSC2	1.00	0.92	#N/A	#N/A	6	0.52
NECESSITY	1.00	0.83	#N/A	#N/A	6	2.53
MACUSTAR	0.83	0.67	#N/A	#N/A	6	1.98
HIPPOCRATES	0.80	0.15	#N/A	#N/A	5	4.32
Immune-Image	1.00	0.90	#N/A	#N/A	5	2.67
iCONSENSUS	0.60	0.35	#N/A	#N/A	5	1.26
MELLODDY	0.75	0.75	#N/A	#N/A	4	0.62
EBOMAN	1.00	0.94	#N/A	#N/A	4	3.88
DO->IT	0.75	0.81	#N/A	#N/A	4	1.19
DECISION	0.75	0.00	#N/A	#N/A	4	2.60
SafeSciMET	1.00	1.00	#N/A	#N/A	4	0.89
ADAPT-SMART	0.75	0.50	#N/A	#N/A	4	0.58
Eu2P	0.33	0.67	#N/A	#N/A	3	2.01
ND4BB	0.67	0.58	#N/A	#N/A	3	1.36
imSAVAR	1.00	0.83	#N/A	#N/A	3	5.01
T2EVOLVE	0.67	0.25	#N/A	#N/A	3	3.66
ImmUniverse	1.00	0.58	#N/A	#N/A	3	0.00

PROJECT	CROSS-SECTOR SCORE	INTERNATIONAL SCORE	STABILITY SCORE	COLLABORATION INDEX	TOTAL PAPERS	CITATION IMPACT (FIELD-NORMALISED)
IMMUCAN	0.67	0.58	#N/A	#N/A	3	0.87
COVID-RED	1.00	1.00	#N/A	#N/A	2	0.44
PIONEER	1.00	1.00	#N/A	#N/A	2	1.26
Inno4Vac	1.00	0.38	#N/A	#N/A	2	0.00
STOPFOP	0.50	0.88	#N/A	#N/A	2	2.17
PEVIA	1.00	0.88	#N/A	#N/A	2	0.80
Trials@Home	0.50	0.38	#N/A	#N/A	2	1.20
VHFMoDRAD	1.00	0.38	#N/A	#N/A	2	0.38
OPTIMA	1.00	0.50	#N/A	#N/A	2	0.75
NGN-PET	0.50	0.50	#N/A	#N/A	2	1.38
HARMONY PLUS	1.00	1.00	#N/A	#N/A	1	11.67
Impentri	1.00	1.00	#N/A	#N/A	1	0.00
BIGPICTURE	1.00	1.00	#N/A	#N/A	1	4.88
EBOVAC	1.00	1.00	#N/A	#N/A	1	3.27
PERSIST-SEQ	0.00	0.00	#N/A	#N/A	1	0.00
RespiriNTM	0.00	0.00	#N/A	#N/A	1	4.39
Pharmatrain	1.00	1.00	#N/A	#N/A	1	0.10
EMTRAIN	1.00	1.00	#N/A	#N/A	1	0.10
Screen4Care	0.00	0.00	#N/A	#N/A	1	0.00
RespiriTB	0.00	0.00	#N/A	#N/A	1	4.39
COMBINE	1.00	0.00	#N/A	#N/A	1	0.07

ANNEX 6: Bibliography of hot papers and highly cited papers

This Annex provides bibliographic data for hot and highly cited papers. Hot papers are papers that receive citations soon after publication, relative to other papers of the same field and age. For the purpose of this report, highly cited papers have been defined as those articles and reviews which belong to the world's top decile of papers in that journal category and year of publication, when ranked by number of citations received. A percentage that is above 10 indicates above-average performance.

Papers are listed in ascending alphabetical order (project, first author) and unassigned papers, are listed at the end of each section.

This section lists papers that have been identified as current hot papers or that have been identified as highly cited in the IMI project publication dataset.

