SOCIETAL IMPACT

of the Novo Nordisk Foundation's grant activities

Annual Impact Report

2019

Table of Contents

The Novo Nordisk Foundation´s vision is to contribute significantly to research and development that improves the lives of people and the sustainability of society.

Preface

The Novo Nordisk Foundation is an independent Danish foundation with corporate interests. We have two objectives: 1) to provide a stable basis for the commercial and research activities of the companies in the Novo Group; and 2) to support scientific, humanitarian and social causes.

This report informs on our contribution to research and society. It links our grant-giving in 2019 and the previous years to scientific outcomes and societal outcomes beyond science.

To fulfil our grant-giving objective, we support high-quality research, research talents, research hospitals and humanitarian and social causes through many different funding instruments. We consider our support as investments and since 2014, we have invested DKK 22 billion (€3 billion) in science and society. The Foundation has an ambition to strengthen research in Denmark and the Nordic countries while contributing to knowledge creation and growth that may pave the way for societal development and sustainable solutions.

Historically, the Foundation has supported physiological, endocrinological, metabolic and other medical research as well as research hospital activities within diabetes in Denmark; and other scientific, humanitarian and social purposes.

In our 2019–2023 strategy, we increase our payouts from 2019 to 2023 and support projects in a broad range of fields such as medical science, natural science, biotechnology, diabetes treatment, innovation, education, outreach and social and humanitarian causes, many of which illustrate the new, broader scope of the Foundation's grant-giving activities.

As a significant contributor of research funding to universities and research hospitals, we adopt a long-term perspective. Scientific research involves taking risks and achieving results can be time consuming. The Foundation supports high-quality projects and interdisciplinary research, since the greatest breakthroughs often occur when there is room for having great ambitions, collaborations and thinking new ideas.

Sections 1 and 2 describe our investments in society and people. They show how we contribute to the research environment by fostering the development of research talent, stimulating research collaboration and promoting the creation of new knowledge. Section 3 shows the extent to which the Foundation promotes excellent science. Sections 4 to 7 examine outcomes beyond science that directly help people and create growth. We explore how science creates start-ups and promotes innovation in society and the extent to which the results of our grants are used in education, the health sector and the humanitarian sector.

The overall conclusion is that our grant-giving activities make significant contributions to society in Denmark and abroad.

We hope you will enjoy reading this year's impact report.

Lars Rebien Sørensen
Chairman
Board of Directors
Novo Nordisk Foundation

The 2019 impact report
In brief

In this report, we monitor the Foundation's impact of our grant-giving activities to society. It consists of seven sections that study how our investments translate into scientific outcomes and outcomes beyond science. Our analysis focuses on the impacts in society of grants on research, innovation, patient care and humanitarian causes. Our grants for education, outreach and social causes will be analysed in future impact reports.

In 2018 and 2019, the Foundation's estimated share of the total investments in public research in Denmark reached 5.8% and 9.5%, respectively. This funding fostered more than 1,780 research talents (PhDs and postdoctoral fellows) and generated 4,100 jobs in science. The Foundation now funds 11% of all PhD students within the natural sciences (including biotechnology) and 18% of all PhD students within the biomedical and health sciences in Denmark.

Since 2017, the Foundation's grant recipients in science have produced 2,800 publications annually. In 2018, the Foundation-funded research publications represent nearly 6.5% of Danish journal articles; 61% of these were published with international co-authorship and 11% with industry co-authorship. Nearly 1 of 4 journal articles rank among the 10% most frequently cited articles worldwide. Moreover, 12% of the journal articles are cited in patent documents.

The Foundation-funded research is reported to be widely used in policy documents and in many higher education activities and for treating patients at hospitals. In relation to diabetes, cancer and cardiovascular diseases (some of the Foundation's historical focus areas), Foundation-funded research is cited in every fourth treatment guideline. The Foundation-funded Steno Diabetes Centres treated more than 27,000 patients in Denmark.

Further, in 2019, new knowledge generated by scientific grants from the Foundation has reached more than 22,000 students at higher education institutions. Outreach activities reached an audience of 300,000 people mainly in the Nordic countries. Finally, the Foundation's humanitarian grants which are awarded to humanitarian causes outside Denmark have helped more than 800,000 people worldwide since 2014.

Our research on the outcomes and impact of the Foundation's grants builds on extensive analysis of several data sources. First, we analyse data on the activities, outputs and outcomes of the grant recipients systematically collected through our two online data collection and reporting systems: researchfish® and Foundgood. In researchfish®, we have collected data on research grants since 2015, whereas Foundgood has been used for non-scientific project grants since 2019. The two systems enable us to systematically monitor the activities of our grant recipients and the results of their work. Since all grant recipients report annually, we have data on the full population with no attrition.

Second, to learn about the overall scientific contribution of the Foundation's grant recipients, we analysed data on the universe of publications from Web of Science, Scopus and Dimensions.

Third, to understand the use of research in industry and policy, we analysed multiple large-scale databases, including worldwide patent databases with more than 35 million patent applications and granted patents, 15,000 products in 25,000 patents and 800 clinical guidelines in Denmark and abroad. Fourth, and finally, we conducted extensive research of additional data collected through grant applications and reports from grant recipients.

Key impact

input, activities, output & outcome

Overall grant-giving

In 2019

DKK 4.9
billion awarded

DKK 3.6
billion paid out

9.5%
of public research was funded by the Foundation

Supporting people in science and knowledge creation

In 2019

4,100
jobs in science

1,780
PhDs and postdocs supported

2,800
new publications were published

61%
of journal articles published in 2014–2018 were co-authored with international collaborators

Promoting excellent research

In 2015–2017

23%
of journal articles published are among top 10% most frequently cited in the world

4%
of journal articles published are among top 1% most frequently cited in the world

60%
of the grants produced a journal article among the 10% most cited within their field

Research-based innovation

In 2019

18%
of Foundation-funded journal articles cited in patent applications or granted patents 9 years after their publication

11%
of journal articles published were co-authored with industrial researchers

11
new spinouts have been created

Education, outreach and policy contribution

In 2019

22,000
people reached by research-based educational activities taught or organised by grant recipients

300,000
people reached by scientific outreach activities (e.g. talks or workshops)

73
Foundation-supported members of guideline or policy committees

Health and patient care

In 2019

27,000
patients treated at Steno Diabetes Centres in Denmark

48
commercial products were found to be directly or indirectly linked to Foundation-funded journals published since 1994

54%
of clinical diabetes guidelines published cited Foundation-funded research

Humanitarian aid

In 2014-2019

800,000
people supported in Foundation-funded humanitarian crisis initiatives

500,000
of those people were supported by acute humanitarian interventions

45
countries reached by Foundation-funded humanitarian interventions

1

Section 1

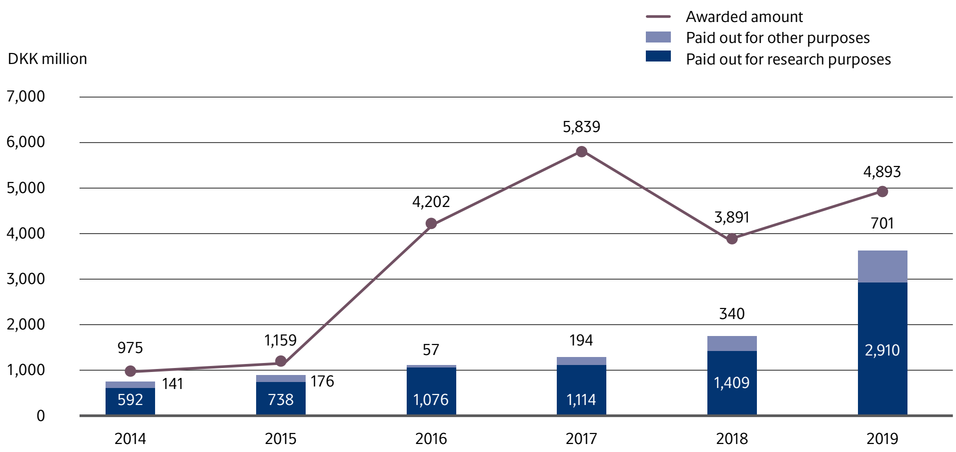
Investing in knowledge and society

This section documents how much the Foundation invests in knowledge and society through a variety of grant instruments. It shows that from 2014 to 2019, the total grant-amount awarded and payout increased fivefold (Figure 1.1), implying that the Foundation's share of funding of total public research expenditure in Denmark is growing.

Investing in knowledge and society
The Foundation has four grant-giving models and several grant instruments (see page 11). As part of the Foundation's strategy, the total payout has increased for all grant-giving models and grant instruments used by the Foundation between 2014 and 2019.

Figure 1.1

Grants and payouts from the Novo Nordisk Foundation, 2014–2019



Note: The awarded amount is defined as the amount of money awarded for new grants within a year.
Payout is the amount of money paid to grant recipients each year because of a grant decision in the same or earlier years.

Source: Novo Nordisk Foundation.

The Foundation's four grant-giving models and grant instruments:

- Open competition:
  - Projects: 0-3 years (up to DKK 3 million)
  - Programmes: small programmes 3-5 years (DKK 3 million to 20 million), and large programmes 5-7 years (DKK 20 million to 60 million)
  - Investigator grants: 5-year grants (DKK 10 million)
  - Scholarships, PhD fellowships and postdoctoral fellowships (up to DKK 4 million)
  - Innovation grants (DKK 0.75 million to 7.5 million)
  - Symposia and prizes such as Novo Nordisk Foundation Symposia, teacher prizes, Novo Nordisk Prize, Novozymes Prize and other prizes (up to DKK 7 million)
  - Infrastructure grants (DKK 5 million to 25 million)

- Strategic awards, research centres and infrastructure:
  - Large infrastructure: stand-alone grants such as the Danish National Biobank, Danish National Genome Centre and MAX IV Laboratory (up to DKK 1 billion)
  - Research centres: >5 years (DKK 50 million to 2 billion)
  - Stand-alone grants such as project grants, programme grants, professorship grants etc. (up to DKK 100 million)

- Partnerships:
  - Public-private such as Steno Diabetes Centres (up to DKK 3 billion)
  - Private-private such as the Danish Refugee Council's Jordan-initiatives and the World Diabetes Foundation initiatives on noncommunicable diseases (up to DKK 120 million)

- Own initiatives to benefit society: BioInnovation Institute and LIFE (Learn – Ideas – Fascination – Experiment)

The changes in payout reflect both a broader interpretation of our articles of association, as stated in the 2019–2023 strategy, and an increase in the number and size of the grants. For instance, payouts for partnerships have increased from DKK 117 million in 2014 to DKK 980 million in 2019. This increase is related to the establishment of the five Steno Diabetes Centres (research hospitals) in Denmark. Other examples are the payments for our open competition initiatives (Table 1.1).

Table 1.1

Payout according to grant instruments in open competition, 2014 and 2019 (DKK million)

Grant instrument in open competition	2014	2019
Fellowship	9.0	96.5
Infrastructure	0.0	62.6
Investigator	74.1	240.2
Innovation	10.7	64.4
Programme	0.0	351.5
Project	132.5	467.8
Symposia and prizes	1.5	9.4

Source: Novo Nordisk Foundation. See https://novonordiskfonden.dk/wp-content/uploads/Grant-Rapport-2019.pdf.

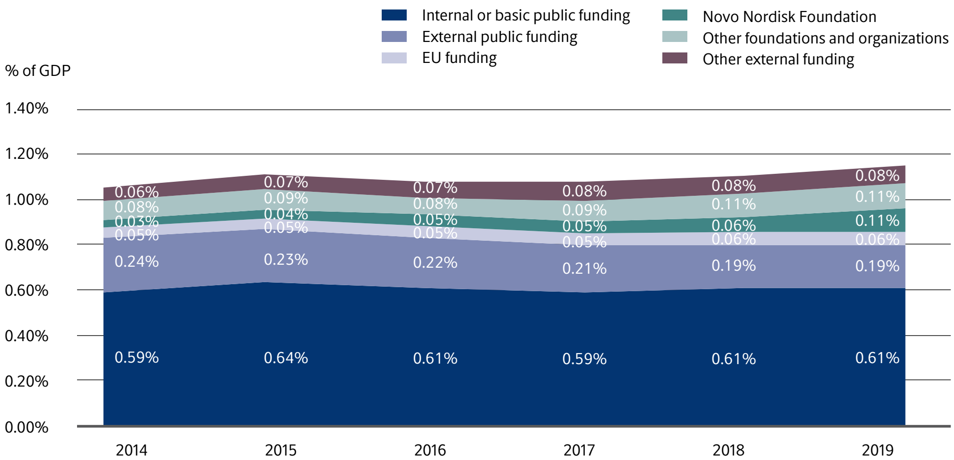
Contribution to public research

The Foundation's contribution to total public sector research investment in Denmark reached an estimated 9.5% in 2019 of a total of DKK 25.9 billion (see bit.ly/nnf-public-research-funding). This means that we contribute to 22% of public research spending in Denmark within the biomedical and health sciences, 5% within the natural sciences, 1% within the engineering/ technical sciences and 2% within the humanities (the Foundation funds art research and art history research).

The Foundation is one of many private foundations and organizations supporting public research in Denmark. In 2019, the Foundation's share of public research was an estimated 0.11% of gross domestic product (GDP), up from 0.03% of GDP in 2014 (Figure 1.2). In comparison, all other foundations and organizations' share was 0.11% of GDP in 2019.

Figure 1.2

Public research expenditure in Denmark according to sources (% of GDP)



Note: Internal or basic funding covers the institutions' own funding (e.g. through prioritization or inkind-resources at hospitals) or block funding at public research institutions (i.e. sector research institutes and universities). External public funding covers public research councils. Other external funding covers domestic and foreign companies, and other foreign sources. The ratio of funding by Danish organizations and foundations to the funding from Danish companies is 5 to 1.

Source: Statistics Denmark and Novo Nordisk Foundation

Contribution to research and humanitarian activities outside Denmark

Twenty percentage of the Foundation's grants (DKK 778 million, € 110 million) and 15% of the Foundation's payouts (DKK 542 million, € 73 million) in 2019 were for research and humanitarian activities and institutions outside Denmark. The Foundation has standing committees of independent national and international experts that receive applications for research and innovation activities in the other Nordic countries (Finland, Iceland, Norway and Sweden). Many of the research grants include applicants or co-applicants from outside Denmark. More than 60% of the research grants awarded include international project collaboration.

The Foundation's grant-awarding leads to actions that support all of the 17 Sustainable Development Goals. Most grants are relevant to up to three Sustainable Development Goals each. The Foundation's Grant Report 2019 shows the number of grants and the awarded amounts in 2019 that support the Sustainable Development Goals, See https://novonordiskfonden.dk/wp-content/uploads/Grant-Rapport-2019.pdf.

Section 2

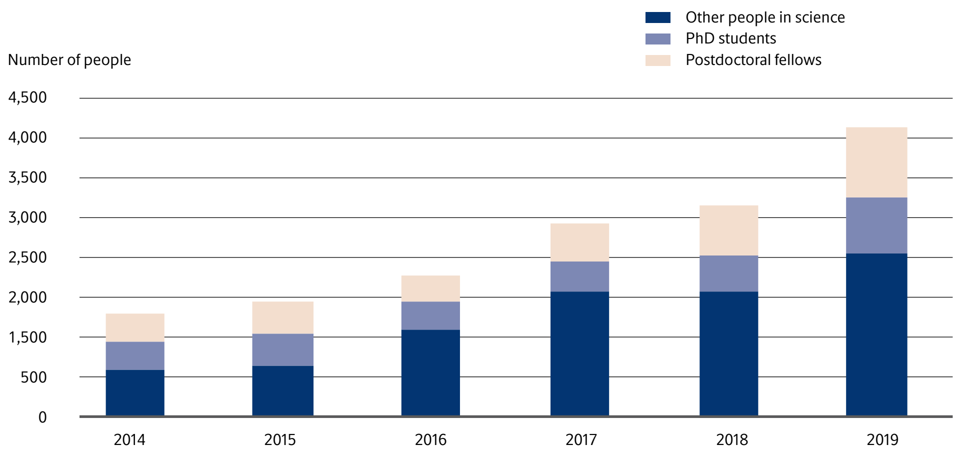
Research talent and knowledge creation

This section illustrates how the Foundation supports the development of researchers and outlines the fields of research to which they are contributing. It shows how the Foundation's support has increased in terms of career stages, expanding the range of scientific fields and increased the volume of research.

2.1 People in scientific activities

The Foundation aims to support the development of talents and that institutions can attract talented researchers from other countries at all career stages to Denmark. In 2019, the Foundation fully or partly funded 4,087 people within science or research hospital settings. The direct support for people within science has been steadily increasing since 2014. Figure 2.1 shows the distribution between fully or partly funded postdoctoral fellows, PhD students and other grant recipients and team members working on grants.

Figure 2.1 Number of people supported fully or partly by the Foundation, 2014–2019



Note: Other people in science includes assistant, associate, and full professors as well as technical and administrative staff.
Sources: Novo Nordisk Foundation/researchfish®.

