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UK Health Research Analysis 2009/10

UK Clinical Research Collaboration 2012

Organisations Participating in the Analysis



Arthritis Research UK



Biotechnology and Biological Sciences Research Council



British Heart Foundation



Cancer Research UK



Chief Scientist Office, Scottish Government Health and Social Care Directorates



Economic and Social Research Council



Engineering and Physical Sciences Research Council

Engineering and Physical Sciences Research Council



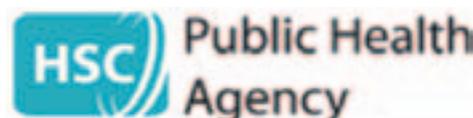
Medical Research Council



National Institute for Health Research



National Institute for Social Care and Health Research



HSC R&D Division of the Public Health Agency



Wellcome Trust



Acknowledgements

The conduct of this analysis was managed by a committee of representatives from each of the participating organisations (the Health Research Analysis Forum, HRAF). HRAF reports to the UKCRC Board.

Dr Andrew Speakman, who developed the database and analysis tools during the UKCRC project in 2006, was engaged to compile and analyse the data. Analysis work was funded by the MRC and Wellcome Trust.

We are grateful to the staff of all the participating organisations for their time and effort, particularly in the task of providing data from their organisations. Coding was carried out by freelance coders, or by programme managers within each organisation. We would particularly like to thank Dr Anna Smith for coding a large proportion of the projects used in the analysis. Thanks also to Helen Meaker from the Office of National Statistics, for helpful advice on the estimation of health relevant R&D expenditure in the UK.

Dr Ian Viney

Medical Research Council



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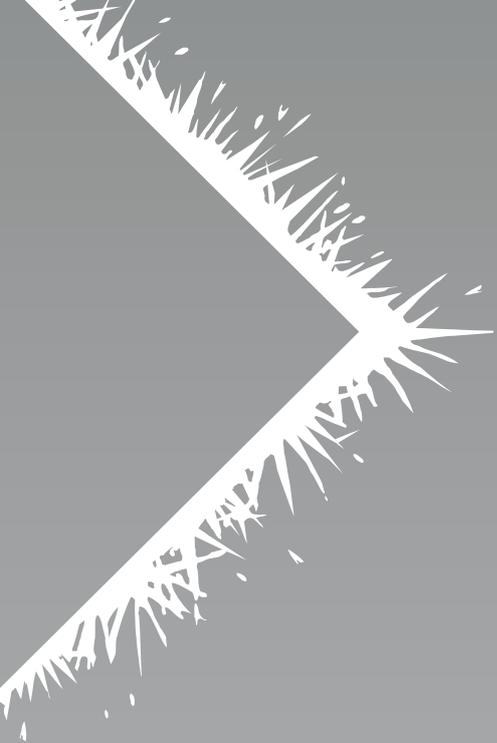
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EXECUTIVE SUMMARY



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Executive Summary

This analysis compiles information about the expenditure on health relevant research in the UK. Comprehensive information about research undertaken in 2009/10 and supported by the 12 main public and charitable funders of health research in the UK was used to examine health relevant research activity in detail.

The monitoring and strategic co-ordination of health research is important given that it represents a substantial part of the UK science base, and has been shown to provide an **exceptional rate of return to the UK economy**¹.

For the first time the total expenditure on health relevant research and development by UK businesses, public sector organisations and not-for-profit organisations is estimated using data from ONS, HESA and the UKCRC. Our estimate for the total expenditure on health-related research and development, performed by UK public, private and not-for-profit organisations (although not necessarily conducted in the UK) in 2009/10 is approximately £8bn². This represents almost a third of all research and development expenditure in the UK. Over half of this (approximately £4.5bn) is carried by the private sector, leaving in the region of £3.5bn of activity in the public and not-for-profit sectors. Significant complementarity is seen between the private, public and charitable investments in health research.

Using the Health Research Classification System (HRCS), almost 12,000 peer reviewed awards from the 12 participating publicly and charitable funded organisations were categorised in detail. These awards total £1.6 billion of direct expenditure on health research in 2009/10. Taking into account a further £824m of spend on research infrastructure, this totals just over £2.4bn of expenditure in support of health research in the UK for that year. It is suggested that this “bottom-up” analysis includes almost all public and charitable funded health research in the UK, and is estimated to cover a significant proportion of the fundamental and translational health research occurring in the UK. We also suggest that the remaining £1.1bn of research performed in the UK outside of the private sector largely comprises quality related funding for Universities from the UK funding councils, overseas funding for UK research and NHS supported clinical academic posts.

Comparisons were made with expenditure on health research in 2004/05 using a UKCRC dataset published in 2006. Several significant differences were noted between the 2004/05 and 2009/10 portfolios:

- Overall annual funding for health-related research included in this analysis was larger by just over 50% in real terms (from £1bn in 2004/05 to over £1.6bn in 2009/10). It was noted that part of this increase was due to the move to full economic costing, but that both public and charitable funding agencies had been able to significantly increase the support available for health research.
- 60% of the health research portfolio analysed in detail is focussed on the basic understanding of health and disease. Areas relevant to “underpinning” and “aetiological” research received over £226m more funding in 2009/10 compared to 2004/05 in real terms. Although the proportion of overall funding allocated to these areas was lower in 2009/10 compared to 2004/05 they remain the areas against which most funding is allocated.
- Within the areas of “underpinning” and “aetiological” research, there was more research with relevance to methodology in the 2009/10 portfolio compared to the 2004/05 dataset.
- Funding in real terms for prevention research, an area identified as in need of expanding in 2006, had more than twice as much funding in 2009/10 compared to 2004/05 (from £27m to £61m), and the main focus of this was on primary prevention research.
- An additional £131m in real terms was spent on research categorised as treatment development and treatment evaluation in 2009/10 compared to 2004/05. These categories represent more translational areas.
- Spending on respiratory medicine research was almost three times higher in real terms in 2009/10 compared to 2004/05 (changing from a small portfolio of £10m in 2004/05 to £28m in 2009/10).

1 Medical Research: What's it worth? Estimating the economic benefits from medical research in the UK. (Health Economics Research Group, Office of Health Economics, RAND Europe, 2008) <http://www.acmedsci.ac.uk/download.php?file=/images/publicationDownload/EBReport.pdf>

2 See Appendix 3.

- Funding for research categorised as relevant to oral/gastrointestinal diseases in 2009/10 was twice that of 2004/05 (a real terms change of £15m to £30m).
- £100m more was spent in real terms on research relevant to cancer in 2009/10 compared to 2004/05 (total spend in 2009/10 £320m), and £35m more on research relevant to neurological diseases (total spend in 2009/10 £161m).
- The proportion spent on research for mental health (total spend in 2009/10 £90m) and infectious diseases (total spend in 2009/10 £177m) was higher in the 2009/10 dataset compared to the 2004/05 portfolio.
- Between the two datasets, five years apart, there were small differences in the distribution of health research funding across UK regions and cities. Both Oxford (+1%) and Cambridge (+0.5%) had a higher share of total health research funding, whereas the share of funding for London institutions was the same at just over a third of the total (33.4%).
- £25m more health research funding was identified for institutions based in Wales in 2009/10 compared to 2004/05, in real terms. Similarly £43m more funding for health research for institutions in Scotland was identified 2009/10 compared to 2004/05. Funding for institutions in Northern Ireland was £4m higher in 2009/10 compared to 2004/05 in real terms. In England, research funding increased by £474m in real terms over the same period.
- The exercise compiled details of almost £60m of funding provided to support health research outside the UK.

The changes reflect in part the impact of a number of initiatives aimed at boosting clinical research and experimental medicine, including joint initiatives developed under the auspices of the UKCRC and OSCHR³. This co-ordination is aimed at delivering a step-change in the way that health research is supported to the benefit of patients, the NHS and the wider healthcare economy.

The funding organisations contributing data to the analysis have different drivers and approaches to funding research and will use the findings from the analysis in different ways.

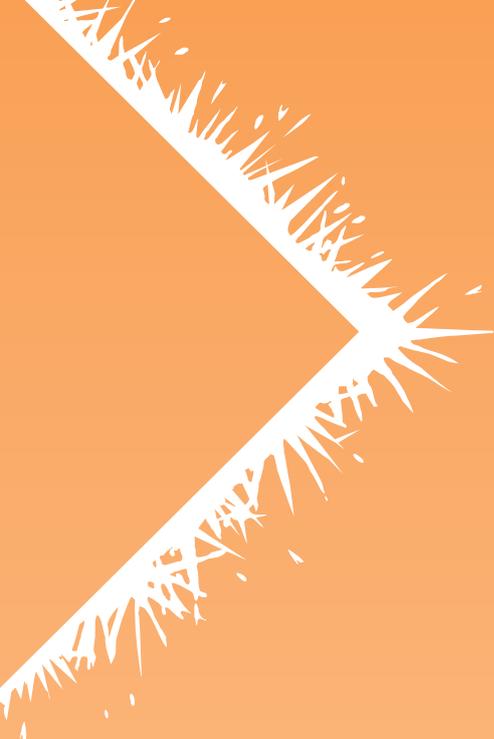
HRAF proposes that a process for the regular compilation of portfolio data, and a community of practice to enhance the use of the HRCS nationally and internationally should be established. Preliminary discussions have already taken place under the auspices of the European Medical Research Council (EMRC), to highlight and encourage use of the HRCS across Europe⁴⁵. In addition HRAF will explore approaches to automate the coding of awards using the HRCS to make future analysis easier, cheaper and more systematic.

3 The Office for Strategic Co-ordination of Health Research (OSCHR) http://www.nihr.ac.uk/about/Pages/about_oschr.aspx

4 European Science Foundation Members Organisation Forum on Evaluation working paper on research portfolio classification (2011) http://www.esf.org/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/be_user/CEO_Unit/MO_FORA/MOFORUM_Eval_PFR_II_/3rd_Workshop/Classification.pdf&t=1336519418&hash=74b434bdd8451faa790cb6d726d6521c44106838

5 European Medical Research Council (EMRC) special policy brief 43 "Health Research Classification Systems – Current Approaches and Future Recommendations" (2011) http://www.esf.org/fileadmin/FlipBooks/emrc_spb43/emrc_sbp43/assets/seo/page1.html





INTRODUCTION AND PURPOSE OF THE ANALYSIS



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1. Introduction and Purpose of the Analysis

The UK Clinical Research Collaboration (UKCRC) was set up in 2004 with the aim of establishing the UK as a world leader in clinical research¹. The Collaboration is a partnership of the main stakeholders that influence clinical research including the major funders of clinical research in the UK. One of the early goals of the UKCRC was to develop a coherent approach to funding health related research. A key step in this process was to map the current UK-wide research portfolio, creating an evidence base that could be used to inform individual and joint planning and to facilitate coordination between the funders.

The *UK Health Research Analysis* report, published by the UKCRC in 2006 (based on portfolio data from 2004/05), was the first ever national analysis of public and charity funded UK health research. It included an overview of all types of health research activity across all areas of health and disease in the UK. This provided robust evidence to support UKCRC discussion of the gaps and opportunities for health research in the UK. It has underpinned several joint multi-funder initiatives launched since.

It was decided to re-visit the national analysis to see whether differences in the UK portfolio can help inform discussions of progress made. This report details work to repeat the analysis of UK health research, using data relating to research active in 2009/10.

To carry out mapping of health research the UKCRC established the Health Research Classification System (HRCS). The role of the HRCS is to facilitate research management by answering strategic questions about investment. The UK Health Research Analysis report examined the research portfolios of the 12 largest government and charity health-related research funders. Using the HRCS for this analysis allowed meaningful comparisons to be made across the different funders' research portfolios. The report included:

- A breakdown of spending on all types of health research (from basic to clinical) across all areas of health and disease
- Details of the distribution of funding within individual areas of health and disease
- The geographical spread of health research investment across the UK.

Subsequently the HRCS was used to analyse the funding activities of 29 medium and smaller sized members of the Association of Medical Research Charities, and this was published in the UKCRC report *From Donation to Innovation*² in 2007.

The two reports have been disseminated widely in the UK and had a major impact, providing the basis for high level strategy discussions and informing a number of joint funding initiatives.

To bring the information together and create a comprehensive picture of health relevant research in the UK three things were needed, a central database containing the funders' research portfolios, a common coding system to classify the data, and resources to carry out the work. In 2006 the UKCRC Secretariat was uniquely placed to undertake this task by providing the resources and expertise necessary to conduct an independent analysis of health related research activity in the UK.

In the latest exercise funders collaborated to compile the data needed to re-visit this analysis via a small group, the Health Research Analysis Forum (HRAF). HRAF had been delegated responsibility for continued governance of the use of the HRCS, by the UKCRC Board, following the disbanding of the UKCRC secretariat in 2007/08.

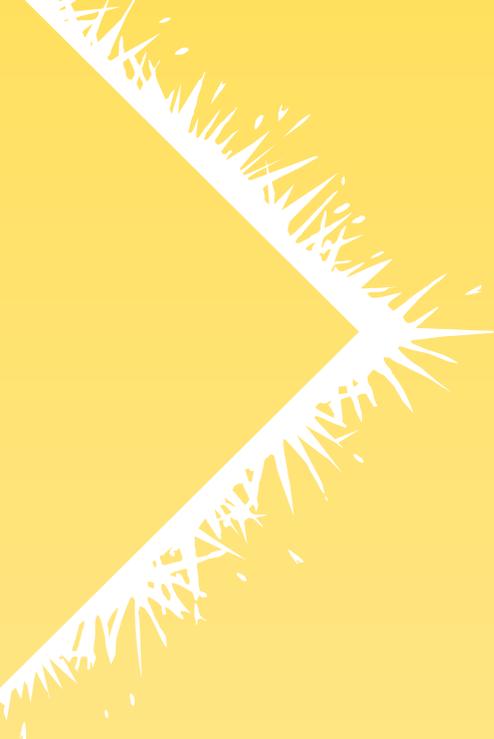
HRAF compiled portfolio data from 12 funding organisations, relating to research active in 2009/10, most of this was pre-coded using the HRCS by each organisation. HRAF then commissioned Dr Andrew Speakman to add this to the Health Research database, carry out checks of completeness, and produce initial tables of data and figures for analysis.

1 UK Clinical Research Collaboration (UKCRC) <http://www.ukcrc.org/>

2 From Donation to Innovation (UKCRC, 2007) <http://www.ukcrc.org/researchcoordination/healthresearchanalysis/charityanalysis/>

The total expenditure analysis was undertaken at the request of the UKCRC board and the majority of the analysis undertaken by MRC, overseen and approved by HRAF members.





SCOPE OF THE ANALYSIS



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2. Scope of the Analysis

2.1. Participating Organisations

The largest government and charity organisations that fund health relevant research in the UK have again participated in this analysis.

The government bodies involved include the four devolved administration Health Departments, and four research councils. The government organisations are:

- Biotechnology and Biological Sciences Research Council (BBSRC)¹
- Chief Scientist Office, Scottish Government Health and Social Care Directorates (Scotland)
- HSC R&D Division of the Public Health Agency (Northern Ireland)²
- Engineering and Physical Sciences Research Council (EPSRC)³
- Economic and Social Research Council (ESRC)³
- Medical Research Council (MRC)
- Department of Health (England)⁴ ,
- National Institute for Social Care and Health Research (Wales)⁵

The full research portfolio of the Medical Research Council has been included in the analysis. The other three research councils have wide, non-health related remits but also fund health related research.

Four of the largest medical research charities in the UK were included in the analysis. Collectively they are estimated to fund more than 70% of UK charitable health related research. These organisations are:

- Arthritis Research UK⁶
- British Heart Foundation
- Cancer Research UK
- Wellcome Trust (Wellcome)

Together the research portfolios of these 12 funding bodies represent the overwhelming majority of non-commercial health related research in the UK.

2.2. Data Included in the Analysis

There are a number of elements of funding that are essential to support research activity. These include direct costs such as peer reviewed research awards and indirect costs such as “administration” and “building maintenance”. This analysis focuses exclusively on the directly funded peer reviewed UK research of the participating funders. The criteria for inclusion in the analysis are as follows:

1 In 2004/5 BBSRC provided a health relevant portfolio that focused on its ageing research portfolio and in 2009/10, BBSRC provided a portfolio of research which is directly relevant to their Strategic Priority of ‘Basic bioscience underpinning health’ which in particular encompassed research directly relevant to ageing: lifelong health and wellbeing, regenerative medicine and pharmaceuticals.

2 Previously Research and Development Office for the Northern Ireland Health and Personal Social Services (Northern Ireland)

3 The EPSRC and ESRC provided their health related research portfolios for inclusion in this exercise and the previous analysis in 2004/05

4 Including the National Institute for Health Research (NIHR)

5 NISCHR is the Welsh Government Health and Social Care Research and Development Unit. It encompasses the previous Wales Office of Research and Development for Health and Social Care (Wales)

6 To note that the Arthritis Research UK (then the Arthritis Research Campaign) portfolio was not included in the original UK Health Research analysis, but was included in the subsequent “Donation to Innovation” report. The 2004/05 Arthritis Research UK portfolio was extracted from the “Donation to Innovation” dataset and is included in the current analysis.

- Research is funded by a participating organisation
- Research must be taking place within the UK
- Research is of health or biomedical relevance
- The award must be active during the 2009/2010 financial year
- Research where funding can be directly attributed to a set of clearly defined research objectives and therefore can be classified by type of research activity or area of health or disease i.e. directly funded research, including training awards, projects, programmes, institute and unit awards

The analysis is designed to provide a snapshot of directly funded peer reviewed research that was 'live' (i.e. funded research was taking place) during the 2009/2010 financial year. The database holds a total of 11742 awards (11475 relating to research in the UK), which amounts to a combined spend of almost £1.7bn on this type of research during this period.