Hot papers associated with IMI projects

AIMS-2-TRIALS: Moreno, Carmen et al. How mental health care should change as a consequence of the COVID-19 pandemic, LANCET PSYCHIAT 7: 813-824

DIRECT: Aguet, Francois et al. The GTEx Consortium atlas of genetic regulatory effects across human tissues, SCIENCE 369: 1318-1330

EUbOPEN: Attwood, Misty M. et al. Trends in kinase drug discovery: targets, indications and inhibitor design, NAT REV DRUG DISCOV 20: 839-861

EUROPAIN: Kosek, Eva et al. Chronic nociplastic pain affecting the musculoskeletal system: clinical criteria and grading system, PAIN 162: 2629-2634

IMI-PainCare: Kosek, Eva et al. Chronic nociplastic pain affecting the musculoskeletal system: clinical criteria and grading system, PAIN 162: 2629-2634

IMPRiND: Shi, Yang et al. Structure-based classification of tauopathies, NATURE 598: 359-+

PHAGO: Meinhardt, Jenny et al. Olfactory transmucosal SARS-CoV-2 invasion as a port of central nervous system entry in individuals with COVID-19, NAT NEUROSCI 24: 168-175

PRISM: Moreno, Carmen et al. How mental health care should change as a consequence of the COVID-19 pandemic, LANCET PSYCHIAT 7: 813-824

Quic-Concept: Zwanenburg, Alex et al. The Image Biomarker Standardization Initiative: Standardized Quantitative Radiomics for High-Throughput Image-based Phenotyping, RADIOLOGY 295: 328-338

RTCure: Simon, David et al. SARS-CoV-2 vaccination responses in untreated, conventionally treated and anticytokine-treated patients with immune-mediated inflammatory diseases, ANN RHEUM DIS 80: 1312-1316

RTCure: Haberman, Rebecca H. et al. Methotrexate hampers immunogenicity to BNT162b2 mRNA COVID-19 vaccine in immune-mediated inflammatory disease, ANN RHEUM DIS 80: 1339-1344

SOPHIA: Stefan, Norbert et al. Global pandemics interconnected - obesity, impaired metabolic health and COVID-19, NAT REV ENDOCRINOL 17: 135-149

Highly cited papers associated with IMI projects

This section lists papers that perform above average as defined by citation counts in the 10th percentile.

3TR: Stengel, Stephanie T. et al. Activating Transcription Factor 6 Mediates Inflammatory Signals in Intestinal Epithelial Cells Upon Endoplasmic Reticulum Stress, GASTROENTEROLOGY 159: 1357-+

3TR: Bernardes, Joana P. et al. Longitudinal Multi-omics Analyses Identify Responses of Megakaryocytes, Erythroid Cells, and Plasmablasts as Hallmarks of Severe COVID-19, IMMUNITY 53: 1296-+

3TR: Kolmert, Johan et al. Urinary Leukotriene E-4 and Prostaglandin D-2 Metabolites Increase in Adult and Childhood Severe Asthma Characterized by Type 2 Inflammation A Clinical Observational Study, AM J RESP CRIT CARE 203: 37-53

3TR: Yordanova, Ivet A. et al. The Worm-Specific Immune Response in Multiple Sclerosis Patients Receiving Controlled Trichuris suis Ova Immunotherapy, LIFE-BASEL 11:

3TR: Schreiber, Stefan et al. Therapeutic Interleukin-6 Trans-signaling Inhibition by Olamkicept (sgp130Fc) in Patients With Active Inflammatory Bowel Disease, GASTROENTEROLOGY 160: 2354-+

3TR: Hoepel, Willianne et al. High titers and low fucosylation of early human anti-SARS-CoV-2 IgG promote inflammation by alveolar macrophages, SCI TRANSL MED 13:

ABIRISK: Kieseier, Bernd C. et al. Disease Amelioration With Tocilizumab in a Treatment-Resistant Patient With Neuromyelitis Optica Implication for Cellular Immune Responses, JAMA NEUROL 70: 390-393

ABIRISK: Wenniger, Lucas J. Maillette de Buy et al. Immunoglobulin G4+clones identified by next-generation sequencing dominate the B cell receptor repertoire in immunoglobulin G4 associated cholangitis, HEPATOLOGY 57: 2390-2398

ABIRISK: Warnke, Clemens et al. Changes to anti-JCV antibody levels in a Swedish national MS cohort, J NEUROL NEUROSUR PS 84: 1199-1205

ABIRISK: Shankar, G. et al. Assessment and Reporting of the Clinical Immunogenicity of Therapeutic Proteins and Peptides-Harmonized Terminology and Tactical Recommendations, AAPS J 16: 658-673

ABIRISK: Ungar, Bella et al. The temporal evolution of antidrug antibodies in patients with inflammatory bowel disease treated with infliximab, GUT 63: 1258-1264

ABIRISK: Warnke, Clemens et al. Cerebrospinal Fluid JC Virus Antibody Index for Diagnosis of Natalizumab-Associated Progressive Multifocal Leukoencephalopathy, ANN NEUROL 76: 792-801