Figure 2.2 shows the number of people funded fully or partly by the Foundation, distributed between early career researchers and more senior researchers. The share of young researchers among Foundation-supported people in science increased by 11 percentage points from 2018 to 2019, supporting the notion that the Foundation supports the development of young research talents in the early career stages. The researchers are either individual grant recipients or employed full- or part-time by the recipients of the Foundation's partnership grants, programme grants, project grants, investigator grants or centre grants.

Figure 2.2 People funded fully or partly by the Foundation grants in 2018 and 2019

Note: Young researcher means mainly PhD students, postdoctoral fellows and assistant professors; senior researchers mean associate professors and full professors. Other personnel cover a broad category of technicians, administrative personnel, physicians, etc.

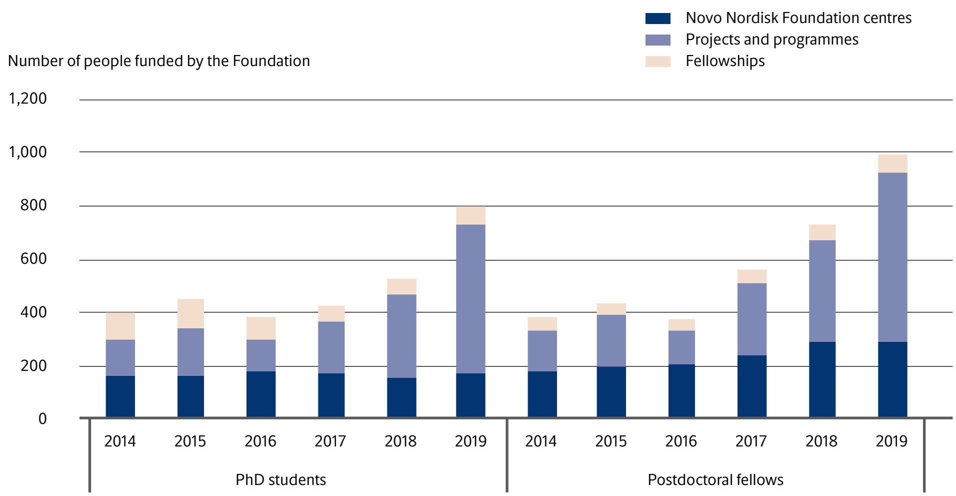
Sources: Novo Nordisk Foundation/researchfish®.

Recruiting people from outside Denmark
The four research centres at the Danish universities which are supported by the Foundation have recruited 51% of their scientific personnel from outside Denmark - of which 70% are PhD students and postdoctoral fellows. The Steno Diabetes Centres have recruited 7% of the personnel from abroad. Research teams funded by the Foundation's research programme grants, investigator grants and research project grants often recruit PhD students and postdoctoral fellows from abroad to work on their grant. The Foundation has three open competition programmes that aim to attract research talent at different career stages to Denmark: Novo Nordisk Foundation Laureate Research Programme, Young Investigator Programme and International PhD programme. These programmes have attracted 48 researchers to Denmark since 2014.

PhDs and postdoctoral fellows
Figure 2.3 shows PhD students and postdoctoral fellows according to grant type. The number of current PhD students and postdoctoral fellows fully or partly funded by Foundation grants has grown from nearly 400 for each category in 2014 to 791 and 989, respectively, in 2019. The number of PhD students increased by 50% and postdoctoral fellows by 36%, compared with 2018.

Figure 2.3

Postdoctoral fellows and PhD students in progress supported by Foundation grants, 2014–2019



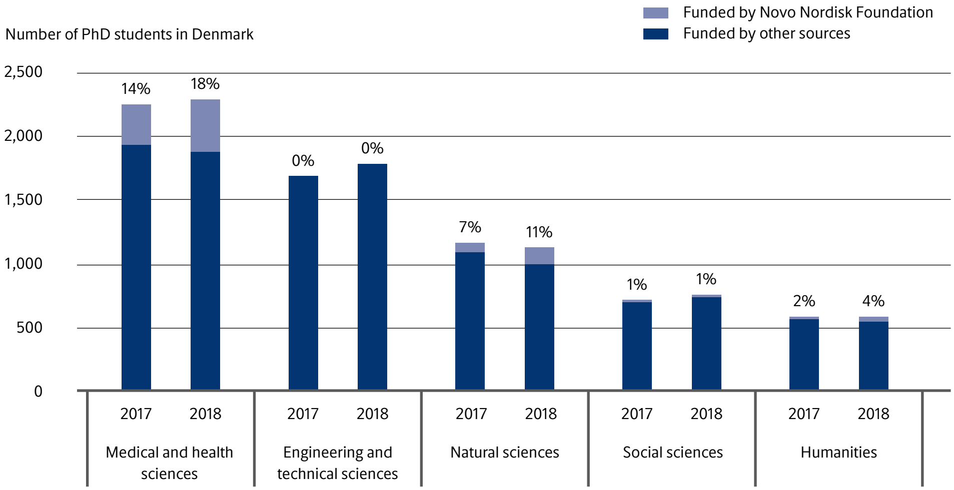
Sources: Novo Nordisk Foundation/researchfish®.

PhD students in the six fields of science in Denmark

The Foundation's strategy contains an ambition to gradually increase payouts. This ambition can be seen in the growth of funded PhD students and postdoctoral fellows. In 2018, the Foundation supported 6% of a total of 9,142 active PhD students in Denmark. The Foundation's share of supported PhD students increased from 2017 to 2018 (Figure 2.4).

Figure 2.4

Number and share of Foundation-funded PhD students in progress within fields of science

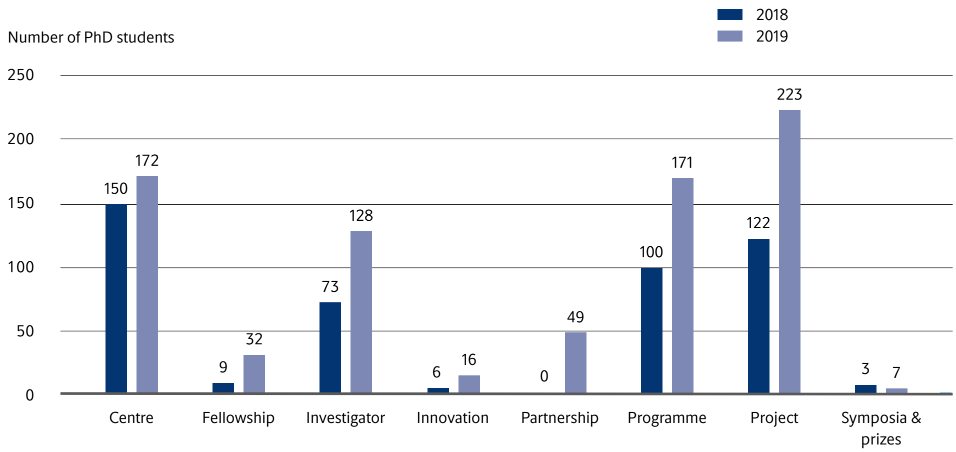


Sources: Novo Nordisk Foundation/researchfish®.

Figure 2.5 shows the PhD students in progress supported by the Foundation's grant instruments. The data shows that the number of PhD students in progress financed by Foundation grants is increasing across all grant instruments.

Figure 2.5

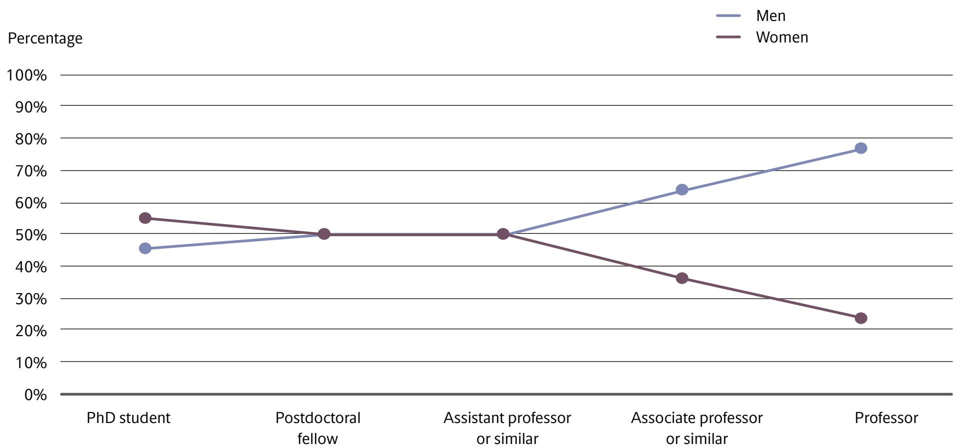
PhD students in progress supported by the Foundation's grant instruments, 2018–2019



Sources: Novo Nordisk Foundation/researchfish®.

Figure 2.6

Gender distribution for people supported fully or partly by the Foundation in 2019



Note: The data included in the figure are for employees at the four research centres funded by the Foundation and team members on Foundation grants either fully or partly funded by the grant.

Source: Novo Nordisk Foundation.

Gender diversity

Figure 2.6 shows the gender distribution for the more than 4,000 people in science fully or partly funded by Foundation grants, 56% of these are men. The highest percentage of women among the researchers is found below the associate professor level. This reflects the situation at the universities (see Danmarks talent barometer 2018, www.ufm.dk). The Foundation has adopted a diversity policy in 2019 (see www.novonordiskfonden.dk) that aims to support diversity among grant recipients.

2.2 Journal articles across fields of science and countries

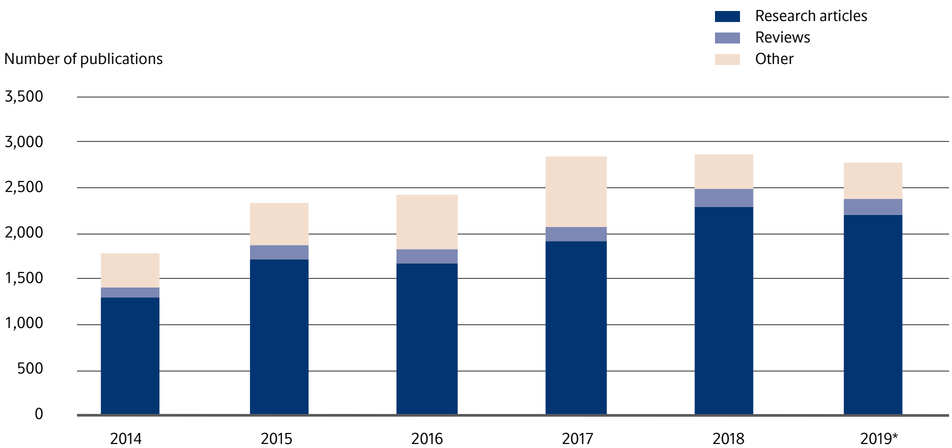
The Foundation aims to support research excellence, research collaboration and knowledge creation in all fields of science. In 2019, grant recipients have reported almost 2,800 publications. Because the recipients of Foundation grants typically obtain additional funding and multiple authors contribute to a publication, the Foundation does not exclusively fund all these publications.

Creating knowledge by producing journal articles

Of the publications published from 2014 to 2019 funded by the Foundation, about 80% were journal articles (research articles and reviews) and 20% were other publications, such as policy papers, technical reports, letters and book chapters (Figure 2.7).

Figure 2.7

Total number of publications published by recipients of Foundation grants, 2014–2019

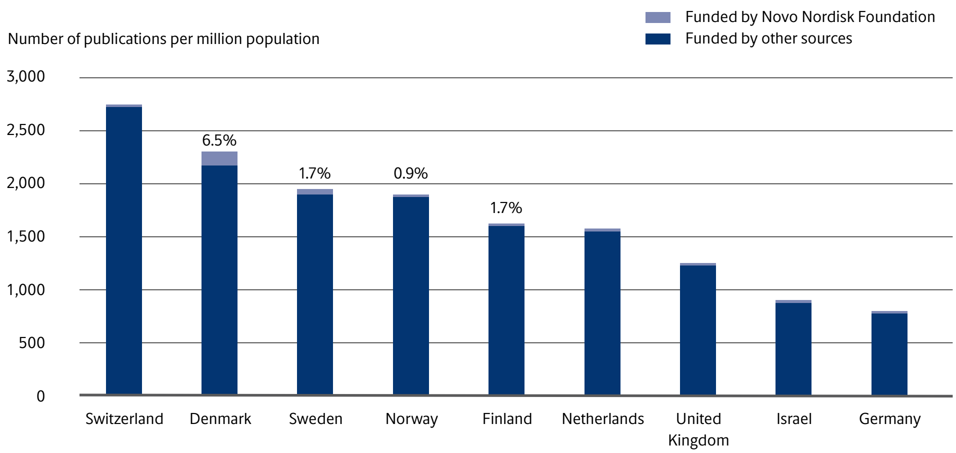


Note: *) Preliminary estimate. The actual figure is likely to be higher, since every year in January grant recipients also report publications they have previously omitted.

Sources: Novo Nordisk Foundation/researchfish®.

Researchers in Denmark published more journal articles per million population in 2018 than researchers in most other countries. Only researchers in Switzerland published more articles per million population (Figure 2.8). Recipients of Foundation grants published 240 publications per million population, or 6.5% of the published journal articles with authors based in Denmark. Further, the scientific impact of the journal articles funded by Foundation grants are very high (see section 3).

Figure 2.8 Number of publications per million population in selected countries, 2018, and the Foundation-funded share of publications in the Nordic countries

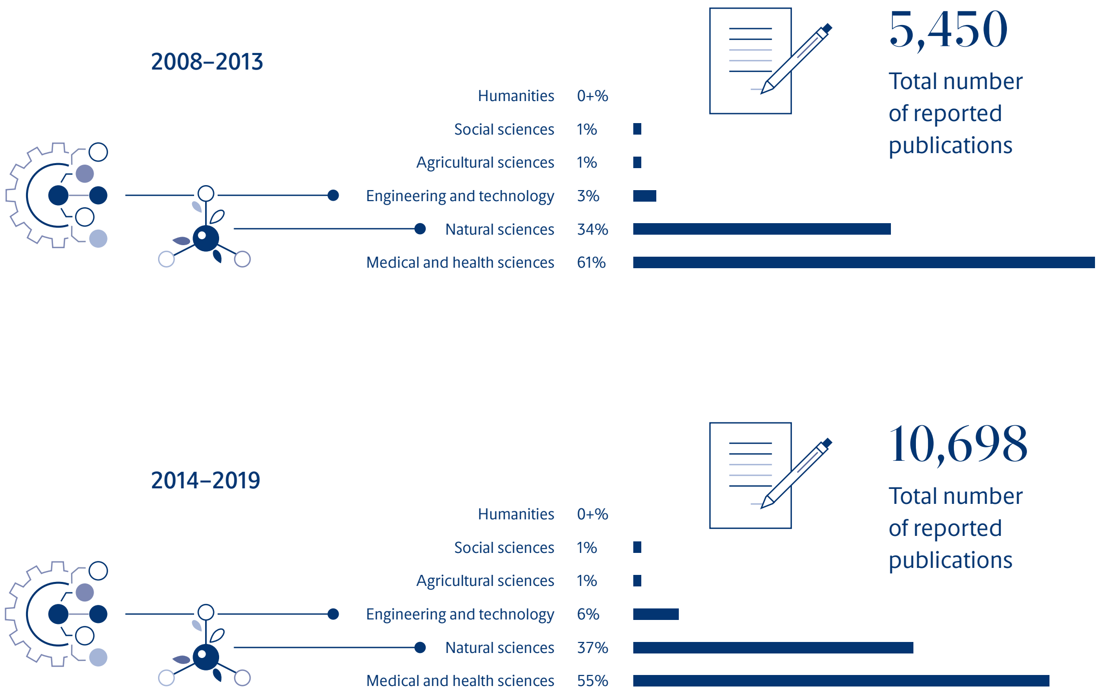


Sources: Novo Nordisk Foundation/stats.oecd.org and Danish Centre for Studies in Research and Research Policy.

Fields of science for journal articles

Compared with the previous six-year period (2008-2013), the number of journal articles published between 2014 and 2019 has almost doubled but the distribution according to science fields has not changed markedly. This is in line with the Foundation's former strategy 2014-2018 and its general strategy to strengthen the research community. In the recent period, the medical and health sciences (55%) constituted the most common field for Foundation-funded journal articles, followed by the natural sciences (37%) and engineering and technology (6%). The number of published journal articles for the remaining fields is small and accounts for 2% of all Foundation-funded journal articles (Figure 2.9).

Figure 2.9 Number of journal articles within science fields, 2008–2013 and 2014–2019



Note: The classification of articles is based on aggregating the journal classification used in Web of Science to the OECD field of science.
Sources: Novo Nordisk Foundation/researchfish®.

2.3 Research collaboration

This section describes the co-authorship patterns of journal articles, which shows how researchers work. The patterns show that the share of international co-authorship in Foundation-funded journal articles is high. Research collaboration transcends national borders and can involve both public and private researchers and collaboration between disciplines (interdisciplinary collaboration).

National and international collaboration on journal articles
The proportion of articles co-authored with international researchers have increased from 54% in 2008–2013 to 61% in 2014–2018 (Table 2.1). This proportion is higher than the share of international co-authorship for all Danish journal articles in 2014-2018, which is 55% (www.leidenranking.com).