The amount of annual funding included in the analysis was 70% higher in 2009/10 compared to 2004/05 (a difference of £671m). In real terms this difference is 62% (£546m).

The number of separate UK awards was 1574 higher in the 2009/10 dataset, compared with the 2004/05 dataset (16% difference). For most funding agencies the average and median value of awards was larger in 2009/10 compared to 2004/05. Although the impact of additional infrastructure funding via full economic costing (see below) should be noted, across all funders there was a real terms difference of almost £34k (30% difference) between the average value of an award in 2004/05 and 2009/10, and a £14k difference between the median values (27% difference).

2.3. Infrastructure support

This analysis is not designed to be a national audit of all spending on biomedical and health related research by the participating organisations. The majority of expenditure compiled is directly funded UK based research awards that are associated with clear research objectives. In 2004/05 the detailed analysis of expenditure on research **excluded** the following:

- Research support costs including: building construction, maintenance and associated infrastructure and core support costs (such as core support for the Wellcome Trust Sanger Institute)
- Administrative costs
- Membership of professional bodies
- Library maintenance costs
- Costs relating to attending or holding meetings
- R&D support costs for NHS providers funded by the UK Health Departments.

However efforts were made, over and above the approach used in 2006, to document the main streams of infrastructure funding in the UK. The situation with respect to infrastructure funding has changed significantly since 2004/05. From 2006 the UK Government provided additional funding for science, **not** to increase the volume of research, but to improve the sustainability of the HEI sector. Research Councils moved from providing 46% of project costs as an "overhead", to funding 80% of the full economic costs (fEC) of research, and so part of the increase in Research Council funding for research is focussed on sustaining world-class infrastructure in UK Universities. The Government provided £264m additional funding across the Research Councils in 2009/10 to increase contributions toward the full economic costs of research, while keeping the volume of research reasonably constant. It was not feasible in this analysis to separate out the indirect and estates elements of the costing for all research council grants, but an estimate of the element of fEC uplift attracted by health relevant research grants for each research council is noted in Table 1.

The Government and devolved administrations have also made available additional funding to support charitable research. This is distributed to HEIs in proportion to the value of peer-reviewed grants which they receive from charities. In England this additional element is often termed the Charities Research Support Fund (CRSF) and it totalled £194.0 million in 2009/10 to support all areas of research (not just health related research). The AMRC estimates that charities meet approximately

60% of the full economic costs of research, and that the CRSF meets an additional 20%. Therefore to place the charitable funding presented in this report on a similar basis to expenditure figures from the research councils an allowance would have to be made for CRSF infrastructure support. £453m of the charity funding captured in this report (health related research) is administered by England HEIs, and HESA state that Universities in England received £680m of charitable income in 2009/10. This would indicate that health related charitable grants may have been responsible for attracting 65% (453/680) of the CRSF funding alone. This would amount to £125m of additional infrastructure support won as a result of health related research, although Universities are free to allocate this funding to any area of research.

The funding for research and development within the NHS has also undergone major changes since 2006. The number of staff involved in supporting clinical research has increased and the approach taken by NHS Trusts to ensure that good quality research can take place has been streamlined. At the same time, the NIHR Clinical Research Network has been developed, first in topic areas like cancer, and then across the whole of England. The Network is set up to 'provide the infrastructure that allows high-quality clinical research to take place in the NHS'.

Given the large changes to the funding of infrastructure, organisations included in this analysis have provided further information about the funding that they provide for infrastructure (most notably R&D support costs provided by the Health Departments), and an explanation of these is included in Appendix 1. A summary of this information is included in Table 1.

As far as possible the same approach was taken to compile data relating to expenditure on projects and programmes in 2009/10 as was taken in 2004/05 for the detailed analysis, with a couple of minor exceptions. Organisations have provided further detail of their approach to selecting portfolio information for inclusion in the analysis in Appendix 1.

Research funded by the participating organisations taking place outside the UK was not included in the main analysis. However this data was collected, and is summarised in Appendix 2.

It is recognised that there are other funders of health related research in the UK and inclusion of their research portfolios would add to the overall landscape of UK research activity. Obtaining these data has not been feasible at this stage, however it is hoped that it may be possible to include some of this information in future analyses.

Health relevant funding that is not included in the detailed analysis:

- Industry funded health research
- Research funded by smaller UK not-for-profit organisations
- Research taking place in the UK funded by non-UK funding organisations
- Higher Education Funding Councils funding to support research infrastructure
- NHS support for clinical academic salaries

2.4. An estimation of the total health related research performed by UK institutions

To set the analysis in context, work was undertaken to estimate the total health related research and development expenditure by UK public, charitable and private sector institutions in 2009/10. This is set out in detail in Appendix 3. The approach was "top down" looking at information on the total research and development activity across the three research performing sectors. We found that the total expenditure on health related research and development by UK publicly and charitable funded research institutions and UK businesses in 2009/10 was approximately £8.1bn.

If the overall figure for health relevant research expenditure is £8bn, the detailed project, by project analysis accounts for approximately 20% of the research expenditure by UK institutions (1.6/8.1) in this area. Adding in the infrastructure funding identified in Table 1, accounts for £2.4bn (30%) of health relevant research expenditure.

A large proportion of R&D performed by UK businesses is conducted outside of the UK (around 30%), indicating that the project and infrastructure spend analysed in this report may represent up to 40% of the health relevant research and development actually conducted in the UK. In addition, due to the focus of business research and development being on applied work, the detailed analysis in this report is likely to cover the overwhelming majority of basic and early translational research performed in the UK.

Of the £3.5bn of health related research and development activity **not performed by the business sector**, £2.4bn is accounted for by our detailed “bottom up” analysis of research projects and infrastructure funding, leaving £1.1bn not accounted for. It is suggested that this is largely comprised of the elements noted above (in 2.3), which we could not include in our detailed analysis; research funded by smaller not-for-profit organisations, quality related funding from the UK funding councils, overseas funding for UK research, and NHS support for clinical academics. It is not possible to entirely reconcile the “bottom up” and “top down” estimates of health research expenditure, but it seems reasonable to suggest that these elements make up the majority of the remaining £1.1bn.

Research funded by smaller not-for-profit organisations

Approximately £840m of charitable expenditure on research and research infrastructure is included in this analysis. However the Association of Medical Research Charities (AMRC) reports⁷ that AMRC members spent £1.16bn on research (including capital) in 2009/10. The four large medical research charities included in this analysis represent just over 70% of the total AMRC spend. If data from the remaining 120 smaller AMRC member charities could be compiled, then this should contribute information on an additional £300m of spend on projects, programmes, capital and other infrastructure.

Quality related (QR) funding from the funding councils

QR funding supports the research infrastructure necessary for universities to conduct research, including permanent academic staff salaries, premises, libraries, central computing costs and a contribution to postgraduate training. HEFCE allocated £1.6bn of QR funding to Universities in 2009/10 across all disciplines⁸. The calculation of QR funding is based upon the quality of research (last assessed in the 2008 Research Assessment Exercise (RAE)) across Units of Assessment (UoA), UoAs 1-15 are relevant to biomedicine. In 2009/10 HEFCE allocated £370m⁹, HEFCW allocated £19m¹⁰, SFC allocated £70m¹¹ and DELNI allocated £13m¹² on the basis of the quality of these UoAs. This provides a rough total of £472m funding provided to UK Universities on the basis of the quality of their health research, however it should be noted that Universities are free to deploy this funding to support any area of research.

Overseas funding for health research

Data on R&D expenditure in the UK from ONS (see Appendix 3) estimates overseas investment in UK Universities and public sector research establishments to be approximately £900m in 2009/10. It might be reasonable to expect around 20% of this to be in support of health research (given the proportion of University and public sector research establishment research that is health related).

NHS support for clinical academics

In 2010 there were 3175 FTE clinical academics employed by the 32 UK medical schools with a substantive contract of employment with a University and an honorary NHS contract¹³. A FTE of 1319 of these were funded by the NHS, representing approximate expenditure on salaries of at least £100m¹⁴ (although the full economic costs of employment will be higher).

7 Who funds medical research in the UK? (AMRC website) http://www.amrc.org.uk/value-charitable-investment-in-medical-research_value-charities-contribution-to-uk-success-in-life-sciences_who-funds-medical-research-in-the-uk

8 HEFCE 2009-10 funding allocations <http://www.hefce.ac.uk/whatwedo/invest/instititns/annalocns/archive/2009-10/>

9 The sum of mainstream QR, allocation for London costs, RDP supervision allocation and transitional QR funding

10 HEFCW circular (W09/08HE: Recurrent Grant 2009/10) http://www.hefcw.ac.uk/documents/publications/circulars/circulars_2009/W09%2008HE%20Recurrent%20Grant.pdf

11 Figure for the Research Excellence Grant from SFC circular (General Fund in support of teaching and research for higher education institutions for academic year 2009-10 SFC/14a/2009) http://www.sfc.ac.uk/web/FILES/CircularsSFC1409/sfc14a2009_general_fund.pdf

12 Figure for Mainstream QR plus RDP supervision funds from DELNI University Recurrent Research Grant Summary Tables 2011/12 http://www.delni.gov.uk/update_to_university_recurrent_research_grant_summary_tables_2011_12_on_website_-_november_2011.xls

13 Staffing Levels of Medical Clinical Academics in UK Medical Schools, 2010 data (Medical Schools Council, 2011) http://www.medschools.ac.uk/AboutUs/Projects/Documents/Clinical_Academic_Staff_Survey_as_at_July_2010.pdf

14 Estimated based on clinical salary of £83,000 (clinical academic first appointed to a consultant level post after 2004 with 4 years completed at consultant level)

There may well be other elements of funding which support health relevant research directly or indirectly, but we suggest that those noted above are the most significant.

Table 1: Volume of UK health research funding 2004/05 and 2009/10 ¹⁵

Group	Organisation	Number of Awards 2004/05	2004/05 Amount (£m)	Number of Awards 2009/10	2009/10 Amount (£m)
Charities	Arthritis Research UK	286	17.3	304	26.2
	British Heart Foundation	1038	46.3	912	59.8
	Cancer Research UK	1001	175.3	1476	230.7
	Wellcome	2303	219.0	2310	341.6
Health Depts ¹⁶	England	1040	96.9	1570	200.9
	Northern Ireland	180	8.5	126	9.5
	Scotland	311	13.6	273	22.3
	Wales	43	1.8	163	16.1
Research Councils	BBSRC	249	15.1	279	28.1
	EPSRC	407	26.3	572	89.0
	ESRC	116	9.7	250	26.2
	MRC	2927	335.3	3236	585.6
A) Total HRCS coded research funding ¹⁷		9901	965.0	11475	1636.1

B) Research council fEC uplift (included in the details above) £m ¹⁸

BBSRC	4
EPSRC	6
ESRC	4
MRC	42
Total	56

C) Infrastructure and other spend not coded using HRCS £m ¹⁹

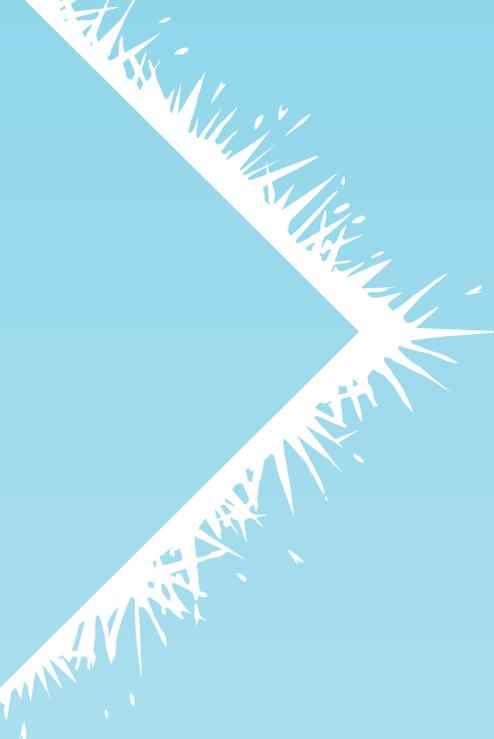
NIHR Clinical Networks	285.0
NIHR BRC and BRU core costs	95.1
Other NIHR costs ²⁰	25.5
Wales NHS R&D funding ²¹	15.1
Scotland NHS R&D Funding ²²	42.3
Scottish contribution to NETSCC Programme ²³	2.7
Cancer Research UK	100.0
Wellcome Trust	78.3
Estimated CRSF attracted by charity grants in England ²⁴	125.0
Total	769.0

Total infrastructure (B + C) £m **827.0**

Total Health relevant expenditure (A+C) £m **2405.1**

- 15 "Non UK" health research (research awards administered by a non-UK research organisation) is excluded from this table, and can be found summarised in Appendix 2
- 16 The figures in Table 1 do not reflect the total health research-relevant spend of the Government Health Departments, as additional funds are awarded through other mechanisms in each nation
- 17 Totals may contain small rounding errors
- 18 fEC uplift is pro-rated based on each Research Council's total research expenditure taken from annual reports for 2009/10 and detailed in Appendix 3
- 19 See Appendix 1 for an explanation of infrastructure spend.
- 20 This includes CRFs, ECMCs, Schools and PSSQR Centres see Appendix 1 for details
- 21 Wales NHS R&D funding for 2009/10 totals £15.08m
- 22 Scotland NHS R&D funding in 2009-10 included NHS Support for Science, NHS Programmes and Generic Infrastructure funding to support research funded by others.
- 23 Scotland contributed £2.682m towards the overall budget for NETSCC Programmes which has not been included in the research spend coded.
- 24 An explanation of this estimate is given in the text under section 2.3. A proportion of the CRSF won as a result of health related charity funded awards is calculated. Figures for the CRSF only apply to England and Universities may allocate this funding to support other areas of research



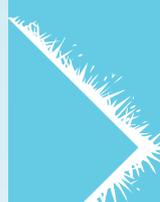


METHODOLOGY



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3. Methodology

3.1. Oversight of the Process

The compilation of the data was managed via the Health Research Analysis Forum (HRAF). The HRAF includes representation from all the participating funding organisations plus the AMRC.

3.2. Data Collection and Processing

The 2009/10 UKCRC Database contains details of 11,742 individual awards. These were collected from the participating organisations in the form of a common Microsoft Excel spread-sheet of information that included details on the principal investigator (including location of the research), the type, amount and duration of the award and the title and scientific abstract of the research being undertaken.

This process was considerably easier than the work in 2006, due to the fact that;

- All participating funders now maintain at least some of the information required in electronic databases and hold this centrally
- Some funders have continued to categorise their research portfolios routinely using the HRCS

The work in 2006 took 10 months to collect the data with dedicated personnel from the UKCRC secretariat working full time on the project, at an estimated cost of at least £150k. The work in 2011/12 was shared among the participating funders, and without central full-time co-ordination took longer to conduct (approximately 14 months). Although contracting out coding and analysis cost no more than £15k, the time contributed by officers from all participating funding agencies added substantially to this. Significant savings in time and effort could be made if a centralised database was used to compile the data, and if automated approaches could be applied to coding portfolio information.

3.3. Ownership of the Data

Data collected in the course of this work are owned by the organisations funding the research and are held in confidence by the MRC. Details of individual awards will not be circulated or published unless agreement is obtained in advance from the participating organisations. It is expected that, with the agreement of the data owners, further analysis can be conducted on the information that has been compiled.

3.4. Understanding the Health Research Classification System

The Health Research Classification System (HRCS) is a two dimensional framework for classifying research awards. One dimension of the framework, the Research Activity Codes, classifies awards according to type of research activity. The other dimension, the Health Categories, classifies research according to the area of health and disease being studied. Full details of the HRCS are available to download from www.hrcsonline.net.

The Research Activity Codes are modelled on the Common Scientific Outline¹ which is a cancer research specific classification system developed by the US National Cancer Institute and Congressionally Directed Medical Research Programs of the US Department of Defence. The Common Scientific Outline has been successfully used by the National Cancer Research Institute

¹ Common Scientific Outline (CSO) <https://www.icrpartnership.org/CSO.cfm>

(NCRI) Partners for the strategic analysis of cancer research in the UK and also by the International Cancer Research Partners² for analysis of global cancer research portfolios.

The Research Activity Codes describe broad areas of research:

- Underpinning Research (Underpinning) - research that underpins investigations into the cause, development, detection, treatment and management of diseases, conditions and ill health
- Aetiology – identification of determinants that are involved in the cause, risk or development of disease, conditions and ill health
- Prevention of Disease and Conditions, and Promotion of Well-Being (Prevention) – research aimed at the primary prevention of disease, conditions or ill health, or promotion of well-being
- Detection, Screening and Diagnosis (Detection and Diagnosis) – discovery, development and evaluation of diagnostic, prognostic and predictive markers and technologies
- Development of Treatments and Therapeutic Interventions (Treatment Development) – discovery and development of therapeutic interventions and testing in model systems and preclinical settings
- Evaluation of Treatments and Therapeutic Interventions (Treatment Evaluation) – testing and evaluation of therapeutic interventions in clinical, community or applied settings
- Management of Diseases and Conditions (Disease Management) – research into individual care needs and management of diseases, conditions or ill health
- Health and Social Care Services Research (Health Services) – research into the provision of health and social care services, health policy and research methodology

Each of these main categories is further subdivided, to give a total of 48 Research Activity Sub-codes. The main eight Research Activity Codes can be used for a ‘top level’ analysis, a more detailed examination can be carried out by analysing the sub-codes of each main category, and cross-cutting analyses can be performed by combining sub-codes from across different categories.