ABIRISK: Hemmer, Bernhard et al. Role of the innate and adaptive immune responses in the course of multiple sclerosis, LANCET NEUROL 14: 406-419

ABIRISK: Warnke, Clemens et al. Natalizumab exerts a suppressive effect on surrogates of B cell function in blood and CSF, MULT SCLER J 21: 1036-1044

ABIRISK: Ringelstein, Marius et al. Long-term Therapy With Interleukin 6 Receptor Blockade in Highly Active Neuromyelitis Optica Spectrum Disorder, JAMA NEUROL 72: 756-763

ABIRISK: Diebold, Martin et al. Dimethyl fumarate influences innate and adaptive immunity in multiple sclerosis, J AUTOIMMUN 86: 39-50

ABIRISK: Quistrebert, Jocelyn et al. Incidence and risk factors for adalimumab and infliximab anti-drug antibodies in rheumatoid arthritis: A European retrospective multicohort analysis, SEMIN ARTHRITIS RHEU 48: 967-975

ABIRISK: Cassotta, Antonino et al. A single T cell epitope drives the neutralizing anti-drug antibody response to natalizumab in multiple sclerosis patients, NAT MED 25: 1402-+

ADAPTED: van der Lee, Sven J. et al. The effect of &ITAPOE&IT and other common genetic variants on the onset of Alzheimers disease and dementia: a community-based cohort study, LANCET NEUROL 17: 434-444

ADAPTED: van der Lee, Sven J. et al. Circulating metabolites and general cognitive ability and dementia: Evidence from 11 cohort studies, ALZHEIMERS DEMENT 14: 707-722

ADAPTED: Tynkkynen, Juho et al. Association of branched-chain amino acids and other circulating metabolites with risk of incident dementia and Alzheimers disease: A prospective study in eight cohorts, ALZHEIMERS DEMENT 14: 723-733

ADAPTED: Wevers, Nienke R. et al. A perfused human blood-brain barrier on-a-chip for high-throughput assessment of barrier function and antibody transport, FLUIDS BARRIERS CNS 15:

ADAPTED: van der Lee, Sven J. et al. A nonsynonymous mutation in PLCG2 reduces the risk of Alzheimers disease, dementia with Lewy bodies and frontotemporal dementia, and increases the likelihood of longevity, ACTA NEUROPATHOL 138: 237-250

ADAPTED: Moreno-Grau, Sonia et al. Genome-wide association analysis of dementia and its clinical endophenotypes reveal novel loci associated with Alzheimers disease and three causality networks: The GR@ACE project, ALZHEIMERS DEMENT 15: 1333-1347

ADAPTED: Cenini, Giovanna et al. Dissecting Alzheimers disease pathogenesis in human 2D and 3D models, MOL CELL NEUROSCI 110:

ADAPTED: Roberto, Natalia et al. Neuropsychiatric profiles and conversion to dementia in mild cognitive impairment, a latent class analysis, SCI REP-UK 11:

ADAPTED: de Rojas, Itziar et al. Common variants in Alzheimers disease and risk stratification by polygenic risk scores, NAT COMMUN 12:

ADVANCE: Pebody, R. et al. Effectiveness of seasonal influenza vaccine for adults and children in preventing laboratory-confirmed influenza in primary care in the United Kingdom: 2015/16 end-of-season results, EUROSURVEILLANCE 21: 41-51

ADVANCE: Karafillakis, Emilie et al. The benefit of the doubt or doubts over benefits? A systematic literature review of perceived risks of vaccines in European populations, VACCINE 35: 4840-4850

ADVANCE: Willame, Corinne et al. Incidence Rates of Autoimmune Diseases in European Healthcare Databases: A Contribution of the ADVANCE Project, DRUG SAFETY 44: 383-395

AETIONOMY: Auffray, Charles et al. Making sense of big data in health research: Towards an EU action plan, GENOME MED 8:

AETIONOMY: Domingo Gispert, Juan et al. Cerebrospinal fluid sTREM2 levels are associated with gray matter volume increases and reduced diffusivity in early Alzheimers disease, ALZHEIMERS DEMENT 12: 1259-1272

AETIONOMY: Gautier, Clement A. et al. The endoplasmic reticulum-mitochondria interface is perturbed in PARK2 knockout mice and patients with PARK2 mutations, HUM MOL GENET 25: 2972-2984

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