Table 2.1 Number of journal articles by co-authorship, 2008–2013, 2014–2018

	2008-2013		2014-2018	
Academic co-authorship	Number of articles	% of articles	Number of articles	% of articles
With international research institutions	2,640	54%	4,927	61%
With national research institutions	1,306	27%	1,907	24%
No cross-institutional collaboration	930	19%	1,207	15%
Total	**5,475**	**100%**	**8,869**	**100%**
Co-authorship with industry	599	11%	835	11%

Note: The articles categorized as 'co-authored' in Web of Science include: 1) articles co-authored with researchers from two or more national academic research institutions only, 2) articles co-authored with researchers from international, academic research institutions, and 3) articles co-authored with researchers from companies. The rest of the journal articles are categorized as no co-authorship and comprise journal articles with a single author or with authors from the same organization.
Sources: Novo Nordisk Foundation/researchfish® and Danish Centre for Studies in Research and Research Policy.

Interdisciplinary collaboration on publications
Interdisciplinary collaboration on publications requires that different academic specialities cooperate. 57% of the journal articles authored by the recipients of Foundation grants are published by authors from 2-4 scientific fields. (Figure 2.10). And 93% of the articles have authors from more than one academic specialization (Figure 2.11). The support to interdisciplinarity was part of the Strategy 2014-2018, but interdisciplinarity has gained even more focus in Strategy 2019–2023.

The co-authors' background determines whether an article is monodisciplinary or interdisciplinary. The definition of an interdisciplinary journal collaboration is based on 1) the researchers´ finely grained academic specializations and 2) on the higher level of OECD field of science.

Figure 2.10

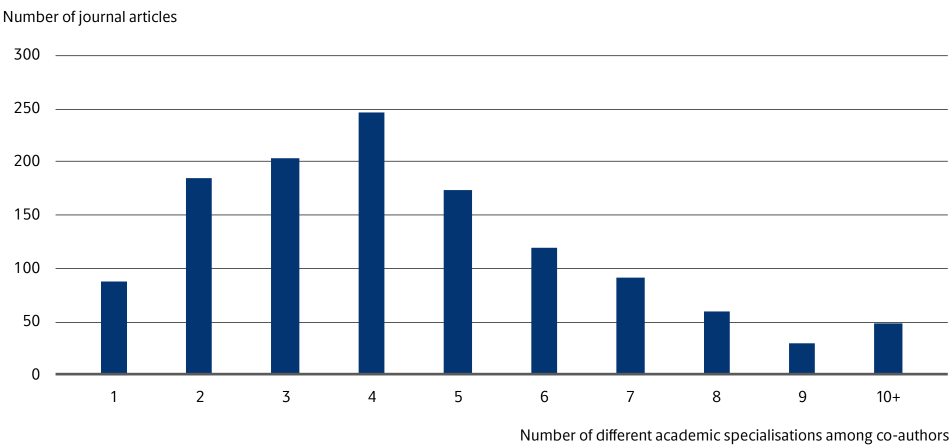
Share of journal articles by number of fields of science among co-authors in a sample of Foundation-funded journal articles

The sample includes 1,215 (20%) journal articles from 2015-2018 funded by the Foundation

Sources: Novo Nordisk Foundation and DAMVAD Analytics.

Figure 2.11

Journal articles by number of academic specializations among co-authors



Note: Sample of 1,215 journal articles from 2015-2018 funded by the Novo Nordisk Foundation.
Sourcs: Novo Nordisk Foundation and DAMVAD Analytics.

The analysis comprises a 20% sample of 1,215 journal articles by researchers with a Foundation grant and covers the years 2015-2018. Of the 1,215 journal articles, 687 are interdisciplinary at the level of the OECD fields of science and technology, and 93% of the articles in the sample have authors within multiple scientific fields and academic specializations (Figure 2.11).

Section 3

Using knowledge in academic research

This section describes how Foundation-funded new knowledge is disseminated and used within academic research. It demonstrates that foundation-funded journal articles have high citation impact. Further, the numbers of journal articles among the world's top 1% and top 10% within their field and year have increased substantially in the past 10 years.

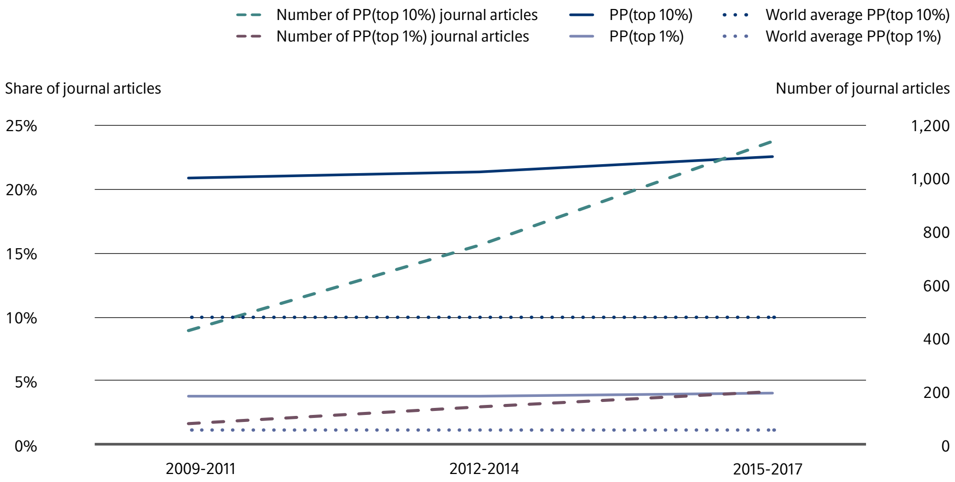
3.1 Overall citation impact

The Foundation tracks the share of Foundation-funded journal articles among the 1% and 10% most frequently cited journal articles worldwide within their field and year by using the indicators PP(top 1%) and PP(top 10%). Figure 3.1 illustrates that the Foundation-funded articles have high citation impact. Despite the increasing number of articles produced over the years, Foundation-funded research maintains a steady fraction (4%) of the top 1% of global research according to this citation impact measure. Further, 23% of the journal articles (1,139 articles) are in the top 10% most frequently cited journal articles in 2015–2017. For comparison, the Danish citation impact is about seven percentage points lower, corresponding to 16% for the same period.

The high citation score is worth noting, also in relation to the change in profile of the people represented by Foundation grants. In 2009, the Foundation supported about 1,000 people in science partly or fully, with a share of 16% PhD students and postdoctoral fellows. In 2017, the Foundation supported 2,740 people, with PhD students and postdoctoral fellows comprising 35%, which is more than a doubling (Figure 2.1).

Figure 3.1

Number and share of journal articles by Foundation grant recipients among the top 1% and 10% most frequently cited journal articles in the world, 2009–2017



Note: To form three- year periods, the first publication year is 2009 instead of 2008, as is standard in the report. Numbers are weighted around the 1st and 10th percentile.

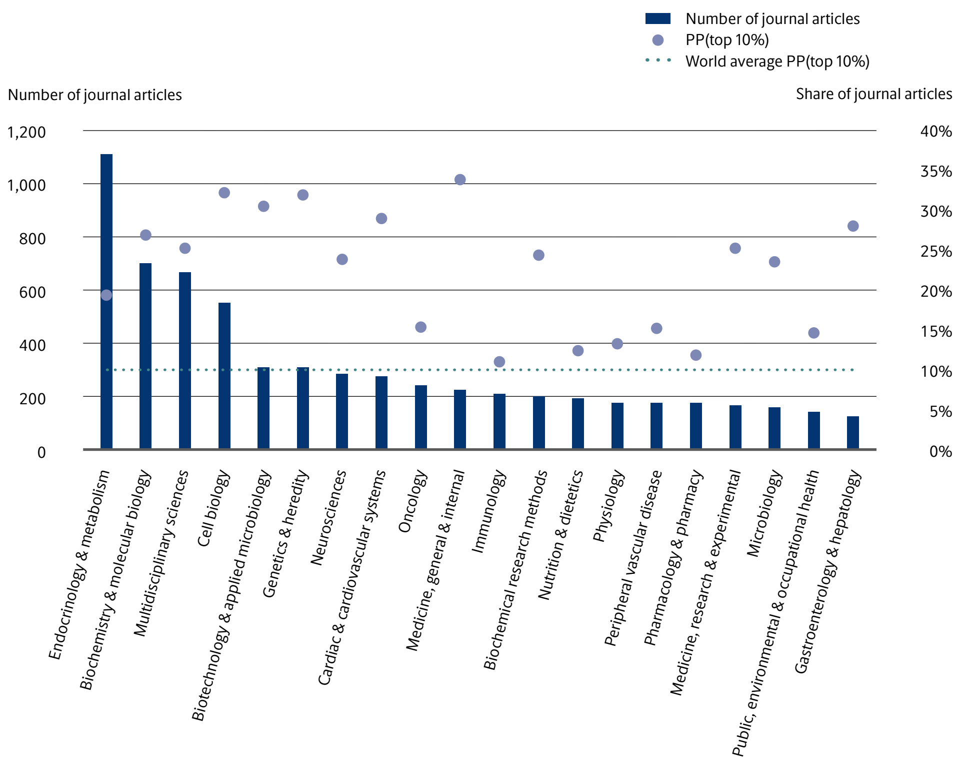
Sources: Novo Nordisk Foundation/researchfish® and Danish Centre for Studies in Research and Research Policy.

Figure 3.2 shows the number of journal articles and the distribution across the specific journal subject categories for the 10% most frequently cited journal articles as defined by Web of Science for 2014–2017. The 20 most frequently used Web of Science subject categories for Foundation-funded journal articles published in 2014–2017 have citation impact scores above the 10% world average.

The 20 most frequently used categories are in accordance with the general strategy of the Foundation, which aims to strengthen the research community over a broad range of science fields but with relative emphasis on the medical and health sciences. More than half the Foundation-funded journal articles pertain to the medical and health sciences. Furthermore, as a result of the Foundation's historical grant-awarding activities, most journal articles are published within endocrinology and metabolism (1,117 articles), with a citation impact score of 1.9 times the world average within this field, while medicine, general and internal, has the highest citation impact score, with 3.4 times the world average within this field (Figure 3.2).

Figure 3.2

Number of Foundation-funded journal articles and share of journal articles by journal subject category among the top 10% most frequently cited in the world – PP(top 10%), 2014–2017



Note: The 20 most frequently used Web of Science subject categories are sorted according to the number of Foundation-funded articles, descending from the left to the right. Each article can be represented in more than one category.
The numbers are weighted around the 1st and 10th percentile.

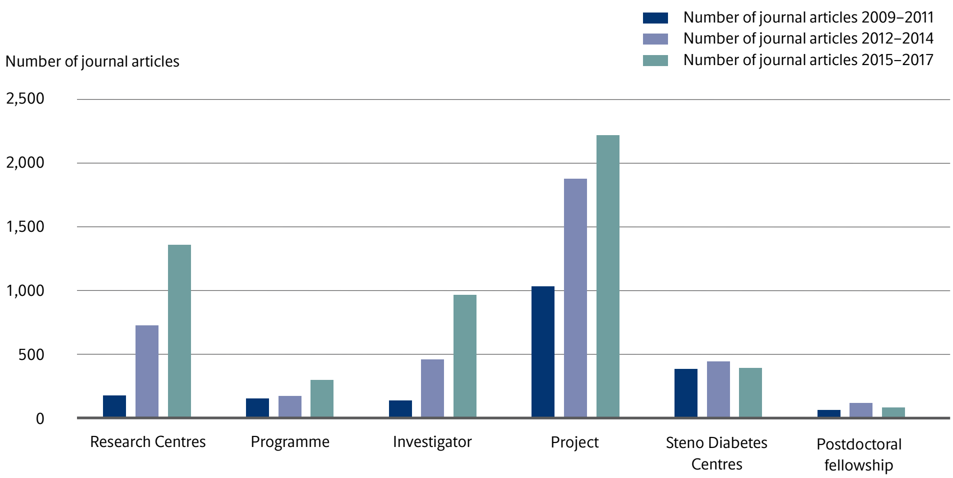
Sources: Novo Nordisk Foundation/researchfish® and Danish Centre for Studies in Research and Research Policy.

3.2 Variation in citation impact

Even though the general citation impact is steady, the number of journal articles published has increased rapidly, as shown in the previous section (Figure 2.9). Furthermore, breaking down the citation impact by grant instrument reveals various trends and a large variation between the individual grant instruments over long time periods.

Figure 3.3a and 3.3b show the number of journal articles and the distribution according to grant instruments and the share among the world's 10% most frequently cited journal articles for 2009–2011, 2012–2014 and 2015–2017. Research programme grants and postdoctoral fellowships both increased their share of the world's 10% most frequently cited journal articles by 10-16 percentage points in 2015–2017 versus 2012–2014, whereas the Foundation's research centres' share of the 10% most frequently cited articles declined by 3 percentage points in the same period, equalling the level of the programme grants.

Figure 3.3a Number of journal articles distributed on grant instruments

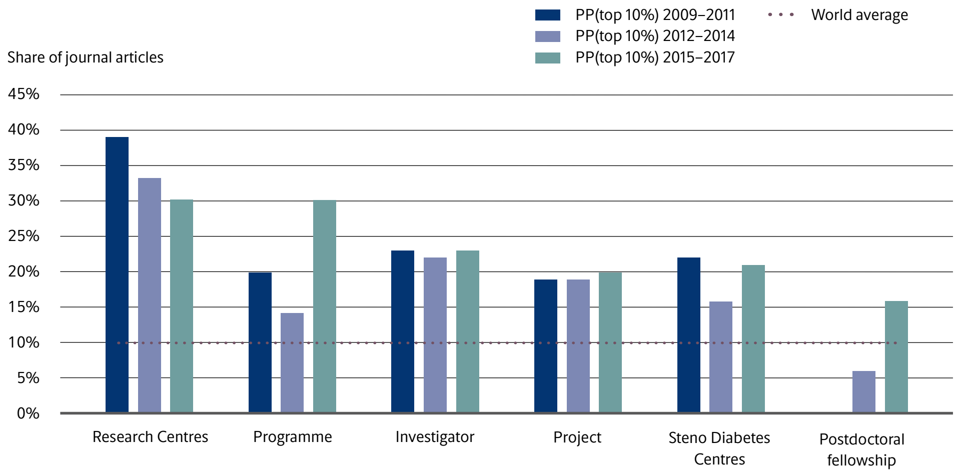


Note: Figures 3.3a and 3.3b cover selected grant instruments of the Foundation. The grant instruments are sorted according to their share of journal articles in PP(top 10%) for 2015–2017, descending from left to right.

Sources: Novo Nordisk Foundation/researchfish® and Danish Centre for Studies in Research and Research Policy.

Figure 3.3b

PP(top 10%) distributed on grant instruments



Note: Figures 3.3a and 3.3b cover selected grant instruments of the Foundation. The grant instruments are sorted according to their share of journal articles in PP(top 10%) for 2015–2017, descending from left to right. The grant instruments in 3.3b are only represented where publication output is sufficient for citation impact analysis.

Sources: Novo Nordisk Foundation/researchfish® and Danish Centre for Studies in Research and Research Policy.

Citation analysis generally shows that most journal articles are rarely cited, a few are relatively frequently cited and a few of the frequently cited articles are disproportionately highly cited. These properties of citations also apply to the articles funded by the Foundation. However, the high-performing journal articles, by citation measures, are not limited to a select group of high-performing research teams. Earlier studies by the Foundation has demonstrated that among open-competition grants, 60% of the funded research teams produce a journal article among the 10% most frequently cited worldwide within their field and year. One-third of these teams, or 20% of all grants analysed, also produce zero-citation journal articles, highlighting that the wide citation spread found in aggregate data also exists at the grant team level. (See Societal Impact of Novo Nordisk Foundation grants 2018 for the full analysis; numbers here are on an expanded sample of 384 research teams).

Section 4

From new knowledge to research-based innovation

This section focuses on channels of transferring knowledge from public research to innovation in companies. It shows that the degree of commercialization of Foundation-funded research is high. This is shown by analyzing grantees' collaboration with industrial researchers, establishment of research-based spinouts and use of Foundation-funded knowledge in patents.

4.1 Co-authoring of journal articles with industrial researchers

Table 4.1 shows that 60% of the journal articles co-authored by recipients of Foundation grants and industrial researchers in 2014–2019 contributed to research within medical and health sciences, and 35% contributed to research within natural sciences (mainly within biological sciences) . Of the Foundation-supported journal articles published in 2014–2019 by grant recipients, 11% (1,307 articles) were co-authored with industrial researchers.

Table 4.1 Distribution of Foundation-funded journal articles by field of research for all journal articles and for journal articles co-authored by industrial researchers, 2014–2019

Field of research (two-digit) (Dimensions)	Field of science (OECD)	Share of all journal articles	Share of journal articles co-authored with industrial researchers
Medical and Health Sciences	Medical and Health Sciences	67%	60%
Biological Sciences	Natural sciences	26%	33%
Chemical Sciences	Natural sciences	2%	2%
Engineering & technology (jointly)	Engineering & technology	2%	2%
Other fields of research	Residual (all sciences)	3%	2%

Notes: Using text mining, Digital Science Dimensions classifies individual articles according to field of research (based on the Australian and New Zealand Standard Research Classification (ANZSRC) and is widely compatible with OECD Field of Science at the two-digit level). Multiple classifications per article can occur. The field contributions per article are therefore adjusted using equal weighting.