The Health Categories are based on the International Classification of Diseases (ICD) codes³ and contain 21 separate groupings which encompass all diseases, conditions and areas of health. Where possible these Health Categories have been designed to match the ICD codes. However, as the ICD codes only describe diseases and ill health, they are not always adaptable to capture the breadth of research funded by the participating organisations. For example there is no appropriate ICD code to accurately classify studies of normal development and function of the immune system. Separate categories, such as the Inflammatory and Immune System, have been created where there is no suitable ICD code equivalent.

Some categories have been created in areas of specific interest to the UKCRC Partners.

For instance a Stroke Research Network was established as part of the UK Clinical Research Network and therefore a separate Stroke category was included in the Health Categories. A further difference from the ICD codes is the Infection category, which includes all diseases caused by infectious agents regardless of the type of infection or system affected. Additionally a Generic Health Relevance category was added to the system to classify research that is applicable to all diseases and conditions or general health and well-being.

3.5. Classification of the Data and Quality Control Process

It was necessary to take a different approach to compiling the data in this analysis compared to the work that led to the 2006 publication. Each funder was responsible for arranging for their portfolio to be categorised, and then returned data according to a standard format. Each funder then provided a commentary describing any changes to the inclusion criteria for awards, the approach that they had taken to quality control the data, and any observations on the results.

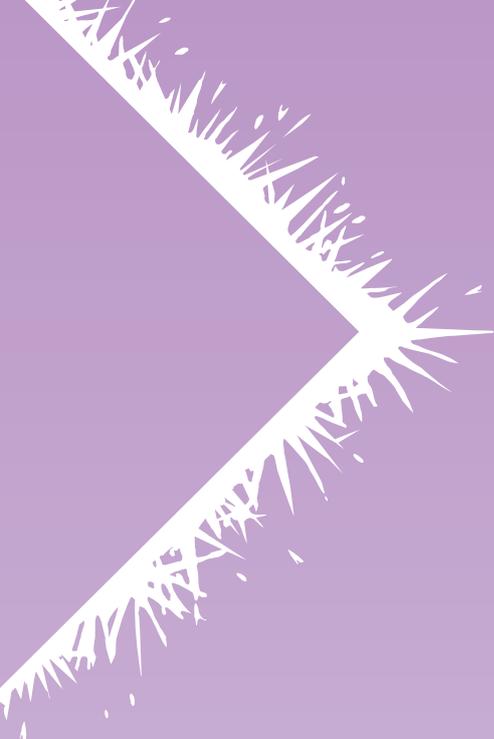
² International Cancer Research Partnership (ICRP) <https://www.icrpartnership.org/>

³ International Classification of Diseases (ICD) <http://www.who.int/classifications/icd/en/>

The majority of awards were coded by freelance coders with the appropriate research experience, and no affiliation to any of the participating organisations. The coders had received training on the use of the HRCS and regular feedback and guidance throughout the coding process.

Each research award was classified with up to two Research Activity Codes (with up to four codes for large programmes and centre awards) and up to five Health Categories to reflect the main aim of the research taking place within the duration of the funding. The funding for the 2009/2010 period of the award was apportioned between assigned codes for both the Research Activity Codes and Health Categories sections of the HRCS, to ensure there was no double counting of award funds in the analysis.

The compiled data was checked to see that the proportions of awards assigned to “other” or “generic health” categories were not significantly different to the average across the entire dataset, and that the guidance for allocating a maximum of up to four codes, and in the main two research activity codes per award.

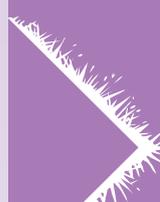


DETAILED ANALYSIS OF HEALTH RESEARCH PORTFOLIOS



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4. Detailed Analysis of Health Research Portfolios

4.1 Understanding the Results of the Analysis

The analysis is designed to revisit the base-line overview of the research activities of the largest government and charity research funders in the UK produced in 2006. That analysis included information from the 2004/05 research portfolios of organisations.

There are a number of factors that should be considered when reviewing the results of this analysis. Firstly, analysis of data can provide valuable information on the relative amounts of directly funded research activity in different areas, but it has not been designed to analyse all spending on biomedical and health research in the UK. Secondly, a research award may have a number of objectives; the Health Research Classification System is designed to capture the central aim of the research taking place rather than every facet or possible outcome of the work. The analysis described here provides an indicator of the 'centre of gravity' of the research awards held on the Database.

The 12 participating funding bodies fund research in differing ways. All use the peer review system to ensure the quality of the research they fund. Some funders commission research to answer specific questions, but the majority use 'response mode' to fund the highest quality proposals submitted to them by the research community. In light of this, there are several factors that might influence the amount of activity in any given area of health related research. These include:

- The scientific opportunity in an area
- The size and quality of the research workforce in each area
- The 'researchability' or tractability of an area
- The burden of disease in an area
- The level of charity fundraising conducted in an area

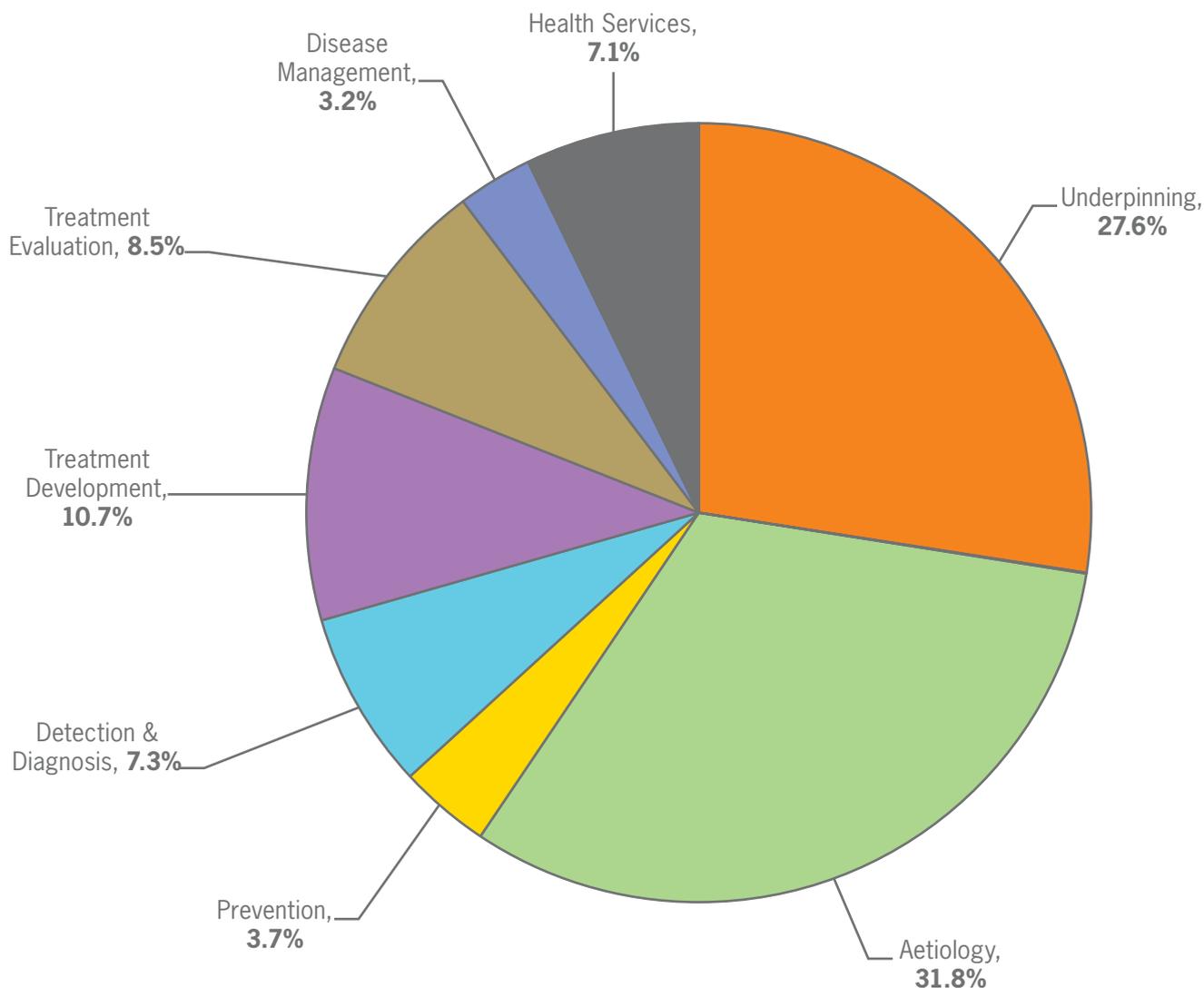
This analysis is primarily on the combined research portfolios of the participating funders and focuses on the Health Categories and the major Research Activity Codes. It is possible to breakdown the research further using the Research Activity Sub-codes, but these analyses are outside the scope of this report.

Lastly it should be noted that this analysis examines two points in time (2004/05 and 2009/10), nothing should be assumed about changes in research spend between these points. We cannot suggest that this data represents a trend or shift in spending. Further time points are required to demonstrate this.

4.2 Distribution of Funding across Research Activities

The distribution of the collective research portfolio of the funders across the eight major Research Activity Codes is shown in Figure 1.

Figure 1: Proportion of Combined Total Spend by Research Activity (2009/10)



Approximately one quarter of funding is concentrated in **Underpinning (27.6%)** research and one third in **Aetiology (31.8%)**. Underpinning research is aimed at understanding normal biological, psychological and socioeconomic processes and functioning, and forms the basis for subsequent investigations into the cause, detection, treatment or management of diseases and public health research. The Aetiology category includes research into the risk or cause and development of ill health and diseases. This category comprises biological, environmental, psychological and socioeconomic factors involved in disease processes. It also includes surveillance and distribution and research designs, measures and methodologies. Most epidemiological studies are included in this category.

The Prevention (3.7%) category contains research into the primary prevention of disease or conditions, or promotion of well-being. This encompasses behavioural and environmental interventions, vaccine development, nutrition and chemoprevention.

The participating funding bodies spend **7.3%** of their combined directly funded research in **Detection and Diagnosis** which encompasses the discovery, development and evaluation of markers, methods and imaging technologies. Research within this category includes population screening and studies of the psychological and socioeconomic factors that affect screening. Studies into the discovery, development and preclinical testing of biological markers, imaging technologies and diagnostic and predictive tests have been classified in a separate sub-code from testing and evaluation in humans. This separation allows for more in-depth analysis of this area.

Research into treatments and therapeutic interventions is divided by the HRCS into **Treatment Development (10.7%)** and **Treatment Evaluation (8.5%)** to reflect the UKCRC Partners' interest in experimental medicine and translational research as well as clinical trials. Both of these research areas contain all types of therapeutic interventions from pharmaceuticals to behavioural and physical therapies. Treatment Development includes discovery, development and testing in model and preclinical systems. It also includes research into the mechanism of action of interventions and understanding side effects or adverse reactions. Treatment Evaluation involves testing and evaluation of interventions in humans in clinical or applied settings and therefore includes all therapeutic trials.

Disease Management (3.2%) and **Health Services (7.1%)** capture two areas of health care. Disease Management is focused at the individual patient level, encompassing individual care needs of service users such as quality of life, treatment compliance, self management and end of life care issues. It also includes studies into all aspects of management by health and social care professionals and contains much of primary care research. Health Services includes research that is aimed at investigating health and social care systems at an organisational level. This category includes all research studying service delivery and organisation, health and welfare, economics and policy. It also includes the development of research designs and methodologies in health care.

If the proportion of combined spend by research activity in 2004/05 is compared with the proportion of combined spend in 2009/10, then there is a smaller proportion of total expenditure on the areas of “underpinning” and “aetiological” research and a larger proportion of spend directed to “detection/diagnosis”, and “health services” research. Spend in real terms is significantly different in 2009/10 compared with 2004/05. £546m additional funding for health research has been captured in 2009/10 compared to 2004/05. Table 2 shows this difference in real terms funding broken down by research activity.

Table 2: Difference in combined spend across Research Activities 2004/05 – 2009/10

Research Activity	2004/05 Total spend (£m)	Spend at 2009/10 prices (£m) ¹	2009/10 Total spend (£m)	Absolute, real terms difference in spend 2004/05 – 2009/10 (£m)
1 Underpinning	324.5	366.7	451.2	84.5
2 Aetiology	334.8	378.3	519.9	141.6
3 Prevention	23.9	27.1	61.3	34.2
4 Detection and Diagnosis	50.8	57.4	119.9	62.5
5 Treatment Development	83.1	93.9	174.7	80.8
6 Treatment Evaluation	80.0	90.4	139.9	49.4
7 Disease Management	22.4	25.3	52.9	27.6
8 Health Services	45.4	51.3	116.4	65.1
Grand Total	965.0	1090.4	1636.1	545.7

Research categorised as underpinning and aetiology is a smaller proportion of the combined UK health research portfolio in 2009/10 than it was in 2004/05, although research in these categories received £226m in total more in 2009/10 than in 2004/05.

There is twice as much funding in real terms for prevention research in 2009/10 than in 2005/05 (£61m compared to £27m).

“Research into treatment development and treatment evaluation in total received an additional £130.2m funding in real terms in our analysis.

¹ HM Treasury deflator used (http://www.hm-treasury.gov.uk/data_gdp_annex.htm), 2009/10 prices are 1.13 times more expensive than 2004/05

Table 3 shows the difference in the proportion of combined spend across research activity areas when the two years are compared. This is to show changes in emphasis across the two datasets. For example the areas of treatment development and treatment evaluation were highlighted in the 2006 report at 16.6% of the total funding for research. In our extended 2004/05 dataset, funding for these two areas is 16.9% of the total. In 2009/10 funding for these areas now represents 19.2% of the total. This is a small change in the proportion of combined spend (+2.3%), but in absolute terms corresponds to significant additional funding (£130m as noted above).

Table 3 also breaks down the proportion of combined spend across research activity sub-categories. From this it can be seen that there are differences in the portfolio of research within each research activity category. For example; underpinning and aetiological research categories have a smaller proportion of overall spend in 2009/10, however research into “research design, methodologies and measurements” within these categories has a larger proportion of combined spend.

Within prevention it is research into “primary prevention interventions to modify behaviour” that has changed to the greatest extent between 2004/05 and 2009/10.

Table 3: Difference in the proportion of combined spend across Research Activities 2004/05 – 2009/10

	% total spend 2004/05	%total spend 2009/10	Difference 2004/05 – 2009/10
1 Underpinning Research Total	33.6	27.6	-6.0
1.1 Normal biological development and functioning	28.3	22.1	-6.2
1.2 Psychological and socioeconomic processes	1.3	0.9	-0.4
1.3 Chemical and physical sciences	1.5	1.8	0.3
1.4 Methodologies and measurements	0.1	0.8	0.7
1.5 Resources and infrastructure (underpinning)	2.5	2.0	-0.5
2 Aetiology Total	34.7	31.8	-2.9
2.1 Biological and endogenous factors	22.5	20.2	-2.3
2.2 Factors relating to physical environment	5.4	3.3	-2.1
2.3 Psychological, social and economic factors	1.6	1.3	-0.3
2.4 Surveillance and distribution	1.8	2.4	0.6
2.5 Research design and methodologies (aetiology)	0.2	1.2	1.0
2.6 Resources and infrastructure (aetiology)	3.1	3.3	0.2
3 Prevention Total	2.5	3.7	1.2
3.1 Primary prevention interventions to modify behaviours or promote well-being	0.5	1.3	0.8
3.2 Interventions to alter physical and biological environmental risks	0.2	0.4	0.2
3.3 Nutrition and chemoprevention	0.8	0.6	-0.2
3.4 Vaccines	0.9	1.0	0.1
3.5 Resources and infrastructure (prevention)	<0.1	0.4	0.4
4 Detection and Diagnosis Total	5.3	7.3	2.0
4.1 Discovery and preclinical testing of markers and technologies	1.9	2.6	0.7
4.2 Evaluation of markers and technologies	2.2	1.8	-0.4
4.3 Influences and impact	0.1	0.1	<0.1
4.4 Population screening	0.5	0.8	0.3
4.5 Resources and infrastructure (detection)	0.6	2.0	1.4
5 Treatment Development Total	8.6	10.7	2.1
5.1 Pharmaceuticals	3.8	5.0	1.2
5.2 Cellular and gene therapies	2.2	1.5	-0.7
5.3 Medical devices	0.7	0.5	-0.2
5.4 Surgery	0.6	0.3	-0.3
5.5 Radiotherapy	0.3	0.4	0.1
5.6 Psychological and behavioural	0.1	0.3	0.2

5.7 Physical	<0.1	0.1	0.1
5.8 Complementary	<0.1	<0.1	<0.1
5.9 Resources and infrastructure (development of treatments)	0.8	2.6	1.8
6 Treatment Evaluation Total	8.3	8.5	0.2
6.1 Pharmaceuticals	3.1	3.8	0.7
6.2 Cellular and gene therapies	0.2	0.2	-0.1
6.3 Medical devices	0.4	0.4	-0.1
6.4 Surgery	0.7	1.0	0.3
6.5 Radiotherapy	0.4	0.4	<0.1
6.6 Psychological and behavioural	0.4	0.6	0.2
6.7 Physical	0.4	0.6	0.2
6.8 Complementary	0.1	<0.1	-0.1
6.9 Resources and infrastructure (evaluation of treatments)	2.5	1.6	-0.9
7 Disease Management Total	2.3	3.2	0.9
7.1 Individual care needs	1.1	1.4	0.3
7.2 End of life care	0.1	0.1	<0.1
7.3 Management and decision making	1.0	1.2	0.2
7.4 Resources and infrastructure (disease management)	0.2	0.5	0.3
8 Health Services Total	4.7	7.1	2.4
8.1 Organisation and delivery of services	2.5	3.4	0.9
8.2 Health and welfare economics	0.6	0.6	<0.1
8.3 Policy, ethics and research governance	0.6	0.7	0.1
8.4 Research design and methodologies	0.6	1.2	0.6
8.5 Resources and infrastructure (health services)	0.4	1.3	0.9

To present data in a format that is readily accessible and allows the ‘centre of gravity’ of research activity in different areas to be compared, the data can be presented as ‘kite diagrams’. This methodology was developed by the NCRI, and has been used by a range of funding bodies since then. The combined research spend classified by research activity illustrated in the pie chart in Figure 1 is displayed as a kite diagram in Figure 2. In the kite diagram the **sum of the areas above and below the line of origin** represents the proportion of each Research Activity Code indicated at the top of the kite diagram.

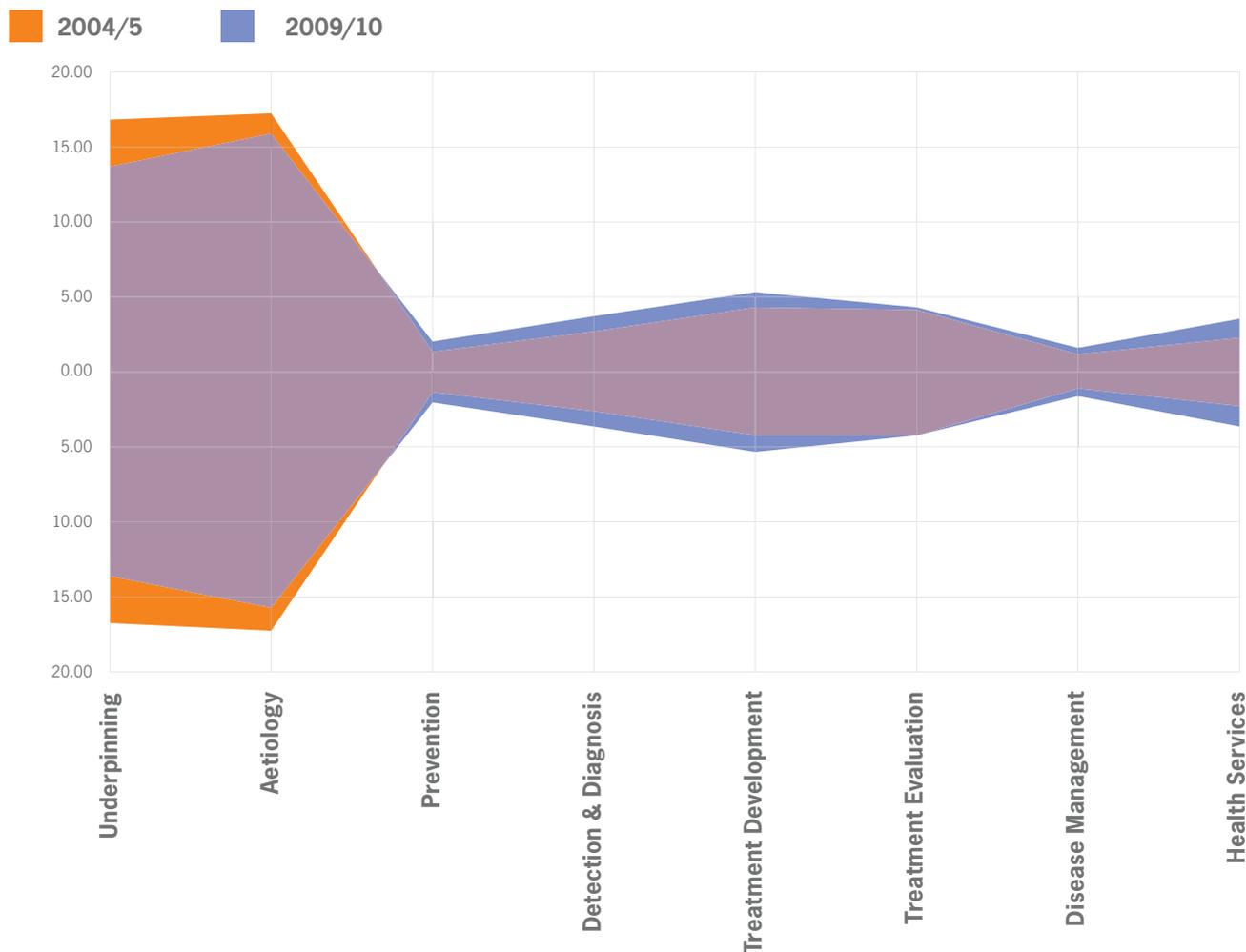
The individual 2009/10 research portfolios of each of the participating organisation are shown as kite diagrams in Figure 3. Each kite represents an organisation’s own relative spend distributed across the eight major areas of research activity. The relative contribution of each organisation to the overall research spend varies and the kites have been colour coded to reflect these relative proportions.

The individual profiles represent the directly supported, peer reviewed research awards such as projects, programmes, units, training awards etc. The figures do not represent all the funding provided by the participating organisations. As outlined in Section 2.3 this analysis does not include infrastructure costs such as administrative and building costs, core support costs and the Health Departments’ research and development support costs for NHS providers. It also does not include research supported outside the UK. The profiles of BBSRC, EPSRC and ESRC presented here represent the health relevant component of each research council’s total research portfolio.

According to HRCS categories, the largest proportion of the four research charities (Arthritis Research UK, British Heart Foundation, Cancer Research UK and Wellcome Trust) was “Aetiology”. For Arthritis Research UK, British Heart Foundation and Wellcome Trust this is followed by “Underpinning”, for Cancer Research UK “treatment development” is the next largest area of spend. This is illustrated in Figure 3. The MRC follows a similar pattern with the largest area of spend being “Underpinning” followed by “Aetiology”. In contrast, the profiles of the Health Departments are generally focused in “Treatment Evaluation” and “Health Services”, followed by “Detection and Diagnosis” and “Disease Management”. The profiles of the relevant research portfolios of the three other research councils reflect their funding remits. The majority of research activity supported by BBSRC is in “Underpinning” research. The EPSRC health related research funding is spread between “Underpinning” research, the discovery and development of Detection and Diagnostic technologies and “Treatment Development”.

Figure 4 highlights the real terms spend for each research activity, for each research funder, in 2004/05 and 2009/10. For funders with smaller portfolios, the award, or termination of small numbers of projects can have large effects on the composition of their portfolios. The MRC, Cancer Research UK and Wellcome Trust all invested more in treatment development and evaluation in 2009/10 compared with 2004/05. It is also clear from this figure that although the proportion of overall spend on underpinning and aetiological research has declined, in the context of additional funding for health research from both public and charitable sources, these areas have still received significant real terms additional funding. For example, in 2004/05 the proportion of Wellcome Trust funding allocated to underpinning and aetiological research was in total almost 90%. Although the proportion allocated to these areas was lower in 2009/10 (75%), research in these areas still benefited by £59m additional funding in real terms over 2004/05.

Figure 2: Proportion of Combined Total Spend by Research Activity (2004/05 – 2009/10) – Kite Diagram



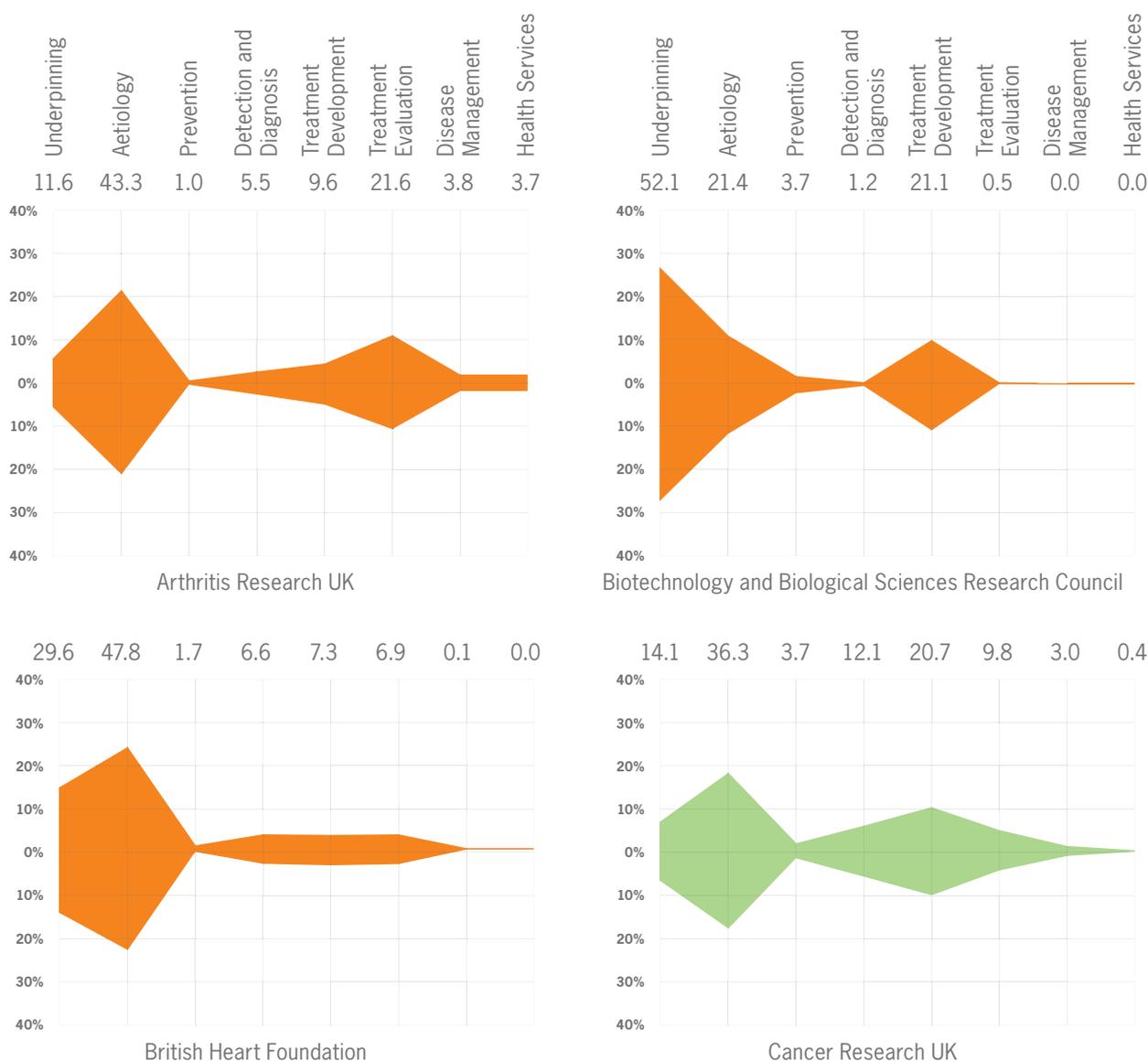
Kite diagrams for proportion of combined spend by research activity in 2004/05 and 2009/10 have been overlaid. Areas common to both are purple. Areas left light orange indicate that the proportion of combined spend in this area is lower in 2009/10 compared to 2004/05. Areas left blue indicate that the proportion of combined spend is higher in 2009/10 compared to 2004/05.

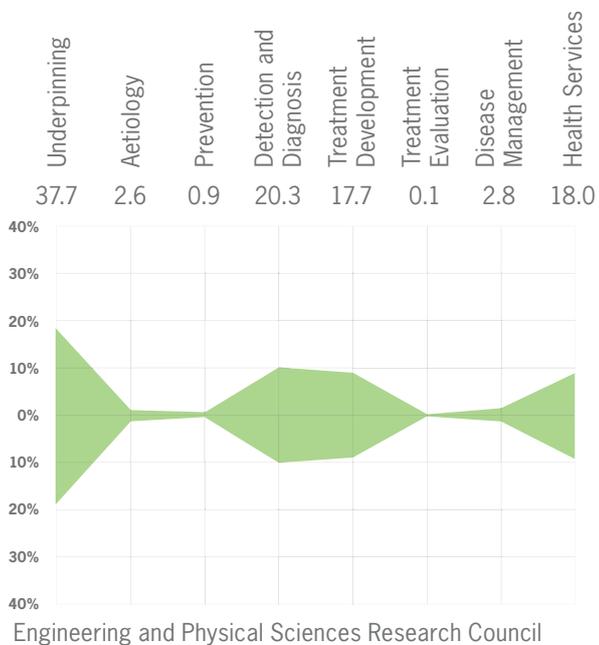
Legend for Figure 3

Kite diagrams are presented coloured according to the proportion each funder's spend is of the total combined spend in the detailed analysis (see Table 1 section A). For example the MRC provided 36% of the total spend on HRCS coded projects and programmes. Each organisation's kite chart shows the proportion of that organisation's total spend on health research allocated to each research activity.

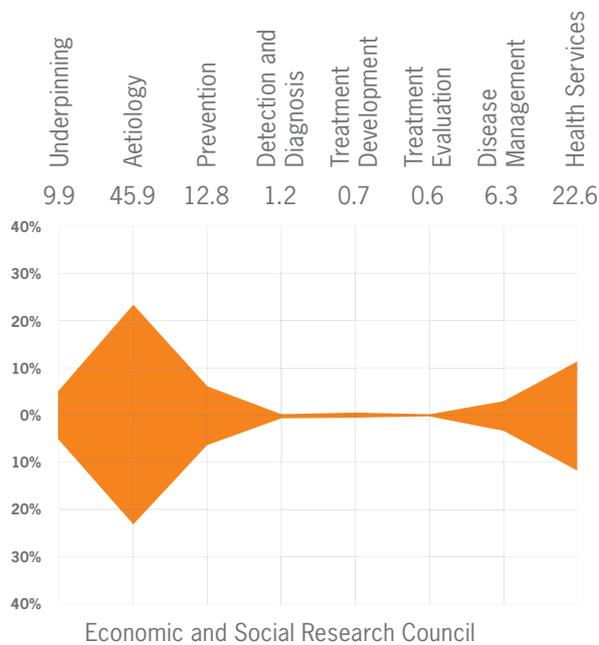
- = Greater than 25%
- = 16% - 25%
- = 5% - 15%
- = Less than 5%

Figure 3: Profile of Each Organisation's spend by Research Activity in 2009/10

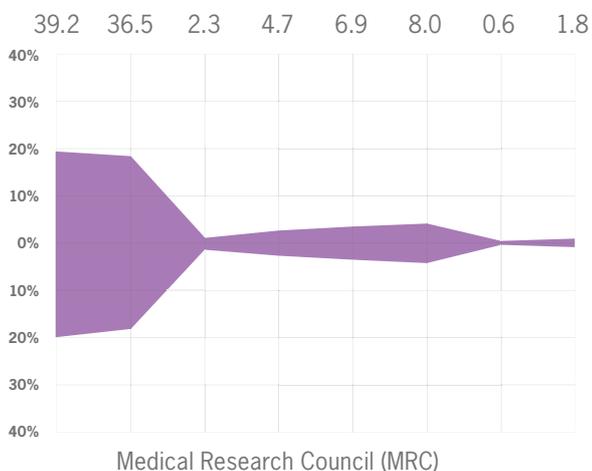




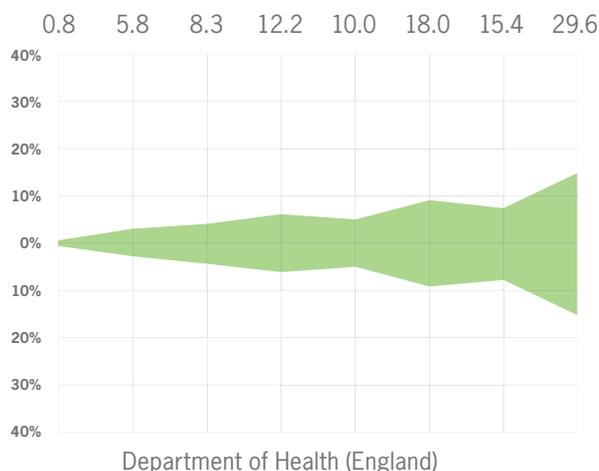
Engineering and Physical Sciences Research Council



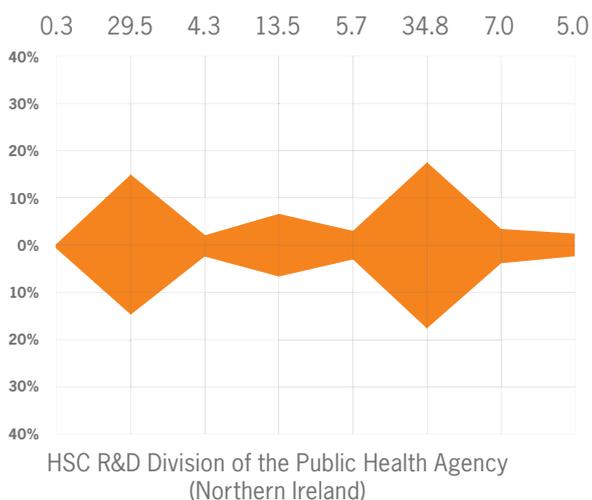
Economic and Social Research Council



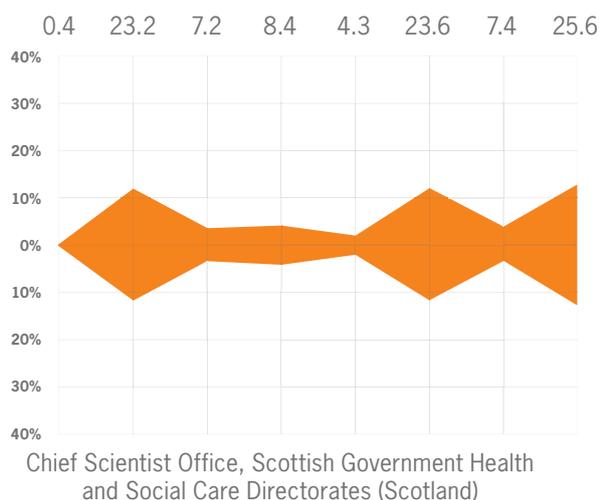
Medical Research Council (MRC)