Sources: Novo Nordisk Foundation, Digital Science Dimensions and DAMVAD Analytics 2020.

Table 4.2 shows how Foundation-funded journal articles co-authored with industrial researchers are distributed by detailed fields of research. The articles contribute to clinical sciences (29%), biochemistry (17%) and genetics (14%) accounting for 60% of the research contributions made (see column 1).

The table also includes distributions for journal articles co-authored with industrial researchers from the bio-technology and pharmaceutical industries. These industries account for 39% and 32% of the co-authored journal articles, respectively. Within these two industries, the journal articles co-authored by industrial researchers and the recipients of Foundation grants are predominantly within clinical sciences, genetics and biochemistry and cell biology (see columns 2 and 3 in Table 4.2). The differences in distribution indicate that biotechnology companies co-authoring articles with recipients of Foundation grants focus on earlier stage innovation to some degree: more genetics and less clinical sciences.

Table 4.2

Distribution of Foundation-funded journal articles by detailed field of research for journal articles co-authored by industrial researchers, 2014–2019

		Share of journal articles co-authored with industrial researchers employed in:	
Detailed field of research (four-digit) (Dimensions)	Share of all journal articles **(1)**	the biotech industry **(2)**	the pharmaceutical industry **(3)**
Clinical Sciences	29%	26%	32%
Biochemistry and Cell Biology	17%	18%	12%
Public Health and Health Services	7%	2%	4%
Genetics	14%	21%	7%
Cardiorespiratory Medicine and Haematology	5%	5%	5%
Oncology and Carcinogenesis	4%	6%	3%
Neurosciences	4%	4%	4%
Immunology	3%	5%	3%
Paediatrics and Reproductive Medicine	2%	2%	2%
Microbiology	2%	1%	1%
Pharmacology and Pharmaceutical Sciences	2%	2%	3%
Other fields of research	11%	8%	24%

Note: We used Digital Science Dimensions to classify articles according to Field of Research (based on ANZSRC and widely compatible with OECD Field of Science at two-digit level). Multiple classifications per article occur, so field contributions per article are adjusted using equal weighting. 12% of the articles are within other fields of research not shown in the table.

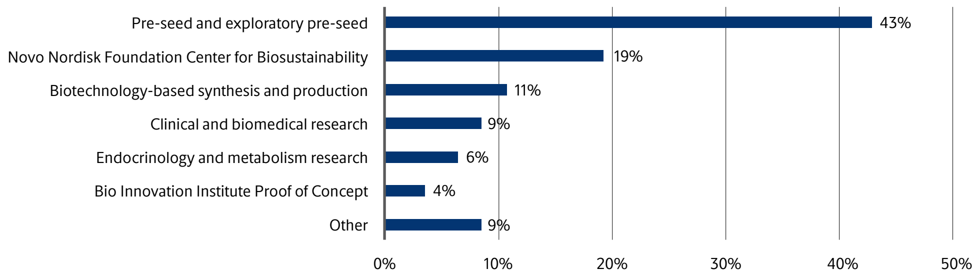
Sources: Novo Nordisk Foundation, Digital Science Dimensions and DAMVAD Analytics 2020.

4.2 Patent activities based on Foundation-funded research

In 2014–2019, recipients of Foundation grants have so far reported published patent applications or granted patents on 143 occasions, amounting to 126 distinct documents as some grants report the same patent document. In 2019, 11 patent applications or granted patents are currently reported, which is lower than the approximately 30 per year reported for the years 2016–2018.

The 2019-number is expected to increase in the coming years, because inventions are kept secret for as long as possible, which limits the opportunities for disclosing and reporting recent inventions to the public. The majority of the patenting activity reported by recipients of innovation grants (Pre-seed and exploratory pre-seed grants and BioInnovation Institute Proof of Concept), which targets public researchers aiming to commercialize their research findings (see Figure 4.1).

Figure 4.1 Share of patent applications and granted patents filed by grant recipients, 2014–2019



Note: BioInnovation Institute has offered Proof of Concept since 2019.
Sources: Novo Nordisk Foundation/researchfish®.

Of the 126 distinct patent documents, 19 are reported as licensed and 10 are reported to be active as "commercial in confidence".

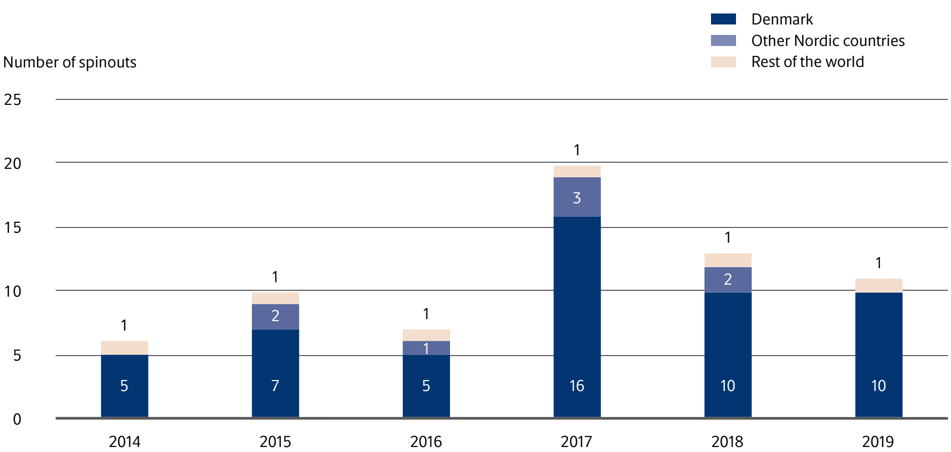
4.3 Spinouts based on Foundation-supported research

Recipients of Foundation grants also report the establishment of spinout companies based on Foundation-funded research. In 2014–2019, 67 established spinouts were reported, of which 53 were in Denmark (Figure 4.2).

The 2018- and 2019-figures are preliminary. Of the 20 spinouts established in 2017, 14 were reported at the earliest opportunity, two spinouts were reported with a 1-year delay, and four spinouts were reported with a 2-year delay. For the 13 spinouts reported established in 2018, six were reported with 1-year delay and seven were reported at the earliest opportunity.

Figure 4.2

Number of spinouts based on Foundation-funded research and innovation, 2014–2019



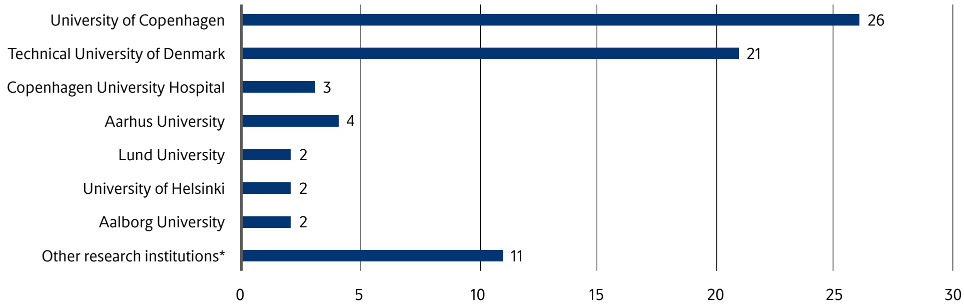
Note: Due to the delayed reporting of spinouts we expect the reported number of spinouts established in 2018 and 2019 will prove to be higher. The total number of spinouts is 67.

Sources: Novo Nordisk Foundation/researchfish®.

Of the spinouts in 2014–2019, 44 (70%) distinct spinouts came from the University of Copenhagen or the Technical University of Denmark, three of which were reported by both universities (see Figure 4.3). These two universities are also the largest beneficiary institutions of Foundation funding for research and innovation.

Figure 4.3

Number of spinout companies from research institutions in the Nordic countries based on Foundation-funded research, 2014–2019



Note: *Other research institutions include institutions reporting only one spinout each in 2014-2019. The total comes to 71 spinouts, since two or more research institutions can report the same spinout. The distinct total is 67 spinouts.

Source: Novo Nordisk Foundation/researchfish®.

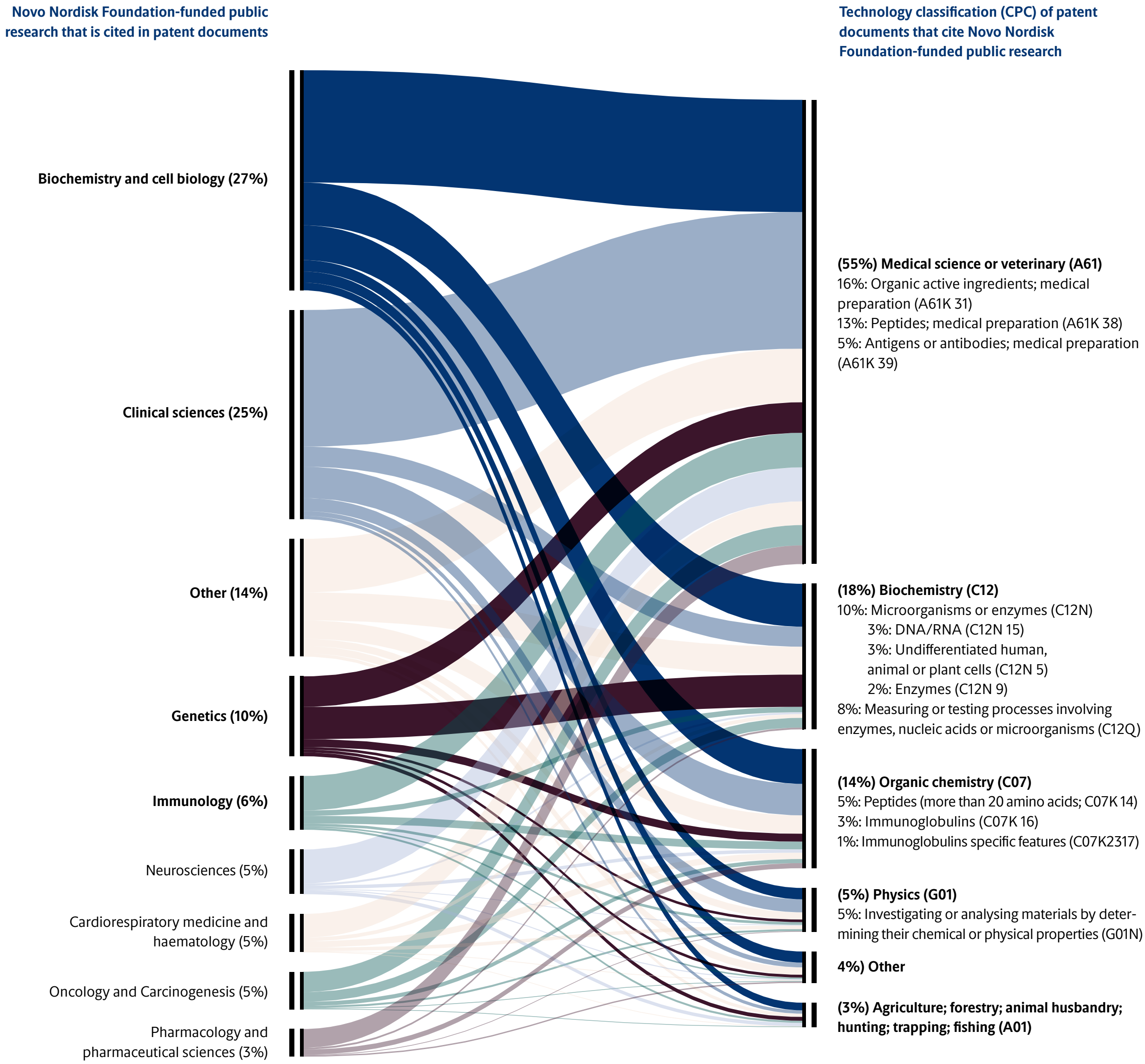
4.4 Foundation-funded journal articles cited in patents

Patent citations provide a measure illustrating the extent to which research knowledge is directly relevant to knowledge deemed to have commercial value. The analysis in this section shows that at least 18% of all Foundation-funded journal articles are cited by patent applications and granted patents (patent documents) within 5 to 9 years of publication. Currently 1,624 journal articles are cited in 4,756 patent documents belonging to 3,255 patent families. This implies that 10% of all Foundation-supported journal articles published in 2019 and earlier are currently cited in patent documents. Patent documents based on academic-level research often cite journal articles when illustrating the context and describing the research on which the patent builds.

How Foundation-supported research areas and patent technology areas are matched

Figure 4.4 illustrates which field of research the cited journal articles contribute to and what type of patent technology area they map into. The results of this investigation are that 27% of the research fields identified for journal articles cited in patents and patent applications are within biochemistry and cell biology, 25% within clinical sciences and 10% within genetics. The most common technologies of the patent documents that cite the grant recipients' research are within "medical or veterinary science" (55%), "biochemistry" (18%) and "organic chemistry" (14%).

Figure 4.4 Foundation-funded public research cited in patent documents and the technologies of the patent documents citing them



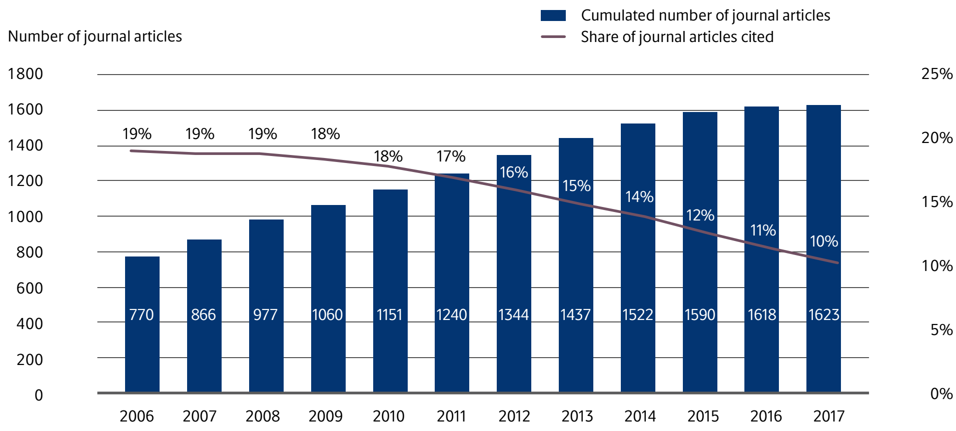
Note: The left side of the figure shows the percentage distribution of the fields of research of Foundation-funded journal articles cited in patent documents. The right side of the figure shows the percentage distribution of technologies (Cooperative Classification System, CPC) of the patent documents that cite Foundation-funded journal articles. The first three CPC codes listed in ordered sequence on a patent document are used to classify the main technologies.

Sources: Novo Nordisk Foundation/researchfish®, Digital Science Dimensions and European Patent Organisation DOCDB.

Identifying use of research in inventions typically takes at least 5-9 years
Measuring patent documents that refer to Foundation-supported research takes time. First, a journal article must be published. Second, a patent application must cite it, and third, the patent application must be published before we can observe it. Patent applications and granted patents currently cite 10% of the journal articles based on Foundation-funded research[1]. However, this is an underestimate of the citation rate. The median elapsed time from a Foundation-supported journal article is published until it can be observed in a published patent application is 5 years and 9 years for granted patents. Adjusting for this time lag, our analysis finds that at least 18% of all Foundation-funded journal articles are cited in patent documents (cf. the 2010-estimate in figure 4.5).