Department of Health (England)



HSC R&D Division of the Public Health Agency (Northern Ireland)



Chief Scientist Office, Scottish Government Health and Social Care Directorates (Scotland)

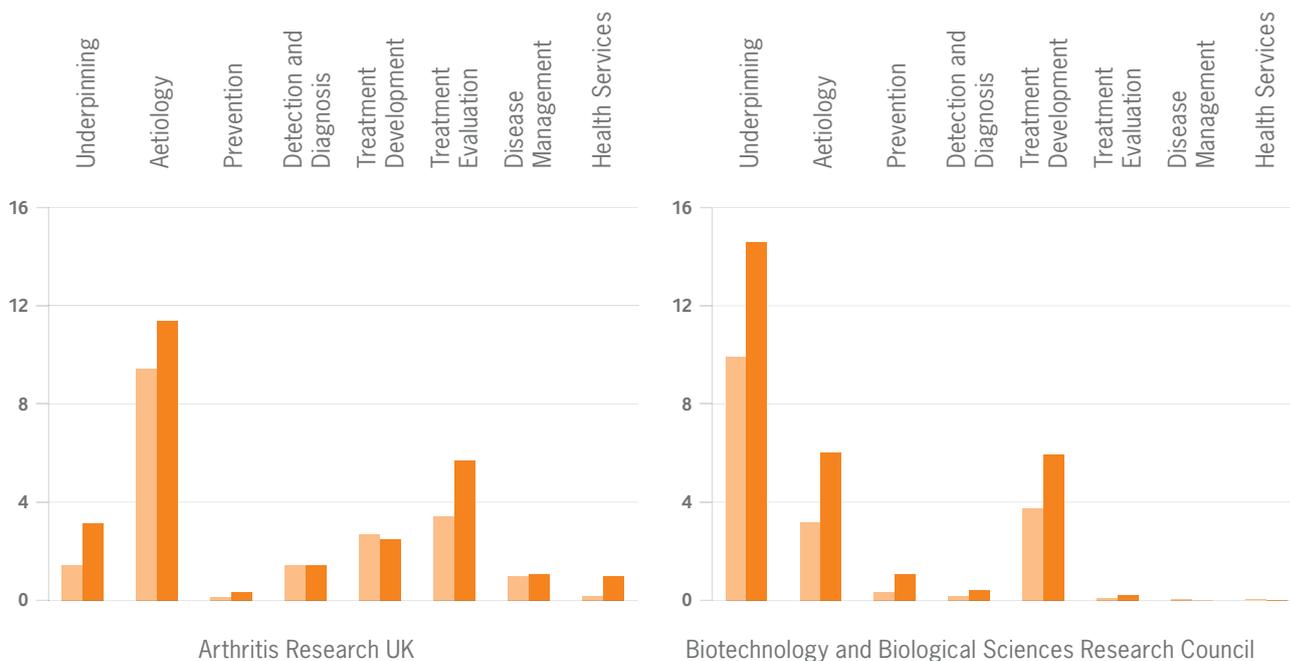


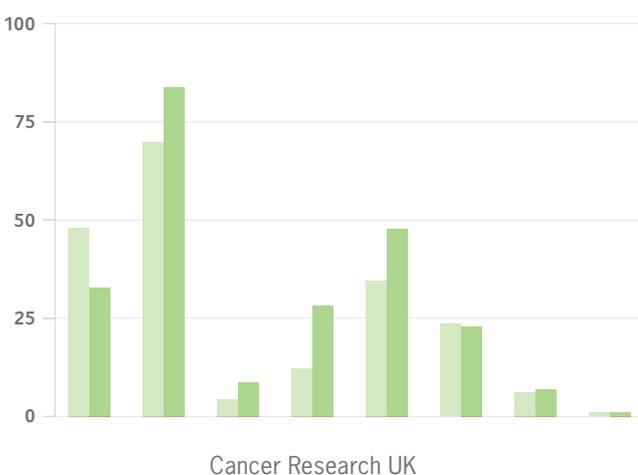
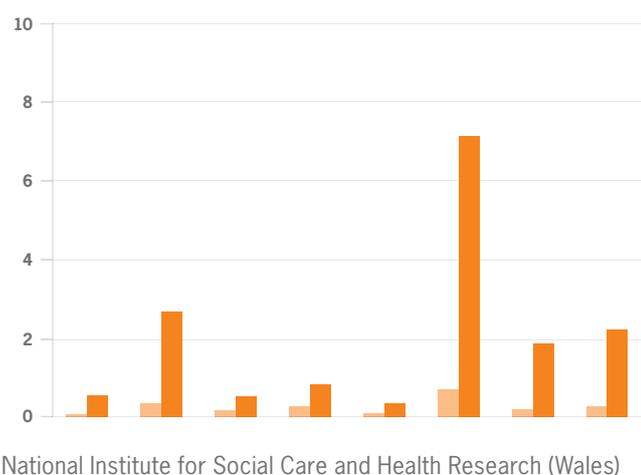
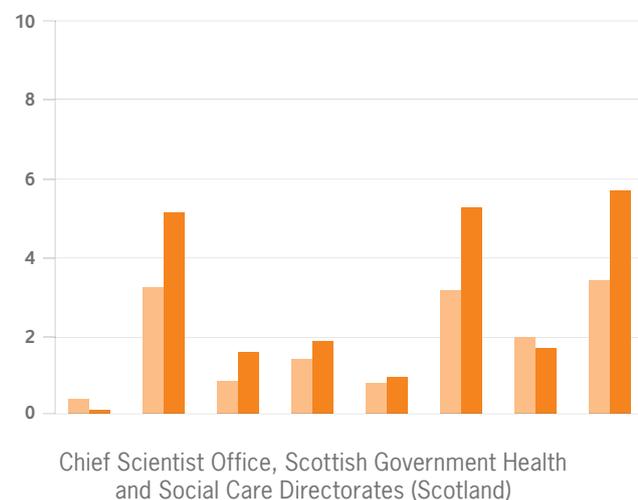
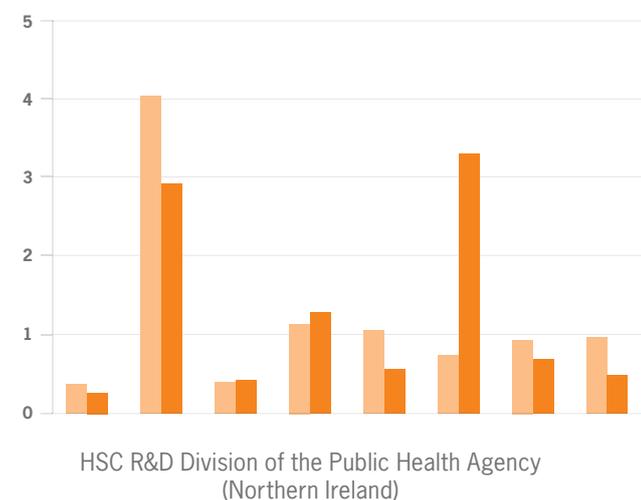
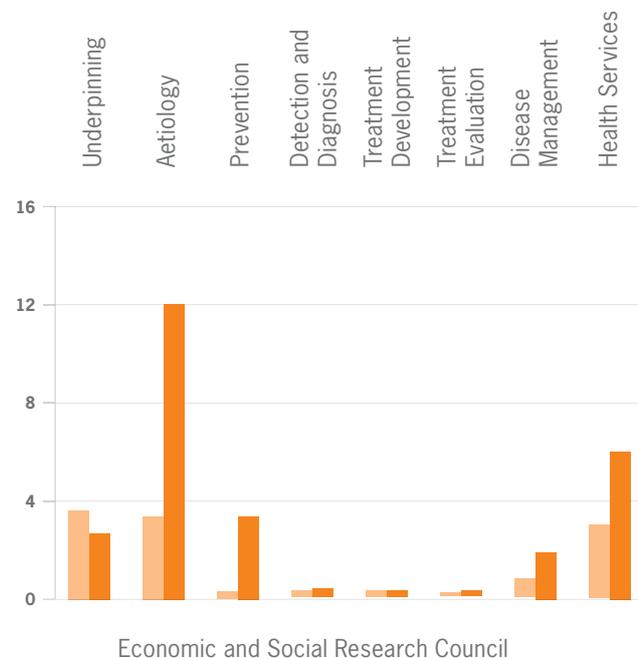
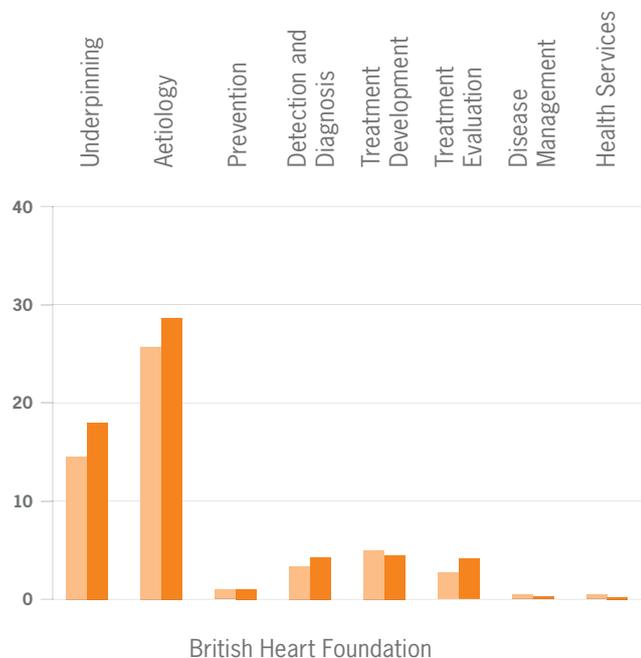
Legend for Figure 4

The bar charts show spend in 2004/05 (at 2009 prices), and spend in 2009/10, in £m. Light colours are 2004/05 figures and darker shaded bars correspond to spend in 2009/10. The charts are presented coloured according to the proportion each funder's spend is of the total combined spend in the detailed analysis (see Table 1 section A). For example the Wellcome Trust provided 20% of the overall spend on HRCS coded projects and programmes.

- = Greater than 25%
- = 16% - 25%
- = 5% - 15%
- = Less than 5%

Figure 4: Organisation spend (£m) in 2004/05 and 2009/10 by Research Activity





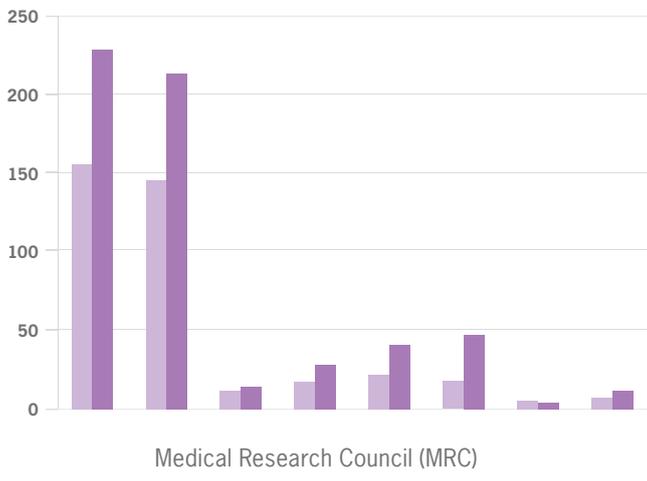
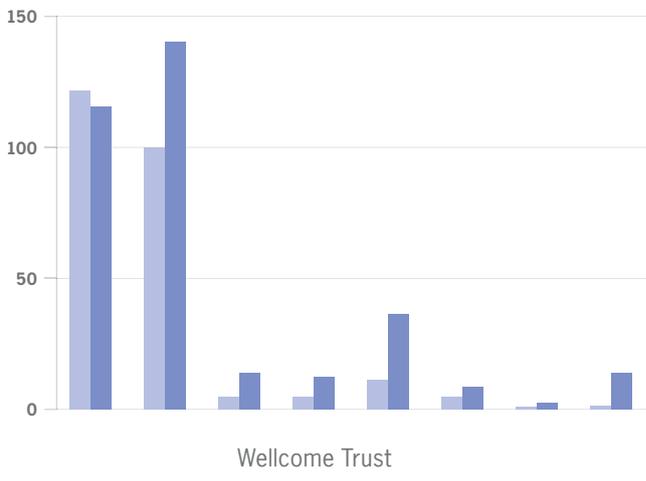
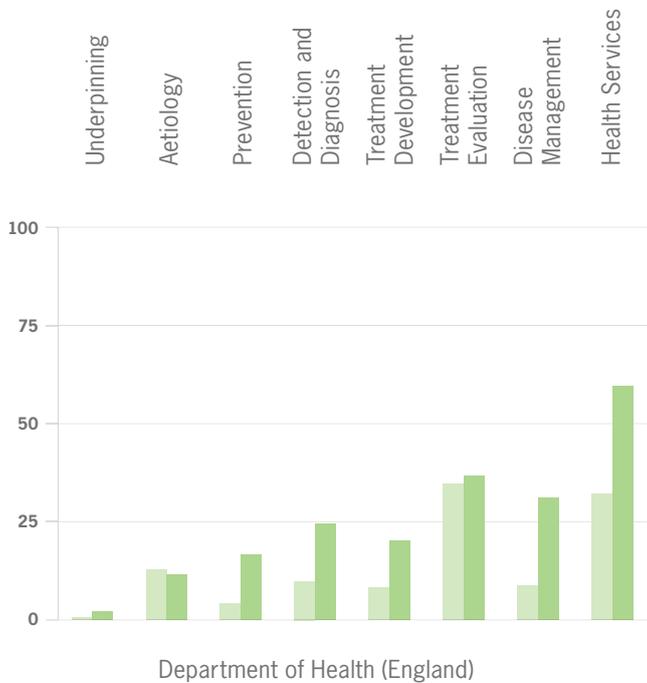
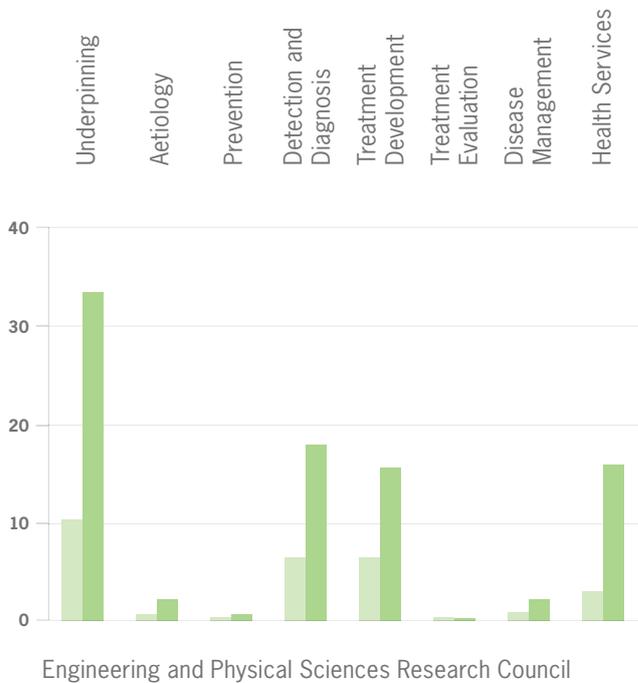


Table 4: 2004/05 spend by research activity, by funding organisation at 2009/10 prices (£m)

	Arthritis Research UK	BBSRC	BHF	CRUK	EPSRC	ESRC	MRC	NIHR	HSC R&D, Northern Ireland	CSO (Scotland)	NISCHR, Wales	Wellcome
Underpinning	1.41	9.88	14.36	48.07	10.33	3.58	155.98	0.60	0.37	0.37	0.01	121.75
Aetiology	9.47	3.14	25.54	69.78	0.90	3.36	145.75	12.54	4.04	3.27	0.34	100.16
Prevention	0.09	0.20	0.95	4.066	0.65	0.06	11.03	3.98	0.37	0.89	0.17	4.59
Detection and Diagnosis	1.39	0.07	3.14	12.16	6.52	0.09	17.13	9.78	1.17	1.42	0.30	4.25
Treatment Development	2.67	3.68	4.85	34.28	6.53	0.02	21.13	8.09	1.05	0.80	0.08	10.75
Treatment Evaluation	3.40	0.09	2.70	23.22	0.60	0.18	17.02	34.41	0.71	3.18	0.69	4.23
Disease Management	0.96	0	0.43	5.70	1.00	0.75	4.55	8.30	0.92	2.02	0.20	0.50
Health Services	0.11	0	0.33	0.79	3.20	2.91	6.26	31.78	0.96	3.43	0.30	1.20
Total	19.50	17.07	52.28	198.07	29.72	10.94	378.85	109.47	9.60	15.39	2.08	247.43

Table 5: 2009/10 spend by research activity, by funding organisation (£m)

	Arthritis Research UK	BBSRC	BHF	CRUK	EPSRC	ESRC	MRC	NIHR	HSC R&D, Northern Ireland	CSO (Scotland)	NISCHR, Wales	Wellcome
Underpinning	3.05	14.63	17.69	32.59	33.52	2.6	229.31	1.56	0.03	0.09	0.56	115.57
Aetiology	11.36	6	28.6	83.68	2.31	12.01	213.55	11.49	2.81	5.16	2.66	140.24
Prevention	0.27	1.05	1.02	8.44	0.76	3.35	13.52	16.52	0.41	1.59	0.54	13.82
Detection and Diagnosis	1.43	0.34	3.98	27.92	18.03	0.32	27.71	24.39	1.28	1.88	0.82	11.76
Treatment Development	2.51	5.92	4.35	47.73	15.74	0.17	40.46	20.21	0.54	0.95	0.33	35.8
Treatment Evaluation	5.66	0.13	4.11	22.6	0.09	0.16	46.75	36.27	3.31	5.26	7.15	8.36
Disease Management	0.99	0	0.08	6.81	2.53	1.64	3.59	30.97	0.66	1.66	1.85	2.13
Health Services	0.96	0	0	0.95	16.01	5.93	10.7	59.53	0.48	5.71	2.22	13.9
Total	26.23	28.07	59.84	230.72	89.01	26.18	585.6	200.94	9.52	22.29	16.13	341.58

4.3. Funder-specific portfolio changes

4.3.1. Arthritis Research UK

Since 2009/2010 Arthritis Research UK has undergone a process of radical change aimed at increasing the investment in musculoskeletal research. This included publication of a new Research Strategy for 2010-2015 and significantly increasing investment in strategic research. In the 2009/2010 period, investments were made in several new strategic initiatives - Centres of Excellence, Strategic Clinical Studies and Special Strategic Awards. These initiatives are designed to meet areas of research need identified by Arthritis Research UK in consultation with experts in the field. One other significant change in Arthritis

Research UK's portfolio over the past five years is the reduction in funding entirely dedicated to infrastructure and academic support. These grants formed part of the 2004/2005 analysis, but were no longer in existence in 2009/2010.

4.3.2. Biotechnology and Biological Sciences Research Council (BBSRC)

BBSRC is the UK's leading funder of academic research and training in the non-clinical life science in universities, institutes and centres with a research portfolio in 2009/10 totalling £290M. BBSRC developed a new strategic plan¹ in 2010 with one of the three Strategic Research Priorities being 'Basic Bioscience Underpinning Health'. This portfolio has been included in the UK Health Research Analysis 2009/10 totalling £29M, encompassing research directly relevant to ageing: lifelong health and wellbeing; regenerative medicine and pharmaceuticals.

BBSRC also supports other 'health' relevant research which is excluded from the UK Health Research Analysis 2009/10 such as diet and health (supported through our 'Food Security' Strategic priority), as well as underpinning bioscience relevant to health, such as immunology, neuroscience, stem cell biology.

Whilst BBSRC directly funds most of its research into health, it also provides funds to significant national cross funder initiatives, for example: the National Prevention Research Initiative²; the four call phases of the cross-council initiative Lifelong Health and Wellbeing³; and the New dynamics of Ageing cross-council programme⁴. Beyond the UK BBSRC is engaged in collaboration within the EU and with the US including the National Institute on Aging.

4.3.3. British Heart Foundation

The British Heart Foundation (BHF) is the UK's largest non-commercial funder of cardiovascular research. BHF increased its overall annual expenditure on active awards from £46.3m in 2004/2005 to £65.4m in 2009/2010. 91% of BHF expenditure (£59.8m) is included in this analysis. A further £5.6m was spent on 4 year PhD programmes, strategic awards, awards supporting infrastructure, and four Centres of Research Excellence that were awarded funding in 2008 to support multidisciplinary cardiovascular research, capacity building and training. The research profile indicated in Figures 3 and 4 reflects the BHF's focus on underpinning research exploring basic cardiovascular mechanisms and aetiology of cardiovascular diseases, as well as its support of preclinical treatment development through to translational research.

4.3.4. Cancer Research UK

Since 2004/2005, Cancer Research UK has increased its overall investment in cancer research from £222m to £334m in 2009/2010. Around two thirds of CRUK's annual expenditure on research in 2009/2010 has been included in this report. A further £100m is spent on essential research infrastructure, scientific meetings, building costs and technology transfer activities designed to hold, develop and exploit intellectual property rights arising from research to ensure that any discoveries that could lead to new drugs, diagnostics or vaccines reach the clinic. The shift in research profile in Figure 4 for CRUK reflects a focus on enhancing early detection, diagnosis, prevention and treatment whilst maintaining a strong base of basic research. Full details of CRUK's strategy, research, information and advocacy expenditure can be found on its website⁵.

4.3.5. Engineering and Physical Sciences Research Council (EPSRC)

The increase in the number and value of EPSRC awards reported compared to the 2004/05 data collection exercise is mainly due to the introduction of a strategic programme in Healthcare at EPSRC. This programme has been involved in two large partnerships, with the Wellcome Trust and Cancer Research UK, which involved investment of £30m (£15m each). The programme has also been strongly involved with various multidisciplinary cross-council activities, such as NDA (New Dynamics of Ageing) and LLHW (Lifelong Health and Wellbeing). The programme has also run its own calls, focussing on partnership (with SMEs and Charities) and translation.

1 <http://www.bbsrc.ac.uk/strategy/>

2 <http://www.mrc.ac.uk/Ourresearch/ResearchInitiatives/NPRI/index.htm>

3 <http://www.mrc.ac.uk/Ourresearch/ResearchInitiatives/LLHW/index.htm>

4 <http://www.newdynamics.group.shef.ac.uk/>

5 <http://aboutus.cancerresearchuk.org/what-we-do/our-annual-publications-and-strategy/>

4.3.6. Economic and Social Research Council (ESRC)

The increase in the number and value of ESRC awards reported compared to the 2004/05 data collection exercise could be due to a number of reasons. The profile of ESRC funding in the area of health has continued to increase over the last five years. Over this time the Council's responsive mode portfolio of health related awards has at least been maintained and the Council has also been involved in the development of more collaborative activities with partner organisations. Examples of these include the UKCRC Public Health Centres of Excellence, the National Prevention Research Initiative, and the cross-council programmes on New Dynamics of Ageing and Lifelong Health and Wellbeing.

4.3.7. Medical Research Council (MRC)

As highlighted in the 2006 review of UK health research, chaired by David Cooksey⁶ the MRC closely co-ordinates support for health research in the UK with NIHR and the devolved health departments. The 2007 spending review allocation for the MRC allowed an additional £132m to be directed toward translational research. £43m was spent on new research in this area in 2009/10 alone, and the MRC had committed more than £250m to enhancing the volume and capacity for translational research by 2010. It is therefore expected that there would be a growth in the proportion of MRC's portfolio focussed on translational research, while maintaining high quality underpinning research. In addition MRC expected to reduce its expenditure on work closer to health services, as NIHR takes the lead in supporting this area.

4.3.8. Department of Health (England)

The 2004/5 report captured the research spend of the Department of Health just prior to the establishment of NIHR. The Department's budget for research and development has increased by 48% between 2004/05 and 2009/10. The vast majority of this funding is allocated to the NIHR, which was established in 2006 with a specific remit to increase the volume of clinical and applied health and social care research. Consequently, there has been a substantial increase in funding for such work.

As a result, there has been increased funding in Detection and Diagnosis, Treatment Development, Disease Management and Health Services. Some of this real-term increase can be attributed to the Biomedical Research Centres (BRC), Units (BRU) and Collaborations for Leadership in Applied Health Research and Care (CLAHRC). They receive substantial levels of funding (just over 20% of the 09/10 research figure in Table 1) to translate fundamental biomedical research into clinical research that benefits patients and to support the translation of research evidence into practice. In addition, expenditure on NIHR's Research Programmes in clinical and applied health research has risen substantially. There has also been a considerable increase in investment in research training and career development.

4.3.9. HSC R&D Division of the Public Health Agency (Northern Ireland)

In keeping with the overall data, the Northern Ireland funding profile shows an increased spend on research that is closer to patients/service users. This relates directly to strategic activity over the 5 years since the previous report, and is strongly reflected in the growth in expenditure on the Northern Ireland Clinical Research Network (NICRN) and NI Cancer Trials Network (NICTN), which in 2009-10 represented a significant proportion (9% & 6.5% respectively) of the HSC R&D fund expenditure. Northern Ireland has shown a relatively modest increase in expenditure on prevention research. It is hoped that the UKCRC Centres of Excellence for Public Health can continue to build capacity in this area.

4.3.10. Chief Scientist Office, Scottish Government Health and Social Care Directorates

In relation to the Research Activity Areas, a headline comparison with the original analysis demonstrates that expenditure on underpinning activities (2.0) and disease management (5.7) research showed the greatest falls while expenditure on aetiology (2.0) treatment evaluation (2.9) and health services (3.4) research showed the greatest increases (figures in brackets indicate the percentage increase/decrease). The shift reflects policy decisions to invest in clinical research networks (treatment evaluation) and research with direct patient benefit (health services research).

The pattern of funding across the Health Categories was broadly similar to that in 2004-5 although there are some changes of note, particularly a small increases in expenditure on Mental Health and Metabolic and Endocrine research (reflecting network

6 A review of UK health research funding (HM Treasury, 2006) http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/cooksey_review_index.htm

investment), and a fall in the Oral and Gastrointestinal area from roughly 9% to 3.5%. There was also a halving of expenditure on Reproductive and Childcare research, and a small drop in the area of Cancer.

4.3.11. National Institute for Social Care and Health Research (NISCHR, Wales)

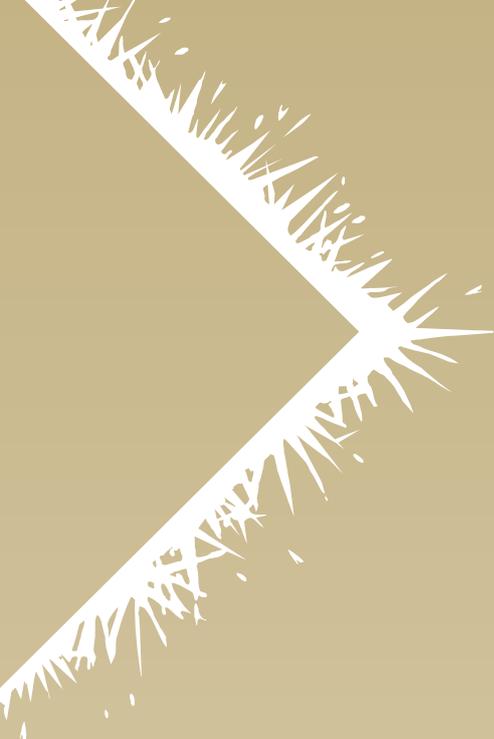
The increase in awards and spend from 2004/05 data is mainly due to the continued development of the National Institute for Social Care and Health Research and accompanying budget increases. Between 2004/05 and 2009/10, for example, NISCHR's total annual health and social care research spend increased from £18.4m to £35.4m enabling it to launch new competitive funding schemes (including responsive schemes, fellowships and studentships), increase its support for clinical and translational research and participate in a range of UK programmes and joint-funding initiatives. Though in relative terms the report indicates some variation in spend across Research Activity Areas, in financial terms we expect that NISCHR spend has increased across the Board. The 12.4% increase in Treatment Evaluation reflects NISCHR's status as a Government health and social care R&D unit with a focus on investing in research that is closer to the clinic and more likely to deliver patient benefit.

4.3.12 Wellcome Trust

The Wellcome Trust has continued to support high quality research with the aim of improving human and animal health. Since the publication of the 2004/05 analysis there have been some shifts in emphasis at the Wellcome Trust and the introduction of several new approaches to grant making at the Wellcome Trust, including: the introduction of Strategic Awards to enable outstanding research teams to take forward large and ambitious programmes of work; the support for technology transfer to enable the practical applications of research has expanded; a number of major initiatives to build individual and institutional research capacity in low and middle-income countries have been launched; and, the Wellcome Collection has opened as an innovative public venue for exploration and debate of medicine, life and art.

The Strategic Plan 2010-2020 outlines the ongoing vision and sets out the Trust's focus areas and research challenges it wants to address. The Trust continues to focus its funding on: 1. Supporting outstanding researchers 2. Accelerating the application of research and, 3. Exploring medicine in historical and cultural contexts. The current five, research challenges it wants to support are to:

1. Maximise the health benefits of genetics and genomics
2. Understand the brain
3. Combat infectious disease
4. Investigate development, ageing and chronic disease
5. Connect environment, nutrition and health.



DISTRIBUTION OF FUNDING ACROSS HEALTH CATEGORIES



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5. Distribution of Funding across Health Categories

The next two sections of the report present analyses of the research on the Database using the Health Categories classification.

There are 21 Health Categories, of which 20 relate to a specific area of health or disease. These 20 health specific categories include research into both disease and normal function, for example, studies of normal hepatic cell function and studies of liver cirrhosis will be classified in the Oral and Gastrointestinal Health Category. The remaining category, Generic Health Relevance, relates to research that is applicable to all diseases or relevant to general health and well-being, for example basic cell and molecular biology studies common to all cell types, or geographical evaluation of health services.

In 2004/05 of the total research funded, 25% was of Generic Health Relevance, whilst 75% related to the health specific categories. In 2009/10 a similar proportion is categorised as Generic Health Relevance (24%). In the 2006 report the analysis concentrated on the 75% of funding which related to health specific categories, and generic health relevance was excluded from the figures. We have chosen to include 100% of the research spend captured in this analysis.

Figure 5 shows the relative distribution of research funding across the health specific categories, as a proportion of total spend. The proportions range between 20% spend in Cancer which includes all types of cancers, to 0.4% in Injuries and Accidents which includes research into fractures, poisoning and burns.

Research within the Cancer, Neurological, Infection and Cardiovascular categories accounts in total for almost half of funding captured in 2009/10 (48%, unchanged from 2004/05). Within this Cancer research received almost £100m more funding in 2009/10 than 2004/05. However, as this change is slightly lower than the average for health research overall (by 0.4%) the proportion of spend relevant to cancer research is very slightly lower in 2009/10 than 2004/05. This picture of slightly lower growth in investment in cancer research over five years is supported by data from NCRI partners¹.

Spend in the area of neurological diseases received an additional £34m in 2009/10 over the level spent in 2004/05. However the proportion of the total spend on research in this area is also slightly lower in 2009/10 than 2004/05 (a difference of 1.6%).

Research in the area of “musculoskeletal” disease, and in the area of “inflammatory and immune system” received a slightly lower proportion of the combined health research spend (-0.2% and -1.0% respectively) in 2009/10 compared with 2004/05. However spend in these areas was £12.7m and £15.8m higher respectively.

The share of the portfolio categorised as research into infectious disease and also research into mental health was slightly larger in 2009/10 compared with 2004/05 (by 1.8% and 1.3% respectively). Research into infectious diseases benefitted from an additional £79m of spend in real terms in 2009/10 compared to 2004/05, putting it into second place behind cancer as the area in which most was spent. Spend for mental health relevant research was £43m higher in 2009/10 than in 2004/05.

The investment in two areas was lower in real terms in 2009/10 compared to 2004/05 (Ear and Congenital disorders).

¹ NCRI investment figures (for 1st April 2005 and 1st April 2010) Lynne Davies pers. comm.