Figure 4.5

The share of Foundation-supported journal articles cited in patent documents depending on the latest journal article publication year analysed

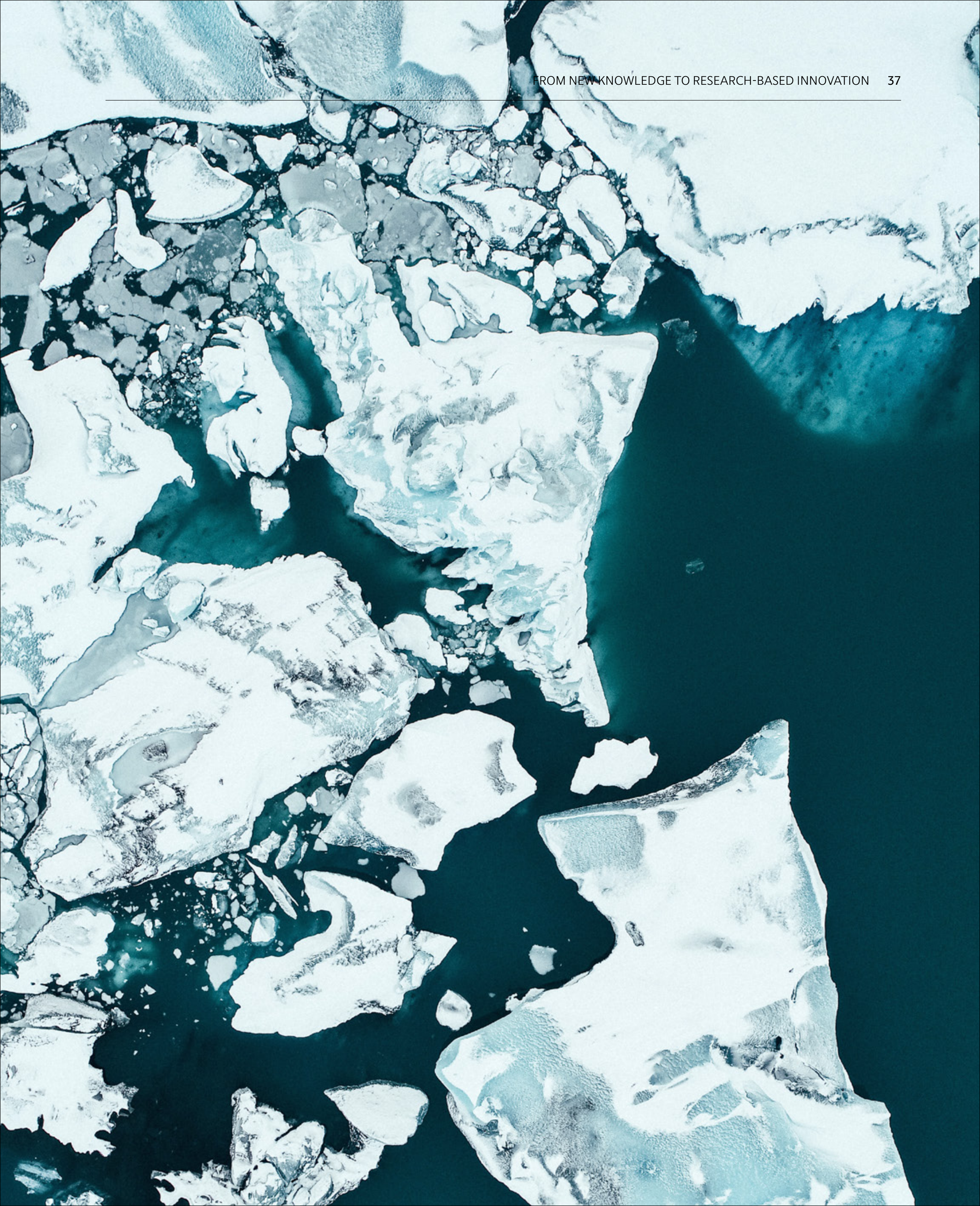


Note: The cumulated number of journal articles for a year sums up the number of journal articles published in that year and all previous years (back to 1947). In 2010 and earlier, 1151 journal articles (18% of all) are cited in patent documents as of end of 2019. The patent documents citing Foundation-supported research were retrieved through an API search in Digital Science Dimensions.

Sources: Novo Nordisk Foundation/researchfish®, Digital Science Dimensions and European Patent Organisation DOCDB.

Figure 4.5 shows the estimated patent citation rate when limiting the analysed sample to a latest publication year. Restricting the sample to articles published in 2010 and earlier retains 1,151 of the 1,623 journal articles identified in 2017 and earlier years (back to 1947). The estimated share of Foundation-supported journal articles cited in patent documents is the 18% referred to earlier, almost double the estimated share using the full sample.

[1] Earlier studies, using a different approach, showed that an identified citation rate of 7% in patent documents was three times the comparable world average rate (based on a matching, stratified sample of 5,000 journal articles within the same fields and years; see Societal Impact of Novo Nordisk Foundation Grants 2018).



Section 5

Using knowledge in education, outreach and policy

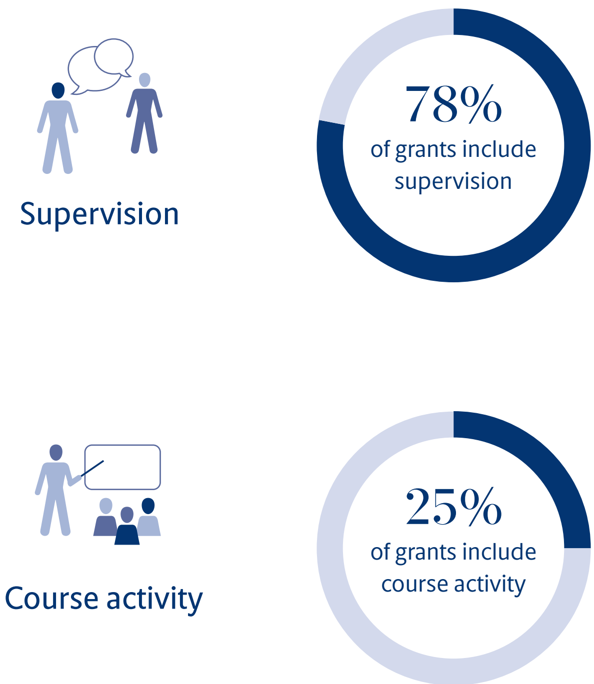
To improve people's lives, it is important that new insights from research are disseminated across society. Dissemination of research findings happens through many channels. This section examines the extent to which the Foundation-funded researchers supervise and teach graduate and undergraduate students, disseminate their research beyond academia and inform policy practice. We show that a large share of the Foundation-funded research delivers knowledge to education, policy and the general public.

5.1 Research-based educational activities by grant recipients

Grant recipients may transfer their knowledge and skills by supervising graduate and undergraduate students and through course activities. This section analyses the extent to which grant recipients report that they have carried out education activities in connection with their grant activities. The reported education activities from grants active in 2019 are analysed. In the Strategy 2019–2023, the Foundation has increased its focus on education and has established a committee for education and outreach, which awards grants within this focus area. As these grants have not yet reported outputs and outcomes, they are not included in the analysis. The analysis shows that the Foundation's grants contribute to educating students and researchers and, to a lesser extent, others. In 2019, education activities by Foundation-supported researchers have reached 22,000 people.

Most Foundation-funded research projects include teaching activities targeting people within academia. Nearly 4 of 5 grants included supervision in 2019 (Figure 5.1), and about 1 in 4 grant recipients report having taught a course or having been responsible for organizing one. Although projects with formal course activities comprise a smaller share than those involving supervision, many of the 204 projects that included course activities as part of their research grant organized or taught multiple courses (an average of 2.4 courses).

Figure 5.1 Most Foundation-funded research grants include education activities in 2019

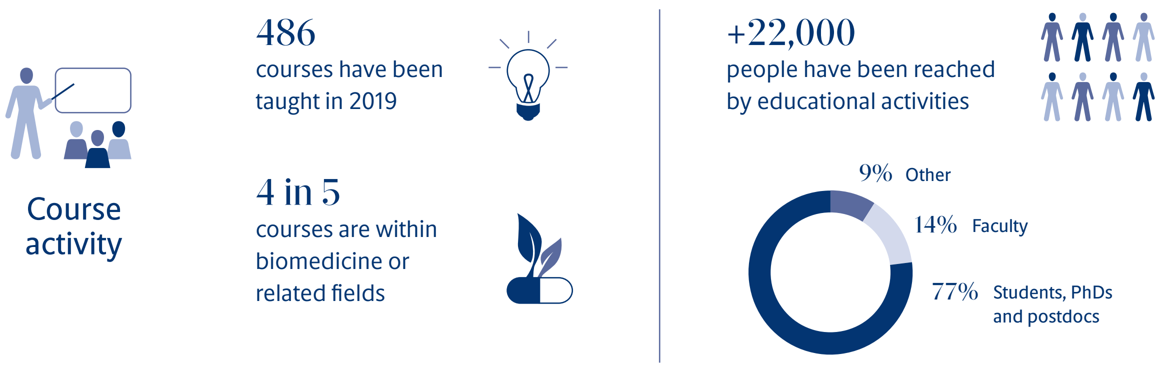


Note: The analysis is based on 811 active grants in 2019. Steno Diabetes Centres are not included.
Sources: Novo Nordisk Foundation/researchfish®.

In total, 486 courses were organized or taught in 2019, reaching an audience of more than 22,000 people (Figure 5.2). Although no information is available on whether these courses covered material from the grant recipients' research grants, we can analyse the content of the courses. A total of 82% of the courses were within biology, biomedicine, pharmacology, physiology or health. The remaining courses mainly fall within art research and art history research, nanoscience and plant science or general training (such as presentation skills, research leadership and how to write a thesis).

Analysis of the target groups of the educational activities shows that most of the courses targeted higher education, from BSc to the post-doctoral level: 77% of the people reached were students, PhD students or post-doctoral researchers and 14% were faculty. Less than 1 in 10 were people outside universities such as patients or professionals. Additional analysis shows that 83% of the courses taught or organized were lectures and 75% of the courses targeting universities enabled students to earn ECTS credits.

Figure 5.2 Foundation-funded course activities reach many people



Note: The analysis is based on 811 active grants in 2019. Steno Diabetes Centres are not included.
Sources: Novo Nordisk Foundation/researchfish®.

5.2 Research-based outreach activities by grant recipients

The Foundation-funded research is disseminated in society beyond educational activities. This section shows that outreach activities supported by the Foundation reached an audience of more than 300,000 in 2019, the largest of which were professional practitioners and industry.

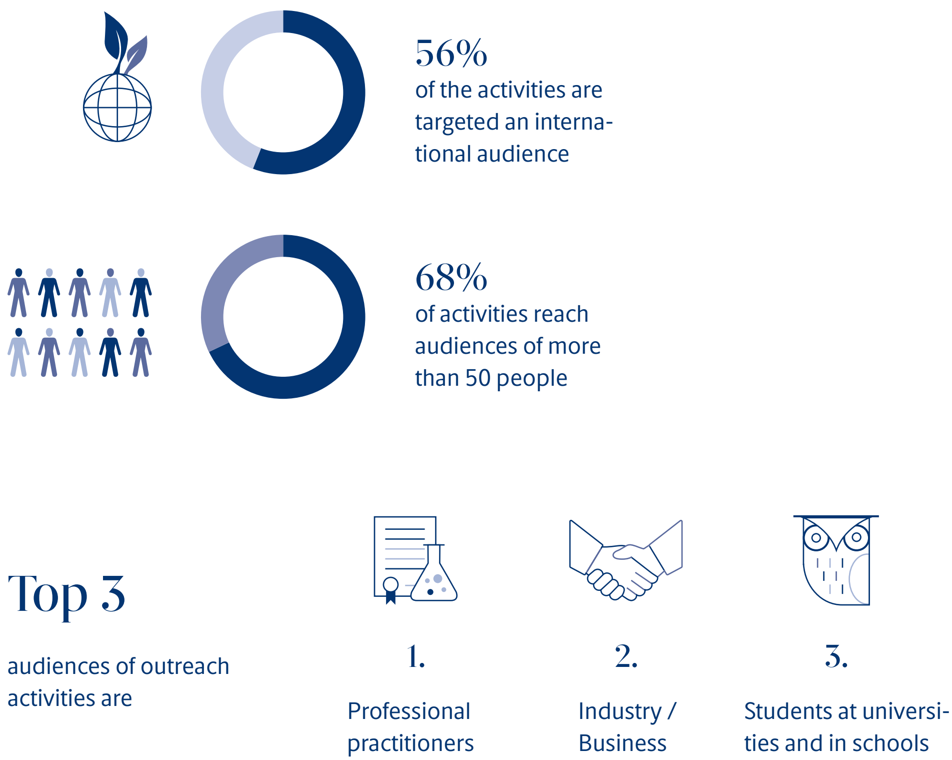
The Foundation supports outreach activities in society through two channels. First, the Foundation directly funds outreach activities such as conferences, seminars and prize symposia. In 2019, the Foundation awarded 74 grants for such outreach activities. Second, Foundation-funded research that includes outreach alongside research activities constitutes an indirect way by which the Foundation supports the dissemination of knowledge to the wider society. Grant recipients reported that 28% of the Foundation's active research grants had dissemination activities (Figure 5.3). These outreach activities resulted in more than 1,400 activities. Breaking down the outreach activities by type, the grant recipients disseminated their knowledge primarily through talks (39%), workshops (19%) or press releases (15%).

Figure 5.3 Foundation-funded grants led to 1,450 dissemination activities in 2019

Note: The analysis is based on active grants in 2019.
Sources: Novo Nordisk Foundation/researchfish®.

Figure 5.4 shows the audiences targeted by the outreach activities. Interestingly, more than half of the activities reached an international audience. About 7 out of 10 of the activities reached an audience of more than 50 people. The activities reached an estimated overall audience of 341,000. A total of 29% of the outreach activities targeted practitioners as the primary audience, and 20% targeted the private sector. Although only 3% of the activities listed politicians and policymakers as their primary audience, this figure rises to about 40% once secondary audiences are included.

Figure 5.4 Outreach activities primarily targeted international audiences and large groups



Note: The analysis is based on active grants in 2019. Steno Diabetes Centres are not included.
Sources: Novo Nordisk Foundation/researchfish®.

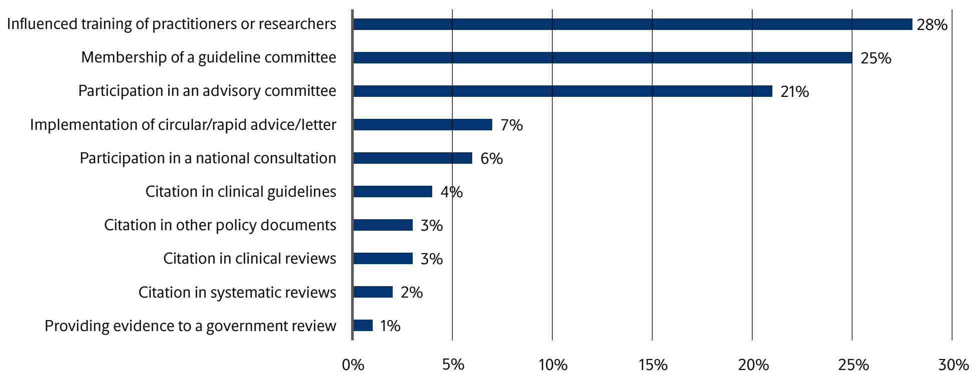
5.3 Contributions to policy and practice by grant recipients

Informing policy is an important aspect of the impact of science. This section shows that Foundation-supported researchers have informed policy-making as members of guideline or policy committees, where they advise and present evidence to government institutions or other authorities.

The grant recipients may advise or present evidence to government institutions and other public authorities in their role as subject experts. They can also contribute to training practitioners and researchers or develop and revise clinical guidelines with recommendations for clinicians on diagnosing, treating and managing diseases. The grant recipients reported a total of 305 such contributions in the period 2015-2019. The number of reported policy-related activities has increased steadily during this period (73 activities were reported in 2019). 28% reported participating in an advisory committee, 25% being members of a guideline committee, and 21% contributing to training practitioners or researchers. The other activities cover a wide range of advisory functions (Figure 5.5).

Figure 5.5 The 305 contributions to practice, guidelines and advisory functions in 2015–2019

Policy



Note: The grant recipients reported 305 contributions reported by 127 grants during 2015, 2016, 2017, 2018 and 2019.
Sources: Novo Nordisk Foundation/researchfish®.

Section 6

Using knowledge in the health sector

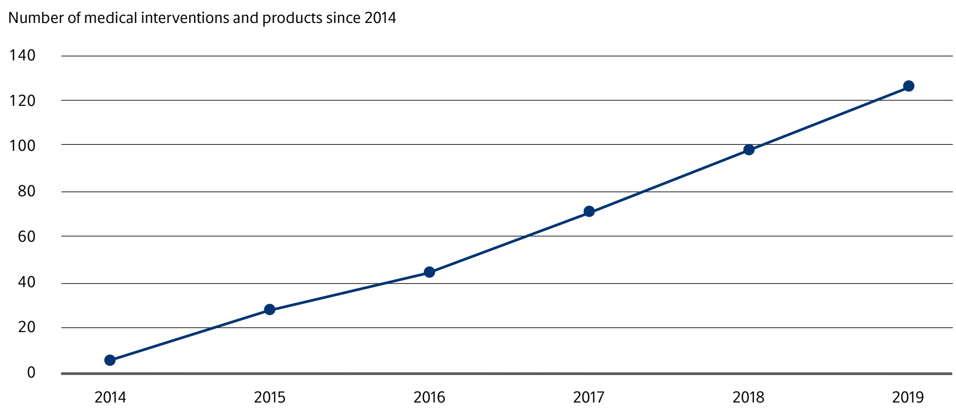
This section presents the results of Foundation-supported grants that turn research and discoveries into medical interventions, new technologies, treatments for diseases, clinical trials, health interventions and diagnostics, products and clinical guidelines. Historically, the Foundation has supported research in biomedicine and biotechnology as well as research hospital activities within diabetes and has had its largest grants within these areas. Since biomedicine and biotechnology are the cornerstones of many parts of the health sector, we anticipate and find major outputs and outcomes at many levels throughout this sector.

6.1 Medical interventions and products

The Foundation funds researchers who invent novel medical interventions and products. Since 2014, 113 grant recipients have reported a total of 126 medical interventions and products (Figure 6.1).