Figure 5: Proportion of Combined Spend on Health Specific Categories

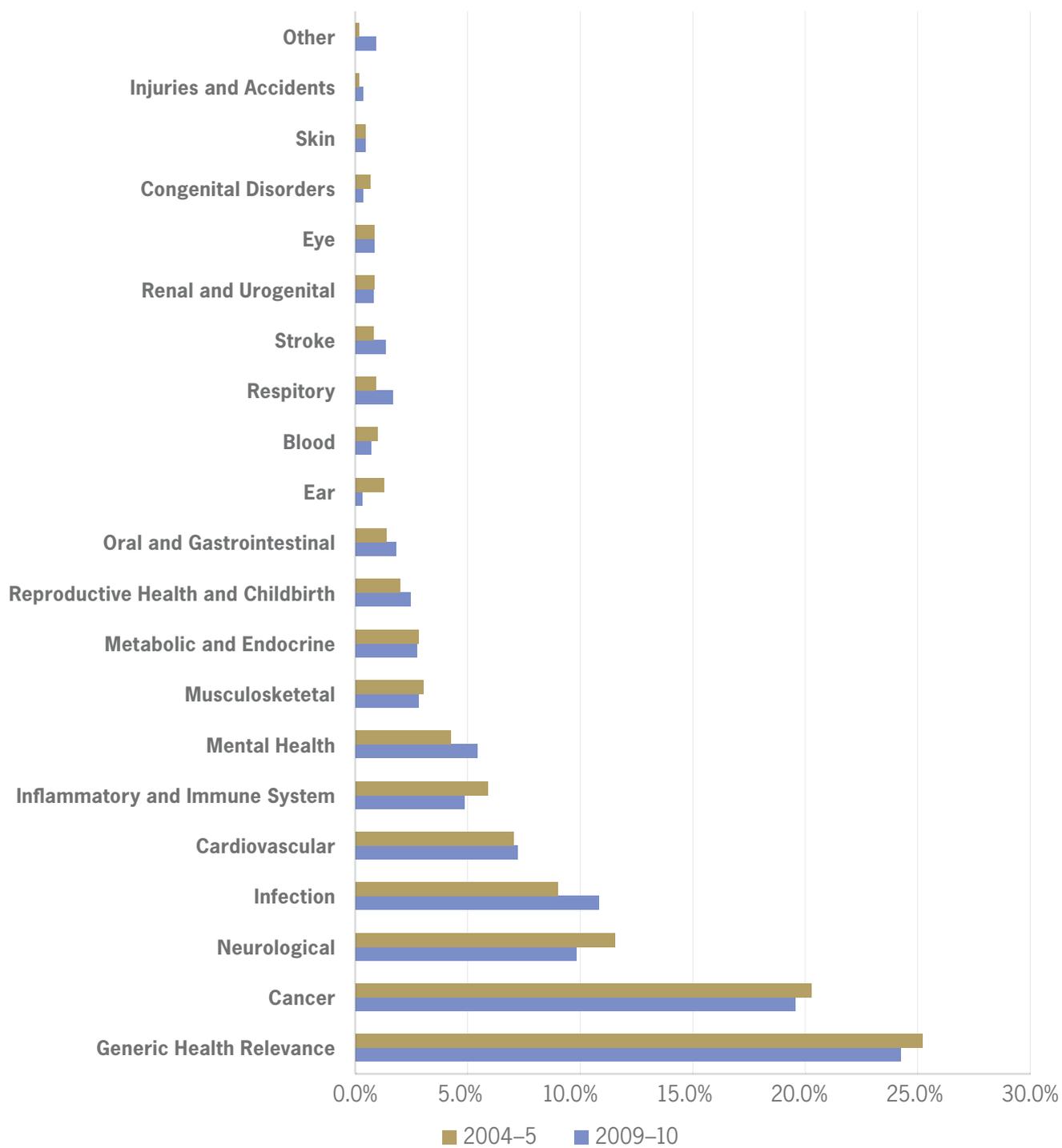


Table 6: Proportion of Combined Spend on Health Specific Categories, Difference 2004/05 – 2009/10

Health Category	2004/05 %	2004/05 Total spend (£m)	2004/05 spend at 2009/10 prices	2009/10 %	2009/10 Total spend (£m)	Difference between 2004/05 % and 2009/10 %	Absolute difference in spend in real terms (£m)
Generic Health Relevance	25.2	243.1	274.7	24.2	396.6	-1.0	121.8
Cancer	20.3	195.7	221.1	19.6	320.7	-0.7	99.6
Neurological	11.6	111.5	126.0	9.8	160.9	-1.7	35.0
Infection	9.0	87.2	98.5	10.8	177.4	1.8	78.9
Cardiovascular	7.0	67.6	76.4	7.2	117.8	0.2	41.3
Inflammatory and Immune System	5.9	56.7	64.0	4.9	79.9	-1.0	15.8
Mental Health	4.3	41.3	46.7	5.5	89.5	1.2	42.8
Musculoskeletal	3.0	29.2	33.0	2.8	45.7	-0.2	12.7
Metabolic and Endocrine	2.9	27.6	31.2	2.8	45.2	-0.1	13.9
Reproductive Health and Childbirth	2.0	19.6	22.1	2.5	40.9	0.5	18.7
Oral and Gastrointestinal	1.4	13.6	15.4	1.8	30.0	0.4	14.6
Ear	1.3	12.1	13.7	0.3	5.5	-0.9	-8.2
Blood	1.0	9.7	10.9	0.8	12.6	-0.2	1.7
Respiratory	0.9	9.2	10.3	1.7	28.4	0.8	18.0
Stroke	0.9	8.6	9.7	1.3	22.0	0.5	12.3
Renal and Urogenital	0.9	8.4	9.5	0.8	13.7	<0.1	4.2
Eye	0.9	8.4	9.5	0.9	14.1	<0.1	4.6
Congenital Disorders	0.7	6.9	7.8	0.4	5.7	-0.4	-2.1
Skin	0.5	4.6	5.2	0.5	8.1	<0.1	2.9
Injuries and Accidents	0.2	2.2	2.5	0.4	5.8	0.1	3.3
Other	0.2	1.7	1.9	1.0	15.6	0.8	13.7
Total	100	965.0	1090.4	100	1636.1	0	545.7

As previously outlined in Section 4.1 there are multiple factors that influence the level of research funding in any area, including scientific opportunity, research workforce capacity, 'researchability' or tractability, burden of disease and fund raising potential. Burden of disease is a measure that has previously been used as a comparator for research investment across different diseases. There are many metrics to assess burden of disease such as incidence, prevalence, mortality, morbidity and length of hospital stay. Comparison with each of these can lead to different interpretations about the appropriate relationship with research funding levels.

Disability Adjusted Life Years (DALY) are frequently used as a measure of burden of disease. DALYs are a measure of the sum of life years lost due to premature mortality and years lived with a disability adjusted for the severity, and thus they take into account the impact of mortality and morbidity in a single measure.

The 2006 analysis presented a comparison of the proportion of research funding across the health specific categories related to UK Disability Adjusted Life Years (DALY) rates from the WHO Global Burden of Disease Project. In that analysis DALY data from 2002 was used, and the WHO has subsequently released DALY data from 2004. We have updated the analysis using 2004 DALY data. The detailed mapping for this can be found in Appendix 5.

Figure 6 presents a comparison of the proportion of research funding across the health specific categories in 2004/05 and 2009/10 related to UK Disability Adjusted Life Years (DALY) rates from the WHO Global Burden of Disease Project. The Health Categories have been combined as necessary to allow appropriate comparison with the available DALY data. The trends in the ranking of research funding generally correlate with the overall trend in the DALY ranking. Notable exceptions to this association

are observed for Infection, Respiratory, and Oral and Gastrointestinal (which includes the liver). In the case of “Infection”, “Cancer”, “Skin” and “Reproductive health” the relative research funding is higher than the corresponding UK DALY ranking, whereas for all other categories the relative research funding is lower.

For the respiratory research category the DALY rate has decreased in the WHO data for 2004, compared to 2002 indicating a small fall in the burden of disease for the UK. This area of research receives almost three times more funding in 2009/10 compared to 2004/05 (£28m in 2009/10, £10m in 2004/05). The proportion of the overall spend directed to respiratory medicine is also higher (a difference of +0.8%).

A larger proportion of the overall spend is directed to research in the oral/gastrointestinal category in 2009/10 (a difference of +0.4% compared to 2004/05) corresponding to real terms funding of £30m compared to £15m in 2004/05.

Spend has changed to the greatest extent for research into infectious diseases, while the UK DALY rate for this area has fallen slightly. Research on infectious diseases is almost £79m higher in 2009/10 over the level of spend in 2004/05. This is an area in which the UK has particular scientific strengths, and concerns about emerging diseases has highlighted the importance of co-ordinating funding to maintain a high quality basic and clinical research base in this area. For example, in 2009 there were several fast-track strategic responses to the influenza pandemic including a new £7.5m commitment jointly from the MRC, Wellcome Trust and BBSRC².

In the 2006 analysis there was no large disparity seen between the amount invested in ear and eye diseases and the relative burden of disease in this area. In Figure 6 it can be seen that the WHO DALY rate for ear and eye diseases has increased significantly, this is the result of new data and areas being added to the eye relevant DALY data. This may highlight that the burden of disease in this area was under-estimated in the earlier analysis. The real terms funding for research in the Ear health category is lower in 2009/10 than 2004/05 whereas funding for research in the Eye health category is higher. In both cases the amount spent is relatively small, relating to a small number of awards (59 awards with relevance to the Ear). From year to year the termination and initiation of awards in such a small portfolio will cause large changes in the annual spend figure.

² Collaborations lead UK research community response to H1N1 pandemic (MRC Website November 2009) <http://www.mrc.ac.uk/Newspublications/News/MRC006480>

Figure 6: Comparison of Proportion of Combined Spend on Health Specific Categories with WHO DALY rates

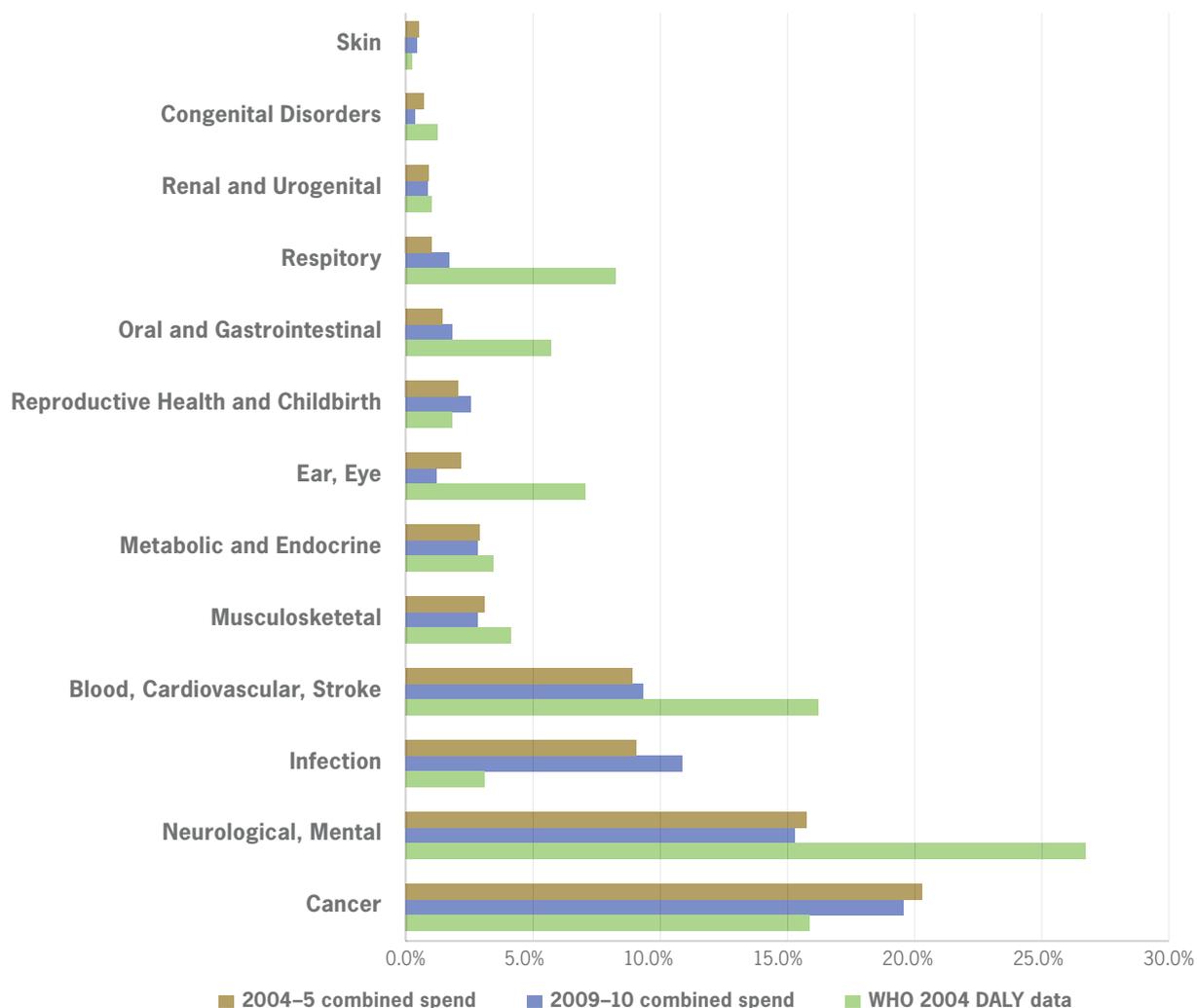
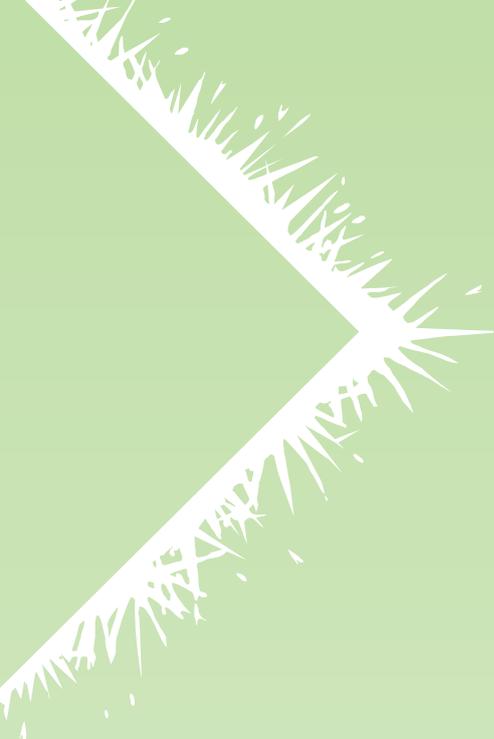


Table 7: Proportion of combined spend on Health Categories compared with DALY rates

Aggregated Health Category	2004 WHO UK DALY %	Combined 2004/05 Spend %	Combined 2009/10 Spend %	Difference 2004/05 – 2009/10 %
Cancer	15.9	20.3	19.6	-0.7
Neurological, Mental	26.7	15.8	15.3	-0.5
Infection	3.1	9.0	10.8	1.8
Blood, Cardiovascular, Stroke	16.2	8.90	9.30	0.4
Musculoskeletal	4.1	3.0	2.8	-0.2
Metabolic and Endocrine	3.5	2.9	2.8	-0.1
Ear, Eye	7.0	2.1	1.20	-0.9
Reproductive Health	1.8	2.0	2.5	0.5
Oral and Gastrointestinal	5.7	1.4	1.8	0.4
Respiratory	8.3	0.9	1.7	0.8
Renal and Urogenital	0.9	0.9	0.8	0.0
Congenital	1.2	0.7	0.4	-0.4
Skin	0.2	0.5	0.5	0.0
Total	94.5³	68.5⁴	69.6	1.1

³ Injuries and accident excluded from 2004 DALY data – hence 5.5% missing

⁴ Some categories (Generic Health Relevance, Other etc.) not mapped to DALY data. Hence only around 70% of spend represented (see Appendix 5 for the detail of this mapping)



GEOGRAPHICAL DISTRIBUTION OF COMBINED RESEARCH FUNDING IN THE UK



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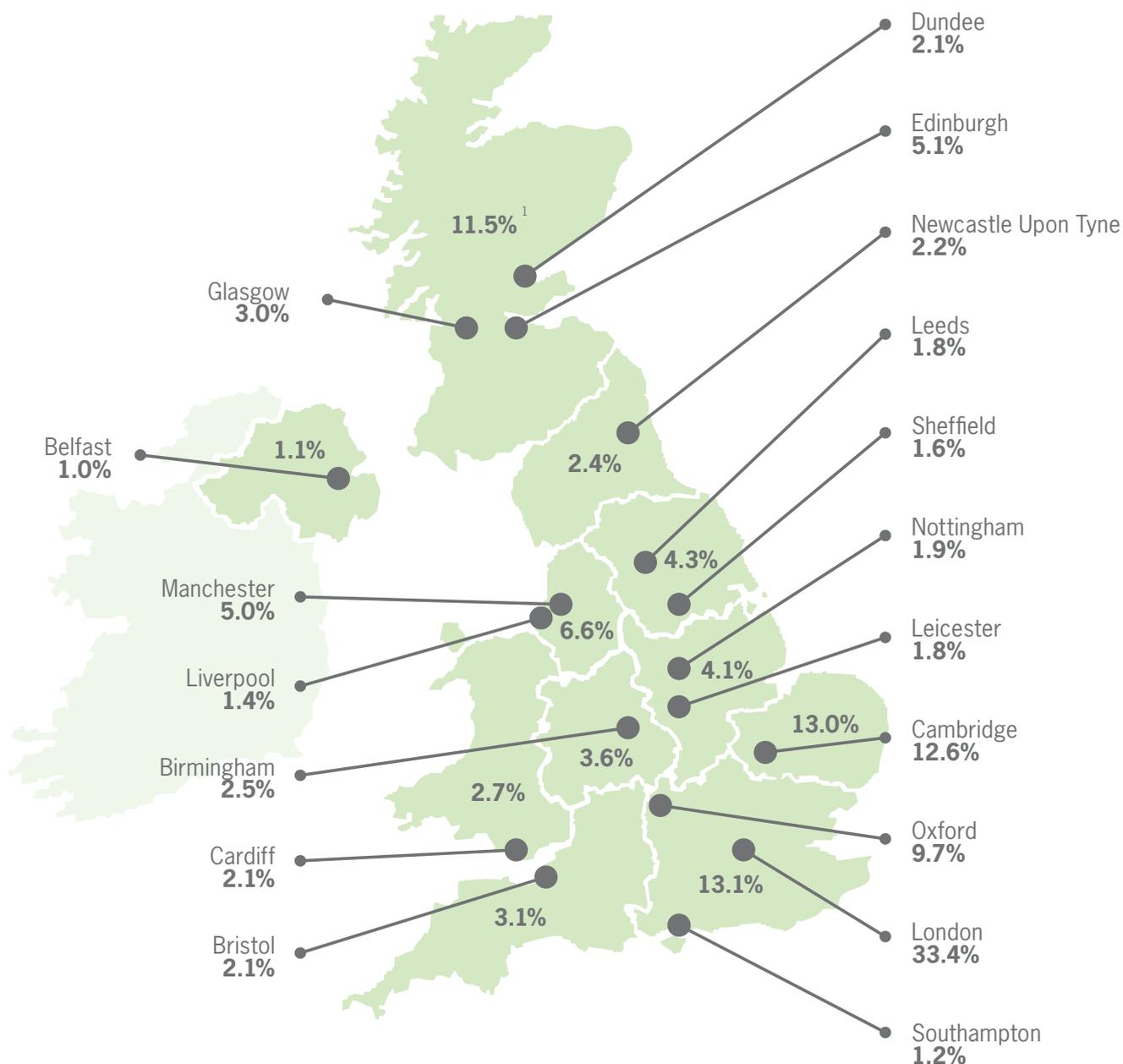
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6. Geographical Distribution of Combined Research Funding in the UK

The compilation of portfolio data centrally provides an opportunity to map the directly funded research of the participating organisations by geographical location within the United Kingdom. A breakdown of funding by individual cities is illustrated in Figure 7. For practical reasons only cities with 1% or more of the overall combined expenditure in the 2009/10 dataset are displayed on the map.