Figure 6.1

Number of cumulative medical interventions and products in Foundation-funded grants, 2014–2019

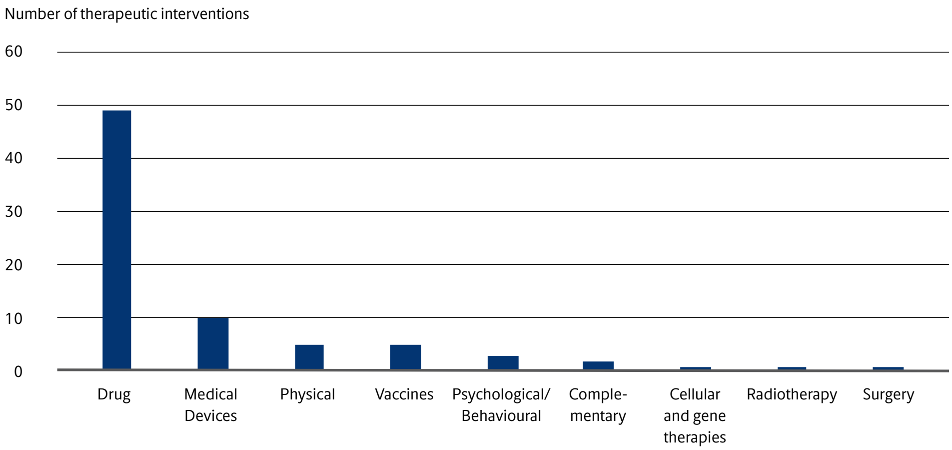


Sources: Novo Nordisk Foundation/researchfish®.

Of the medical interventions reported in 2014–2019, 60% are therapeutic interventions, meaning interventions that directly interact with patients. Of these, 49 are drugs, 10 are medical devices, 5 are vaccines and 13 cover all other types of therapeutic interventions (Figure 6.2).

Figure 6.2

Therapeutic interventions, 2014–2019

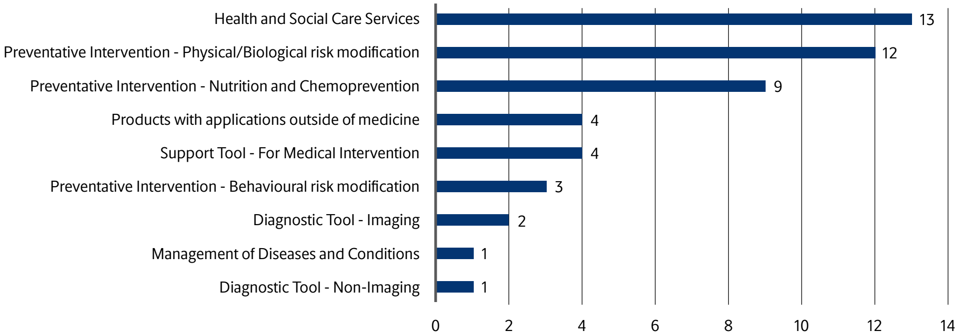


Sources: Novo Nordisk Foundation/researchfish®.

Through medical interventions and products, the Foundation's grants can have a significant impact on health and patient care. One example reported by grant recipients is the invention of a novel way of administering cancer medication. The grant recipients developed a new biodegradable drug-delivery system that has shown very promising therapeutic strategies for cancer therapy and will ultimately ease the treatment for people with cancer. Diagnostic tools, management of diseases and preventive interventions are other examples of frequent medical products and interventions (Figure 6.3).

Figure 6.3

Other medical interventions and products, 2014–2019

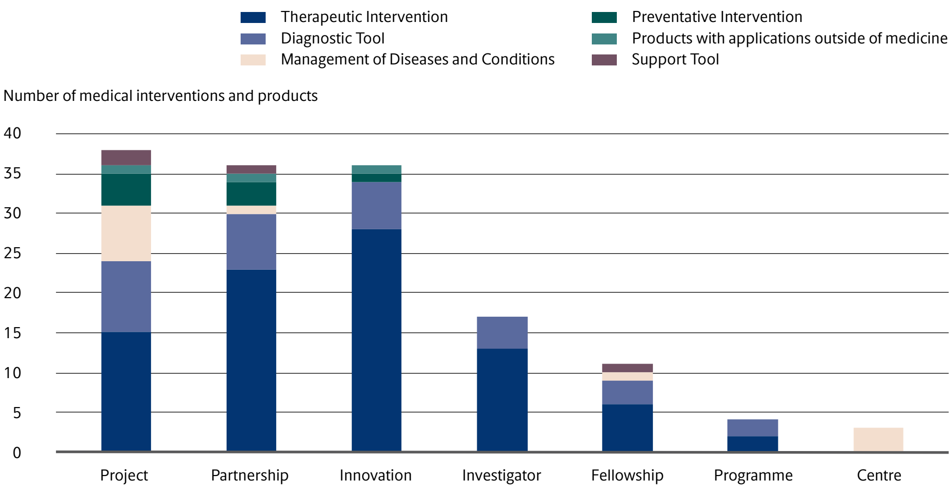


Sources: Novo Nordisk Foundation/researchfish®.

Most medical interventions and products are reported by the recipients of project, partnership and innovation grants, with innovation grants reporting the highest number of therapeutic interventions. Project grants report most solutions for management of diseases and diagnostic tools followed by partnerships (Figure 6.4).

Figure 6.4

Medical interventions and products by type of grant, 2014–2019



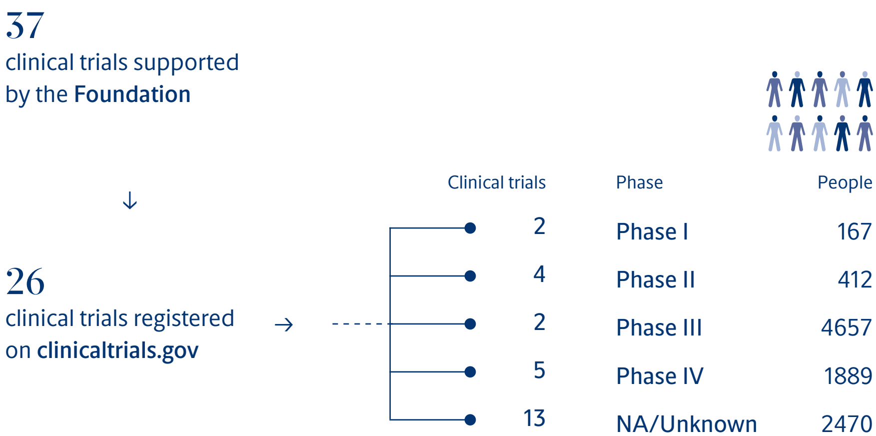
Note: Centre grants are not represented, since the individual grants recipients at the centres have reported medical interventions and products and have been counted as their classification.

Sources: Novo Nordisk Foundation/researchfish®.

6.2 Clinical trials

The Foundation funds researchers who are involved in conducting clinical trials. In 2014–2019, grant recipients reported a total of 37 clinical trials, of which 26 are registered in the United States clinical trial registry clinicaltrials.gov (a database). The 26 clinical trials registered on clinicaltrials.gov were analysed further. 18 of the clinical trials were conducted in Denmark. In total, 9,596 people are enrolled in the 26 clinical trials. Medical interventions go through several clinical trials before being approved for the market. Grant recipients have reported clinical trials in all the different phases, with NA/unknown, which also covers observational clinical trials, as the most frequent phase (Figure 6.5).

Figure 6.5 Clinical trials funded by the Foundation, 2014–2019



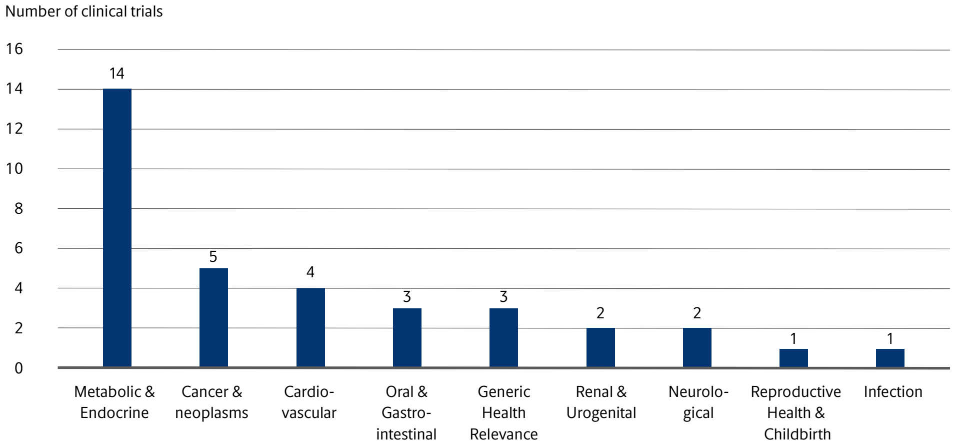
Note: Clinicaltrials.gov is the United States´ clinical trials registry. Any clinical trial which is in any way connected to the United States must be registered. Phase 1 is the first test involving humans, with the main goal of testing the safety of the intervention in a small number of subjects. Phase 2 trials study the efficacy in a larger group of people (up to a few hundred). Phase 3 trials are large-scale (several thousands of people) randomised trials and the final trial phase before regulatory approval. Phase 4 trials are post-marketing surveillance trials.

Sources: Novo Nordisk Foundation/researchfish® and clinicaltrials.gov.

The clinical trials reported by grant recipients are mostly within the health category Metabolic and Endocrine (one of the Foundation's historical focus areas), which includes diabetes and obesity, comprising 54% of the total trials (Figure 6.6).

Figure 6.6

Health categories for clinical trials, 2014–2019

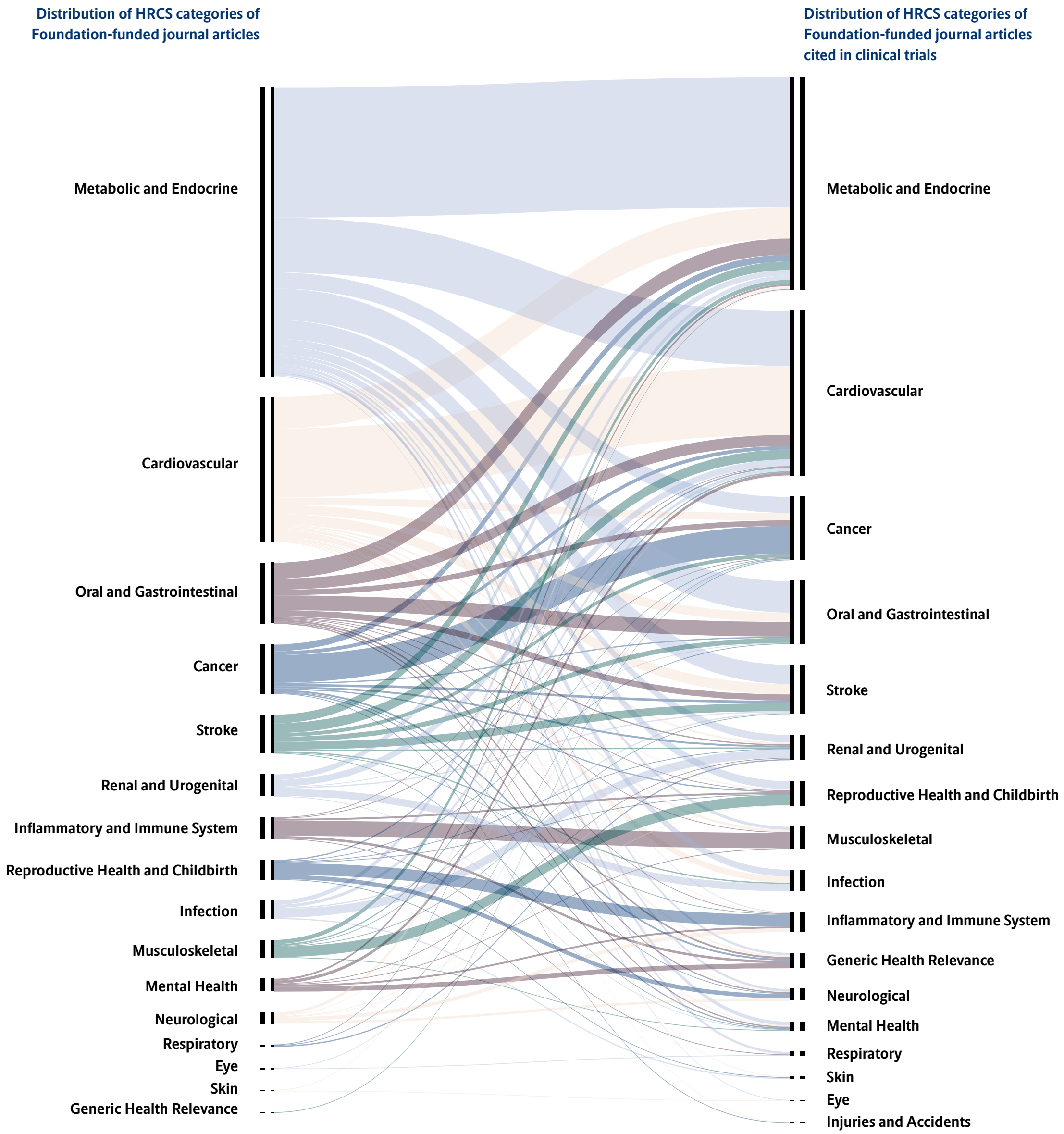


Note: The health categories are mapped according to the Health Research Classification System (www.hrcsonline.net). The analysis is of the 26 clinical trials found in clinicaltrials.gov. One clinical trial can be registered in multiple health categories.

Sources: Novo Nordisk Foundation/researchfish® and clinicaltrials.gov.

Foundation-funded research in clinical trials can be traced by citing articles (Figure 6.7). Foundation funded journal articles were tracked in Dimensions for citations in clinical trials and categorized according to the Health Research Classification System (HRSC). In total, 409 clinical trials were identified to cite 433 distinct Foundation-funded journal articles. Metabolic and Endocrine is the most frequent health research area, followed by Cardiovascular and Cancer and Neoplasms, reflecting the clinical trials reported by grant recipients.

Figure 6.7 Foundation-funded public research citing clinical trials by health category

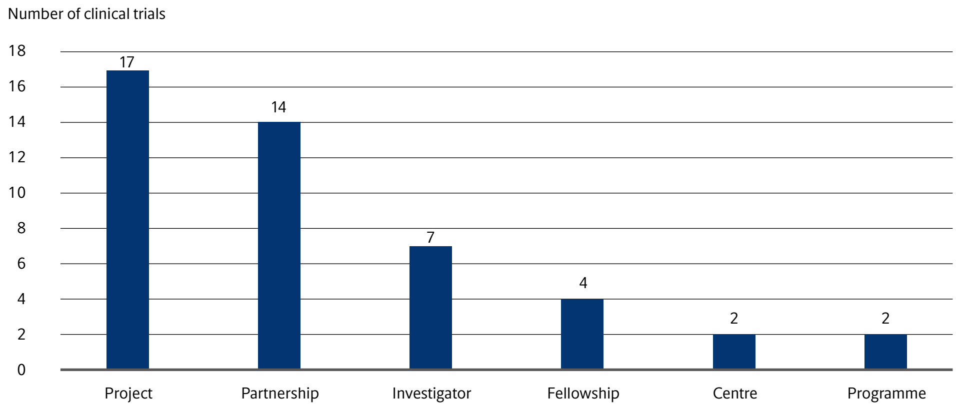


Note: The left side of the figure shows the percentage distribution of health research categories of Foundation-funded journal articles (433) categorised by the Health Research Classification System. The right side of the figure shows the percentage distribution of the health research categories of Foundation-funded journal articles cited in clinical trials (409) categorised by the Health Research Classification System.

Sources: Novo Nordisk Foundation/researchfish® and Digital Science Dimensions.

Figure 6.8 shows that clinical trials are carried out by the recipients of most types of grants, but mainly through projects and partnerships (Steno Diabetes Centres). Moreover, 18 of the clinical trials have been carried out in Denmark, 4 in other Nordic countries and the remaining 4 outside the Nordic countries.

Figure 6.8 Number of clinical trials by type of grant, 2014–2019



Note: The total does not equal 37 as a clinical trial can be reported by mulitple grants, thereby being counted in multiple grant type categories.
Source: Novo Nordisk Foundation/researchfish.

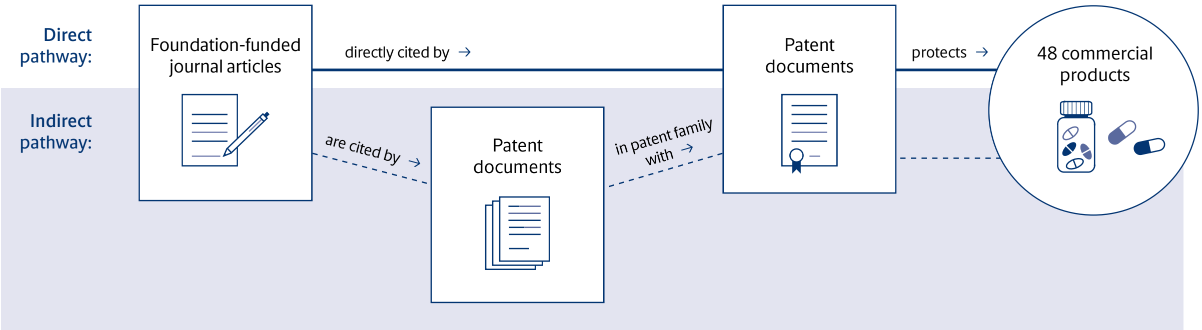
The activities of grant recipients lead to many revolutions in treatments for patients in the form of new tools and methods, e.g. for people with cardiovascular diseases, cancer or diabetes. One example of a clinical trial funded by the Foundation is a trial testing subjects based on hydration levels, determining whether water intake leads to reduced rates of diabetes and cardiometabolic risk. These findings led the grant recipient to test whether increased water intake can prevent diabetes and cardiometabolic risk among people in a randomized controlled clinical trial.

6.3 Disseminating and using public research in patented products

In this section we analyse the use of research in commercial products. We find that the grantees' journal articles are often cited in patents and patent applications and that these patents and patent applications are used in commercial products. Our method is the following: using citations we have linked our publication database (the Foundation-funded journal articles) to patent and patent application databases which are linked to a database for commercial products (the Iproduct database from École polytechnique fédérale de Lausanne, which includes 15,000 products and 25,000 patents)). There are two tracing pathways: a direct and an indirect pathway (Figure 6.9). Our analysis shows that Foundation-funded research in this way can be traced in 48 successful innovative products.

Figure 6.9

Tracking the use of scientific research in commercial products

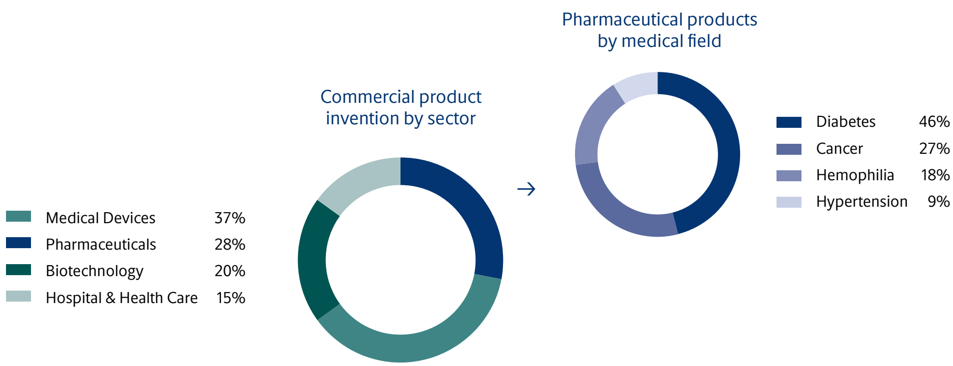


Note: Figure inspired by work conducted by École polytechnique fédérale de Lausanne.

Of 2,238 patent documents that cite Foundation-funded journal articles from 1994 to 2017, 95 patents were identified and matched to Foundation-funded research, which resulted in the identification of 48 commercial products from 23 companies around the world (both directly and indirectly). Figure 6.10 shows the share of commercial products by sector; the pharmaceutical and medical device sectors have the most products that are commercialized. Zooming in on the pharmaceutical sector shows that areas such as diabetes covers 46% of the products.

Figure 6.10

The share of commercial products by sector

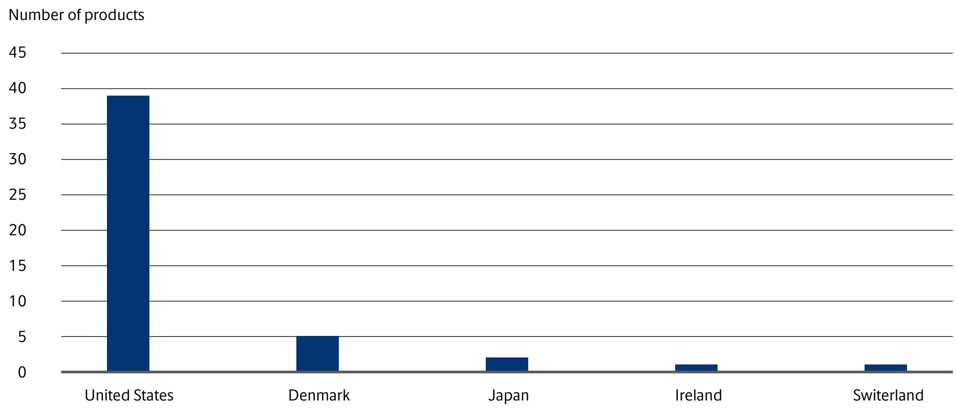


Sources: Novo Nordisk Foundation and Iproduct database, École polytechnique fédérale de Lausanne.

According to the data from the Iproduct database, 81% of the products belong to companies based in the United States (Figure 6.11).

Figure 6.11

Numbers of products

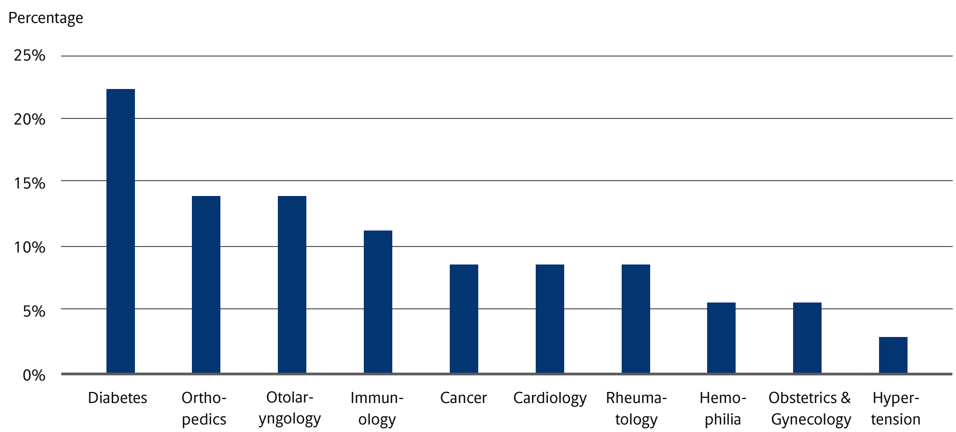


Sources: Novo Nordisk Foundation and Iproduct database, École polytechnique fédérale de Lausanne.

Figure 6.12 presents the 48 products categorized by the 10 medical fields. The products are sold in more than 150 countries worldwide to many millions of people. This improve the health and well-being of people.

Figure 6.12

Total share of products by medical field



Sources: Novo Nordisk Foundation and Iproduct database, École polytechnique fédérale de Lausanne.

6.4 Using Foundation-funded research in clinical guidelines

This section documents how research by grant recipients is used in clinical guidelines and recommendations covering diabetes, cardiovascular diseases and cancer. The analysis shows that 24% of 800 guidelines that covers these three areas of disease cite Foundation-funded journal articles.

The data includes guidelines published between 2008 and 2019 in Denmark, the other Nordic countries and in the United Kingdom and the United States and by international organizations such as the European Union and the World Health Organization (WHO). Clinical guidelines and recommendations for clinicians are continually updated with the latest achievements in research and new knowledge on patient care. Some are updated annually and others every 5-10 years.

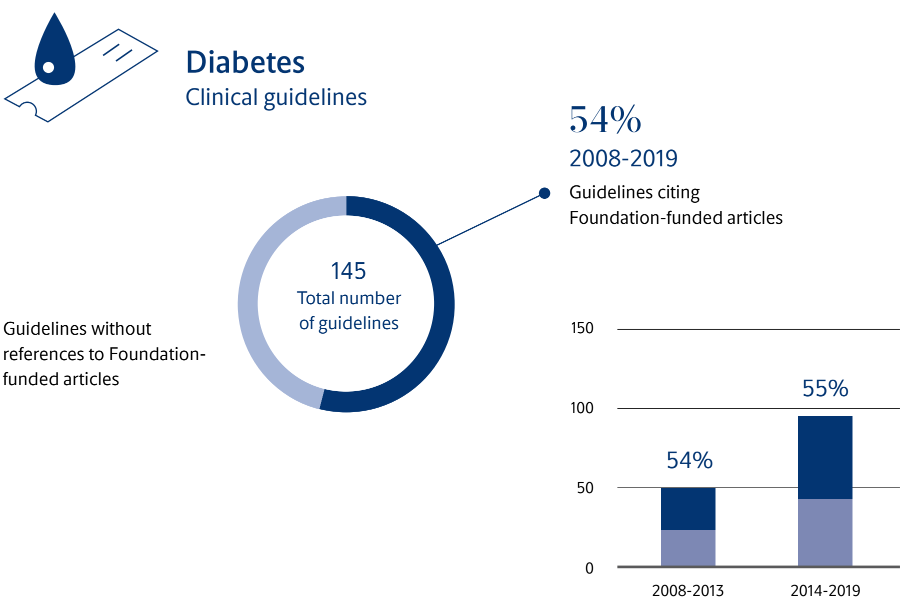
Clinical guidelines

Clinical guidelines are systematically prepared scientific recommendations aiming to guide and support healthcare professionals in decision-making. The extent to which clinical guidelines or recommendation papers for clinicians cite the research conducted by the grant recipients illustrates the significance of the research for the patients. The general perception of the publications being referenced in guidelines is that the research behind the publication is likely to influence the treatment of patients.

Clinical guidelines within diabetes
Figure 6.13 shows the consistency in the use of research published by the recipients of Foundation grants for 2008-2013 compared with 2014-2019 in clinical guidelines and recommendations within diabetes. Historically, the Foundation has focused on diabetes and diabetes complications, but in the past decade more emphasis has been put on supporting research on other noncommunicable diseases such as cardiovascular diseases and cancer.

The analysis shows that, even with a steep increase in the number of guidelines within diabetes between 2008-2013 and 2014-2019, the share of guidelines that cite research published by grant recipients is unchanged: 54% in 2008-2013 and 55% in 2014-2019. The reason could be that the Foundation-funded research forms the basis for understanding diabetes and treating people with diabetes.

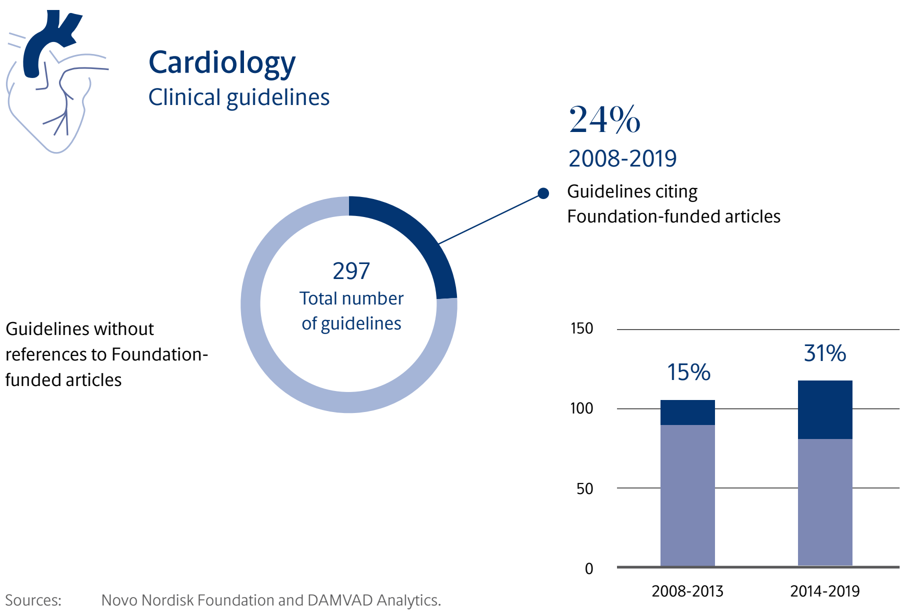
Figure 6.13 Clinical guidelines and recommendations – Diabetes



Sources: Novo Nordisk Foundation and DAMVAD Analytics.

Clinical guidelines and recommendations within cardiovascular diseases
Figure 6.14 shows the contribution of Foundation-supported research in guidelines and recommendations on cardiovascular diseases. The number of active guidelines remains comparable, but the share that cite articles by grant recipients doubled from 2008-2013 (15%) to 2014-2019 (31%).

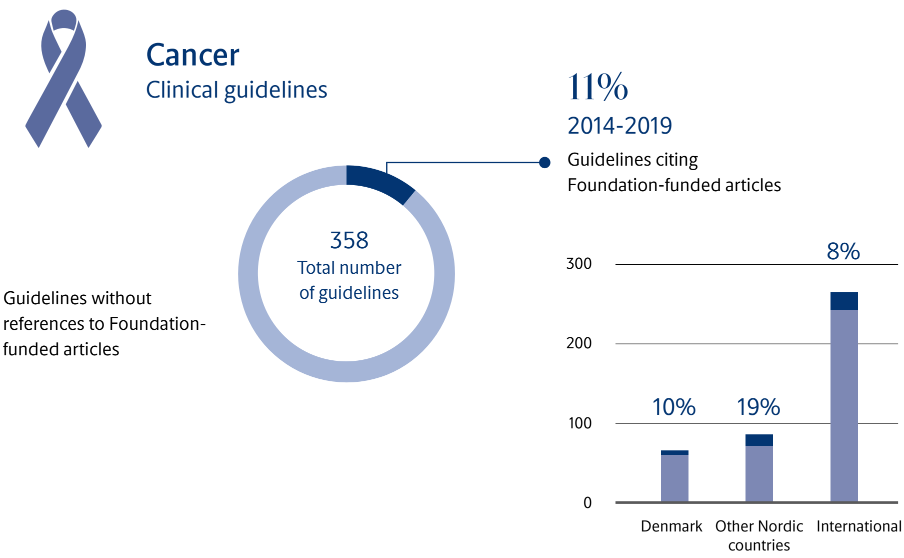
Figure 6.14 Clinical guidelines and recommendations - Cardiovascular diseases



Sources: Novo Nordisk Foundation and DAMVAD Analytics.

Clinical guidelines within cancer diseases
Figure 6.15 shows the number of clinical guidelines concerning cancer published by the public authorities in Denmark, the other Nordic countries and internationally. Less than 5% of the clinical guidelines and recommendations published between 2008 and 2013 were still being used in 2019. The analysis therefore focuses on the period 2014-2019. Our calculations show that the grant recipients contributed to 39 (11%) of the guidelines covering cancer, published in all the Nordic countries, the United Kingdom, and the United States and by international organizations.

Figure 6.15 Clinical guidelines and recommendations - Cancer

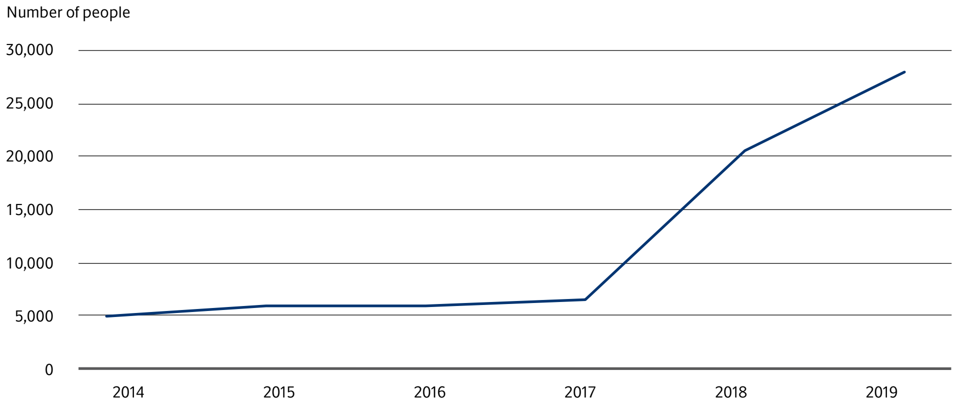


Note: The data include clinical guidelines published by Denmark's public health authorities and international publishers of guidelines such as the World Health Organization, European Society for Medical Oncology (ESMO), National Institute for Health and Care Excellence (NICE) and American Society of Clinical Oncology (ASCO).
Source: Novo Nordisk Foundation and DAMVAD Analytics.

6.5 People treated at the Steno Diabetes Centres
The Steno Diabetes Centres are aiming to advance all aspects of diabetes care in Denmark across a patient's lifetime through a public–private partnership model. Over a 13-year period, the Foundation has awarded DKK 7.4 billion to the five Danish administrative regions, which run the hospitals in Denmark. The goals are to facilitate the development of Danish diabetology to a top international level and to increase the life expectancy and quality of life for people with diabetes in Denmark. The services provided include a wide range of healthcare services related to diabetes, including diagnosis, treatment, eye scanning and examination, podiatry, dietary guidance and courses in a food laboratory. In 2019, more than 27,000 people were treated (Figure 6.16).

Figure 6.16

Total number of people treated at the Steno Diabetes Centres, 2014–2019

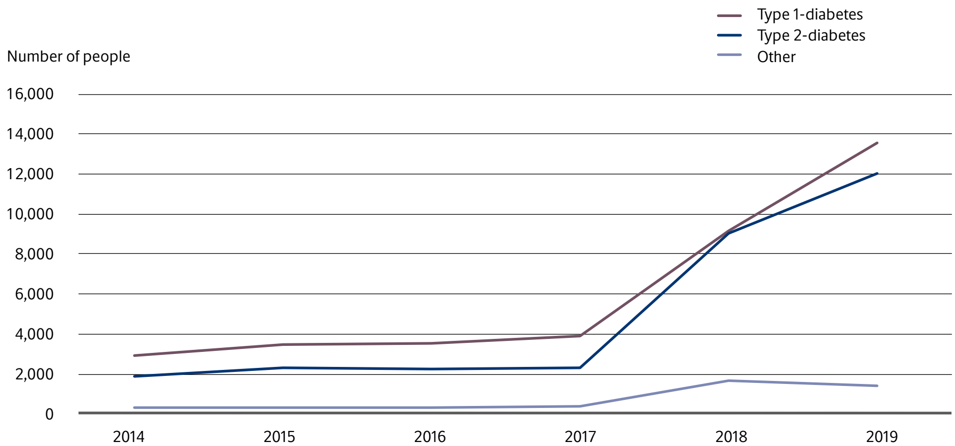


Source: Novo Nordisk Foundation.

Figure 6.17 shows the number of people treated for type 1 and 2 diabetes which has increased since 2017 when the Steno Diabetes Centres outside the Capital Region were established.

Figure 6.17

Patients treated at the Steno Diabetes Centres according to type of diabetes, 2014–2019



Note: Each Steno Diabetes Center has each taken the lead in developing an important diabetes-related issue: Steno Diabetes Center Copenhagen: education and health promotion, Steno Diabetes Center North Denmark: digital health, Steno Diabetes Center Aarhus: integrated health care, Steno Diabetes Center Odense: type 2-diabetes, Steno Diabetes Center Zealand: inequality in health and comorbidities.

Source: Novo Nordisk Foundation.

Section 7

People supported during humanitarian crises

This section describes the impact of the Foundation's support for humanitarian causes targeting disadvantaged people who suffer severe socioeconomic impacts from crises in geographical areas globally. In total, around 810,000 people have benefited from the Foundation-funded initiatives. Although there are clear limitations of data especially in humanitarian crisis situations, more international institutions (the World Bank, the United Nation and WHO) are investing in evidence and knowledge in humanitarian settings.

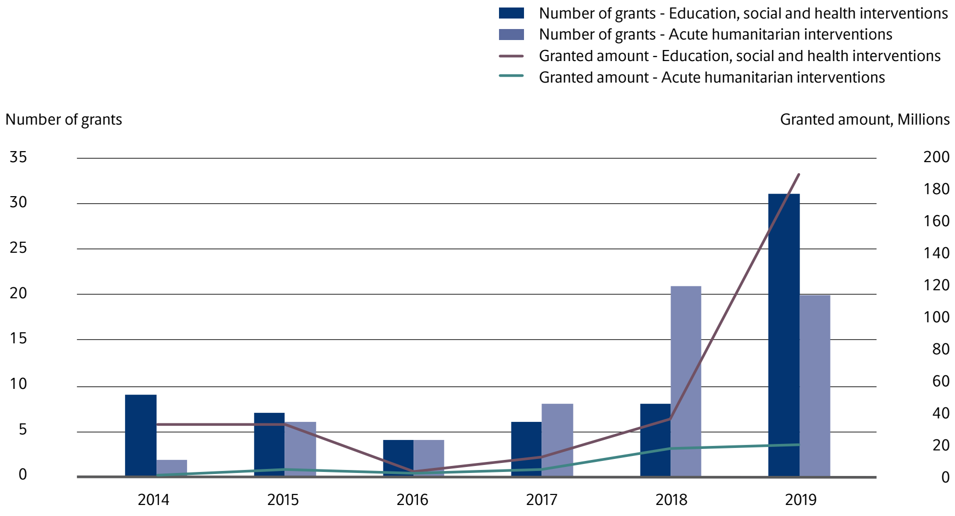
7.1 The Foundation's support of humanitarian interventions

The Foundation supports longstanding strategic partnerships in Jordan and eastern Africa Furthermore, the Foundation supports acute humanitarian crises through open calls. Since 2014, the Foundation has awarded 112 humanitarian project grants and has supported 5 humanitarian partnerships.

Figure 7.1 shows the trend in grant-awarding since 2014. The figure shows the development in the number of grants and the granted amounts. In May 2019, the Foundation adopted its first strategy for the support to humanitarian causes which aim to improve the opportunities for disadvantaged children and young people, that will have a strategic focus on youth empowerment (education and social interventions) and fighting non-communicable diseases (NCDs) (health interventions) and other global humanitarian crisis (acute humanitarian interventions). The support to humanitarian causes before 2019 did not focus on these thematic areas.

The grants for acute humanitarian interventions vary from DKK 0.1 million to DKK 1 million. The project grants for interventions within education, health and social competences vary from DKK 0.1 million to DKK 10 million. The partnership grants vary between DKK 10 million and DKK 120 million. Alone in 2019, the Foundation signed partnerships with the Danish Refugee Council (DKK 120 million) and UNICEF (DKK 20 million) regarding Youth Empowerment (education and social interventions) and with the World Diabetes Foundation (DKK 25 million) fighting Non-Communicable Diseases (health interventions).

Figure 7.1 Grant-awarding activity for humanitarian interventions, 2014–2019

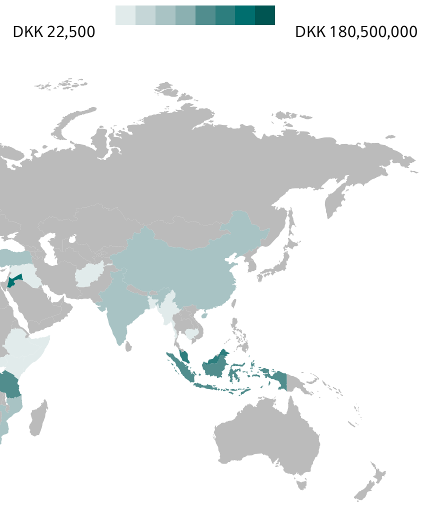


Source: Novo Nordisk Foundation.

7.2 People supported in health and education in low and middle-income countries

The Foundation has supported health, education and social activities globally in low and middle-income countries for many years. Figure 7.2 shows the geographical distribution of the grants which the Foundation has awarded since 2014. From 2014 to 2019, Foundation-funded humanitarian interventions took place in 40 countries. Until 2016, most interventions took place in Asia through the STAR programme and the REACH programme of Steno Diabetes Center which supported health professionals and diabetes patients.

Figure 7.2 Amount awarded by the Foundation for Education, Health and Social causes, distributed geographically, 2014–2019



Source: Novo Nordisk Foundation.

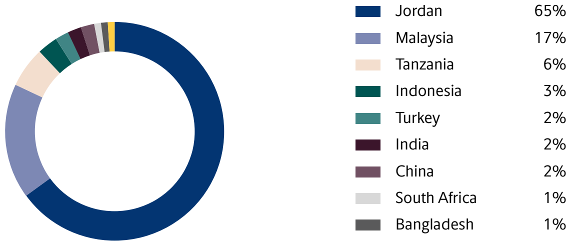
Since 2017, most funding and interventions have taken place in Africa and the Middle East. In accordance with the Foundation's new strategy for 2019-2023, the geographical focus will be countries affected by the Syrian crisis, starting with Jordan and later scaling up with Lebanon and potentially Syria. For NCD initiatives, countries in eastern Africa are a geographical focus. The Foundation will mainly operate through major partnerships with NGOs and international organizations.

Figure 7.3 shows the top 10 most supported countries from 2014 to 2019 for education, health and social causes. The most supported countries include Jordan and Tanzania, which follows the Foundation's recent strategy for humanitarian causes.

Since 2014, the Foundation has supported 74 interventions aiming at improving people's health, and the skills and social competencies of children and young people, so they are better prepared to make positive life choices and become active citizens in society.

Figure 7.3

Top 10 most supported countries within education, health and social competences, 2014–2019

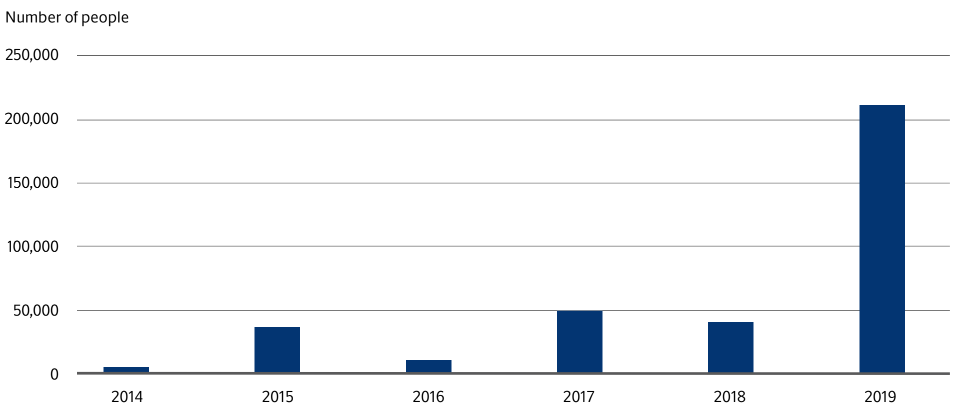


Source: Novo Nordisk Foundation.

Figure 7.4 shows that from 2014 to 2019, at least 270,000 children and young adults received assistance from the allocated support for health, skills and social competencies. Alone in 2019, more than 130,000 received assistance. The figure shows the yearly distribution of people that received support with respect to the improvement of health and skills since 2014.

Figure 7.4

Number of people receiving health, educational or other support from 2014–2019

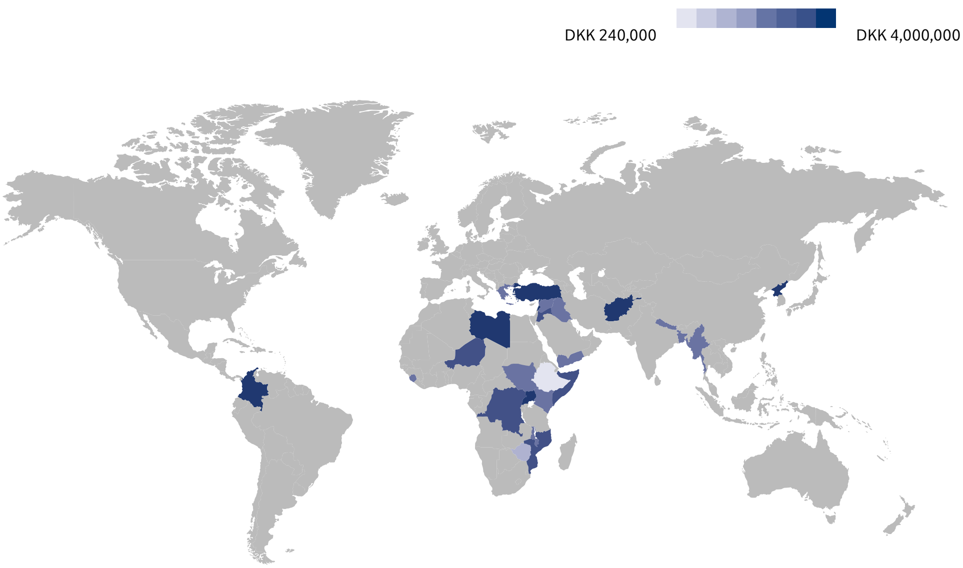


Note: Data for 2018 and 2019 are preliminary since there is a delay in final reports from aid organizations.
Sources: Novo Nordisk Foundation/Foundgood.

7.3 People supported in acute humanitarian crises

Figure 7.5 shows the geographical distribution of all acute humanitarian interventions the Foundation has funded since 2014. The acute humanitarian interventions have taken place in more than 30 countries.

Figure 7.5 Amount awarded by the Foundation for acute humanitarian interventions distributed geographically, 2014–2019

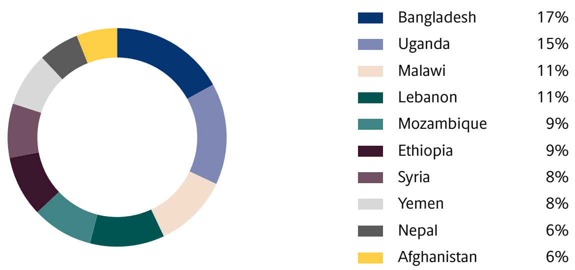


Source: Novo Nordisk Foundation.

Figure 7.6 shows the top 10 most supported countries from 2014 to 2019 in acute humanitarian interventions. The most supported countries include Bangladesh, Uganda, Malawi and Lebanon.

Figure 7.6

Top 10 most supported countries for acute humanitarian aid, 2014–2019

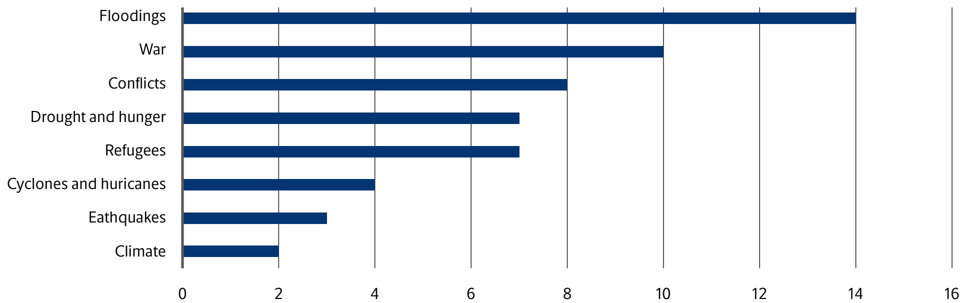


Source: Novo Nordisk Foundation.

The Foundation has supported 55 acute humanitarian interventions from 2014 to 2019 (Figure 7.7), of which 40 took place in 2018 and 2019. The Foundation has supported helping people affected by both conflicts and natural disasters.

Figure 7.7

Number of Foundation-funded interventions in acute humanitarian crises, 2014–2019

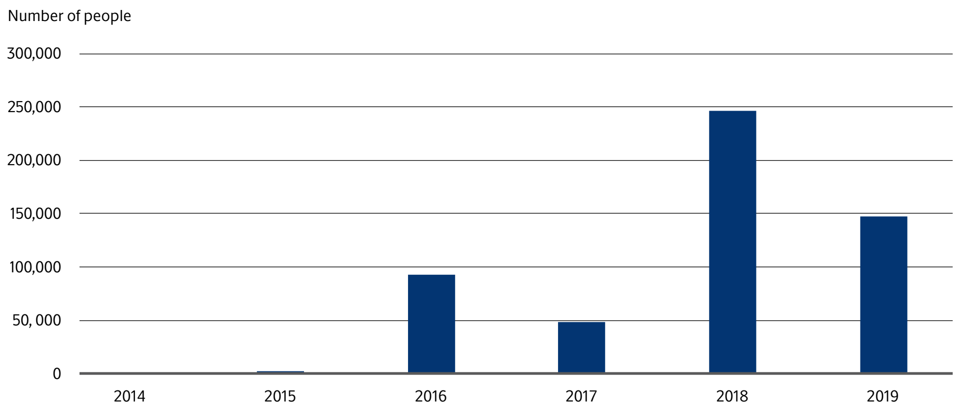


Sources: Novo Nordisk Foundation/researchfish®/Foundgood.

Since 2014, the Foundation-funded acute humanitarian interventions benefited more than 538,000 people worldwide, either during or after a crisis. Figure 7.8 shows the number of people supported in acute humanitarian crisis situations funded by the Foundation. The data for 2019 are still preliminary and not complete, since there is a delay in reporting of data from humanitarian organizations.

Figure 7.8

Number of people supported by acute humanitarian interventions, 2014–2019



Note: The data for 2018 and 2019 are preliminary since there is a delay in final reports from aid organizations.
Sources: Novo Nordisk Foundation/Foundgood.

Sustainable Development Goals

In 2014-2019, the Novo Nordisk Foundation's grant-awarding activities lead to actions that support the 17 UN Sustainable Development Goals (SDGs). Most grants have relevance for up to three SDGs each.

1 NO POVERTY	160 grants	88 DKK million
2 ZERO HUNGER	122 grants	52 DKK million
3 GOOD HEALTH AND WELL-BEING	1,665 grants	5,052 DKK million
4 QUALITY EDUCATION	1,138 grants	1,866 DKK million
5 GENDER EQUALITY	5 grants	3 DKK million
6 CLEAN WATER AND SANITATION	57 grants	11 DKK million
7 AFFORDABLE AND CLEAN ENERGY	13 grants	4 DKK million
8 DECENT WORK AND ECONOMIC GROWTH	975 grants	1,799 DKK million
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	2,162 grants	6,969 DKK million
10 REDUCED INEQUALITIES	137 grants	201 DKK million
11 SUSTAINABLE CITIES AND COMMUNITIES	7 grants	1 DKK million
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	167 grants	231 DKK million
13 CLIMATE ACTION	39 grants	245 DKK million
14 LIFE BELOW WATER	1 grant	1 DKK million
15 LIFE ON LAND	76 grants	64 DKK million
16 PEACE, JUSTICE AND STRONG INSTITUTIONS	1 grants	1 DKK million
17 PARTNERSHIPS FOR THE GOALS	188 grants	4,367 DKK million

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