Figure 7: Geographical Distribution of Combined Research Funding in the UK



¹ The figures for Scotland do not include income to Scottish institutions in relation to research funded through NETSCC Programmes and therefore are a minor underestimation

6.1. Analysis of geographical distribution of combined research funding by region

Table 8 shows a breakdown of the geographical distribution of combined research funding in the UK by region, significant cities within each region and the change between 2004/05 and 2009/10. It should be noted that differences at the regional level may hide growth within the region at the city level, for example the proportion of funding held in the South East in 2009/10 is lower by 1.2% compared with the proportion in 2004/05, whereas funding for all institutions in Oxford within this region is higher (by 0.9% of total funding). The net real funding difference within the South East region when 2004/05 figures are compared with 2009/10 is +£58m, whereas funding in Oxford alone was £63m higher in 2009/10.

Comparing the data in 2004/05 and 2009/10 there were very small changes for regions and cities. Oxford (+0.9%) and Cambridge (+0.5%) attract a larger proportion of the funding available. For Cambridge this represented an additional real terms spend of £75m in 2009/10 over 2004/05. London maintained its share of funding at just over a third of the total at 33.4% which meant in real terms £181m more funding in 2009/10 compared with 2004/05.

Wales received £26m more annual funding in 2009/10 in real terms over 2004/05 (gaining a 1.1% higher share of the total UK health research funding). Scotland obtained £47m more health funding in 2009/10 than in 2004/05, with a slightly smaller share of the overall UK spend (-1.5%). Expenditure in Northern Ireland was maintained at around 1% of the UK total. Funding in England increased by £474m in real terms.

Table 8: Geographical Distribution of Combined Research Funding in the UK

UK Region	2004/05 number of projects	2004/05 proportion of total spend (%)	2004/05 spend (£m)	2004/05 spend at 2009/10 prices (£m)	2009/10 number of projects	2009/10 proportion of total spend (%)	2009/10 spend (£m)	Absolute difference between 2004/05 and 2009/10 spend in real terms
East Anglia total	1065	12.4	119.8	135.4	1075	13.0	213.4	78.0
Cambridge	1013	12.2	117.5	132.7	998	12.6	206.4	73.7
Norwich	50	0.2	2.3	2.6	77	0.4	7.0	4.3
East Midlands total	410	4.4	42.6	48.1	503	4.1	67.0	18.8
Leicester	201	2.1	19.9	22.4	175	1.8	29.7	7.3
Nottingham	190	2.3	22.0	24.8	300	1.9	30.9	6.1
North total	245	1.7	16.4	18.6	350	2.4	38.8	20.3
Durham	27	0.1	1.1	1.2	43	0.1	2.4	1.1
Newcastle Upon Tyne	205	1.5	14.6	16.5	298	2.2	35.7	19.2
North West total	665	6.4	61.9	69.9	802	6.6	107.9	38.0
Liverpool	139	0.7	7.2	8.1	230	1.4	23.4	15.2
Manchester	492	5.3	51.6	58.3	540	5.0	82.4	24.1
Northern Ireland total	230	1.2	11.5	13.0	190	1.1	17.4	4.4
Belfast	199	1.0	10.0	11.3	165	1.0	16.1	4.8
Coleraine	17	0.1	0.7	0.7	18	>0.1	0.7	>0.1
Scotland total ¹	1513	13.0	125.4	141.7	1429	11.5	188.6	46.9
Aberdeen	160	0.9	8.4	9.4	170	0.9	13.9	4.5
Dundee	252	2.2	21.1	23.9	227	2.1	34.4	10.5
Edinburgh	562	5.5	53.3	60.3	587	5.1	84.2	23.9
Glasgow	479	4.1	39.3	44.4	380	3.0	49.5	5.1

UK Region	2004/05 number of projects	2004/05 proportion of total spend (%)	2004/05 spend (£m)	2004/05 spend at 2009/10 prices (£m)	2009/10 number of projects	2009/10 proportion of total spend (%)	2009/10 spend (£m)	Absolute difference between 2004/05 and 2009/10 spend in real terms
South East total	1217	14.3	138.2	156.2	1406	13.1	213.9	57.7
Oxford	752	8.8	84.9	95.9	926	9.7	159.0	63.1
Southampton	194	1.5	14.7	16.6	205	1.2	19.6	3.0
Brighton	77	0.8	7.3	8.2	105	0.6	10.2	2.0
South West total	445	2.8	27.4	30.9	546	3.1	51.2	20.3
Bath	78	0.4	3.9	4.4	69	0.3	4.5	<0.1
Bristol	301	2.0	19.4	22.0	367	2.1	33.8	11.8
Wales total	255	1.7	16.1	18.2	434	2.7	44.5	26.3
Cardiff	220	1.5	14.3	16.1	315	2.1	34.7	18.6
Swansea	15	0.1	0.8	0.9	68	0.4	5.8	4.9
Bangor	15	0.1	0.8	0.9	35	0.2	2.7	1.8
West Midlands total	399	2.8	26.7	30.1	626	3.6	58.7	28.6
Birmingham	313	2.3	22.3	25.2	459	2.5	40.2	15.0
Coventry	47	0.2	2.4	2.7	106	0.8	13.2	10.5
Yorshire and Humberside total	631	5.7	55.0	62.1	721	4.3	70.6	8.4
Leeds	258	2.9	28.3	31.9	284	1.8	29.2	-2.8
Sheffield	221	1.7	16.8	19.0	255	1.6	26.1	7.1
York	104	0.6	6.0	6.8	133	0.7	10.7	3.9
London total	2812	33.5	322.8	364.8	3347	33.4	545.9	181.1
All regions total	9885	99.9²	963.8	1089.1	11429	98.9³	1618.1	528.8

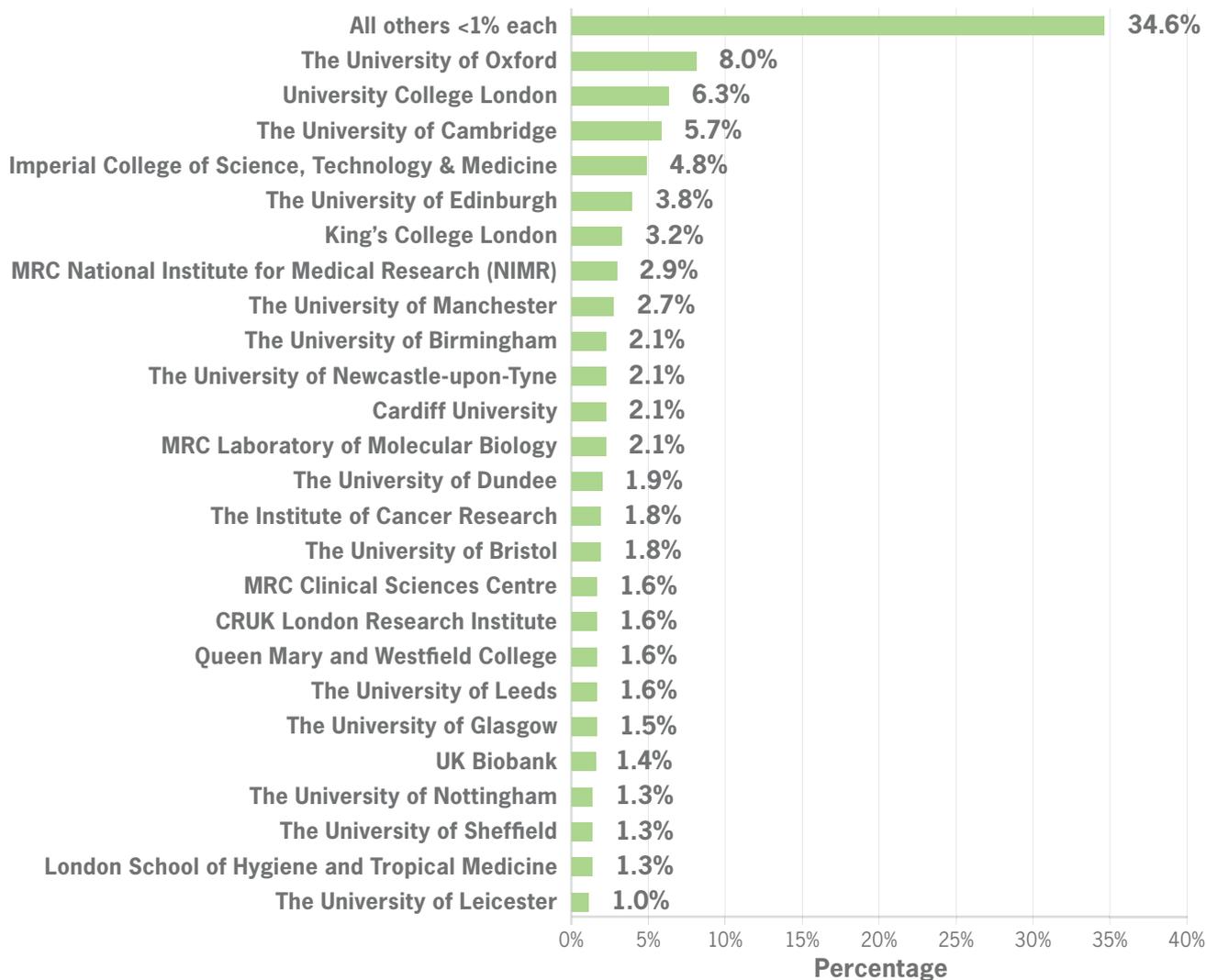
6.2. Analysis of combined funding by institution

The 2009/10 data permits an analysis of funding by individual institution. In the 2004/05 dataset 30% of projects had no details of the specific institution receiving the award, and so a direct comparison is not possible. In Figure 8, 25 institutions that hold at least 1% of the total funding in the dataset are identified. These 25 institutions combined hold almost two thirds (65.4%) of the UK funding identified in this analysis, with four institutions (Oxford, UCL, Cambridge and Imperial College) holding almost 25% of the funding available.

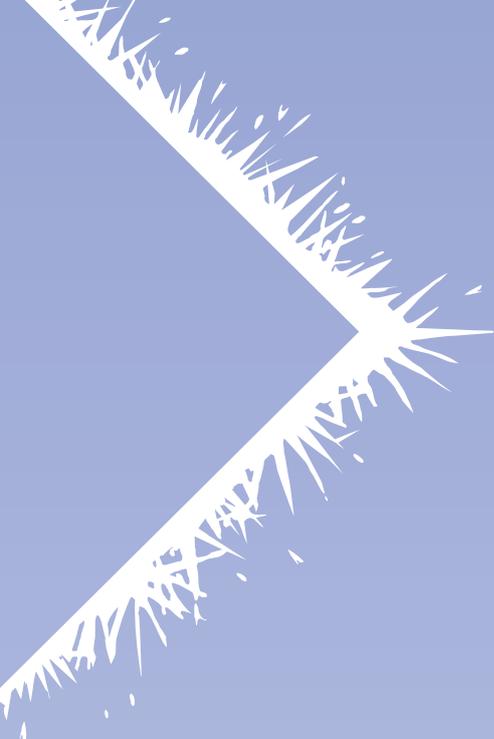
² 16 awards in the 2004/05 data had no location information, totalling 0.1% of the total combined spend (£1.1m)

³ 46 awards in the 2009/10 data had no location information, totalling 1.1% of the total combined spend (£18.2m)

Figure 8: Proportion of combined 2009/10 spend by Institution







NEXT STEPS



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7. Next Steps

We have extended the presentation of data on UK health research funding significantly since the analysis of 2004/05 portfolios, and for the first time set this in the context of an estimate for the total expenditure on health related research and development.

In particular the analysis provides reassurance to funding agencies that areas of research previously identified as in need of investment, are receiving additional funding. It can be seen that strategic initiatives have shaped the research portfolio to some extent, although against a back-drop of increased funding for health research overall. It will be important to continue to consistently track research portfolios in this way to support co-ordination between funding agencies.

HRAF will agree a process for the regular collection and compilation of portfolio data, for the benefit of participating research organisations.

Additional work can be undertaken to examine funding for research infrastructure. We presented a small part of the expenditure on infrastructure for the research base in this report, and if this is to be widened then there are challenges in apportioning such support to different disciplines.

We briefly looked at the funding of health-relevant research outside of the UK, but acknowledge that other stakeholders (for example UK Department for International Development) would need to be involved in examining this in more detail.

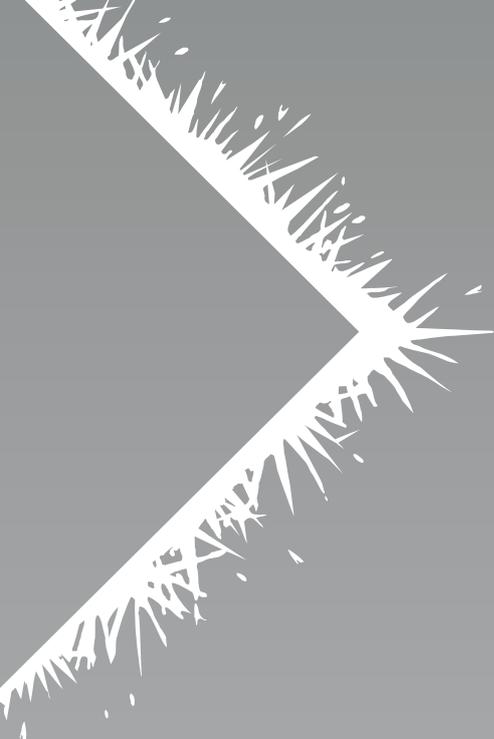
The use of the HRCS has increased internationally since the 2004/05 analysis with funding agencies in Ireland, Sweden, Singapore, and Norway making use of the approach. The EMRC recommended in 2011 that European funding agencies consider its use, and this recommendation has been backed by 23 research organisations¹. The motivation behind recommending a standard approach for categorising research portfolios is to improve the co-ordination between funding agencies, and strengthen the competitiveness of the European Research Area. The ICRP project, which currently collates information from 57 participating cancer research funding organisations in Canada, France, the Netherlands, UK, Australia and the USA is seen as an exemplar for successful co-ordination between partners.

HRAF will work to build on this analysis, and the best practice from ICRP, to identify a suitable repository for health research portfolio information.

Interest is also building in the use of automated approaches to categorise research portfolios, so that larger numbers of projects can be quickly and consistently analysed. The data analysed in this report may be used to test automated approaches to categorising portfolio information, and HRAF will collaborate with suppliers to pursue this work.

HRAF will use the data collected in this analysis to investigate opportunities to develop automated coding approaches.

¹ Health Research Classification Systems - Current Approaches and Future Recommendations <http://www.esf.org/research-areas/medical-sciences/activities/science-policy/health-research-classification-systems-current-approaches-and-future-recommendations.html>



APPENDICES



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Abbreviations

AMRC	Association of Medical Research Charities
BBSRC	Biotechnology and Biological Sciences Research Council
BERD	Business Expenditure on Research and Development
BHF	British Heart Foundation
BRC	Biomedical Research Centre
BRU	Biomedical Research Unit
CLAHRC	Collaboration for Leadership in Applied Health Research and Care
CSO	Common Scientific Outline
DALY	Disability Adjusted Life Year
EPSRC	Engineering and Physical Sciences Research Council
ESRC	Economic and Social Research Council
fEC	Full Economic Costing
GBD	Global Burden of Disease
GERD	Gross Expenditure on Research and Development
HEFCE	Higher Education Funding Council for England
HESA	Higher Education Statistics Agency
HRAF	Health Research Analysis Forum
HRCS	Health Research Classification System
HEI	Higher Education Institute
ICD	International Classification of Diseases
ICRP	International Cancer Research Partnership
LLHW	Lifelong Health and Wellbeing
ICRP	International Cancer Research Partnership
MRC	Medical Research Council
NCRI	National Cancer Research Institute
NHS	National Health Service
NIHR	National Institute for Health Research
NISCHR	National Institute for Social Care and Health Research (Wales)
NPRI	National Prevention Research Initiative
OSCHR	Office for Strategic Co-ordination of Health Research
PNP	Private, Not for Profit
R&D	Research and Development
REF	Research Excellence Framework
UoA	Units of Assessment (for the REF)
UK	United Kingdom
UKCRC	UK Clinical Research Collaboration
WHO	World Health Organisation

Appendix 1 Details of coding approach for organisations participating in the analysis

A1. Arthritis Research UK

All grants active over this period were included. Every grant in the analysis was awarded following peer-review (external, committee, or both) of a specific research project or projects that comprised all or part of the application for funding. This included Project and Programme grants, all Fellowship schemes, PhD studentships, Clinical Studies, Academic Posts and Equipment grants. 'Centre Initiatives' – core funding to establish Arthritis Research UK Centres of Excellence were included for the first time in this analysis. These awards, established in 2008, boost research capacity (infrastructure and staff) in a specific area of need, but are also awarded on the basis of several well-defined programmes of research within each Centre.

All grants were coded by a freelance coder using the UKCRC Health Research Classification System.

A2. Biotechnology and Biological Sciences Research Council (BBSRC)

In 2009/10, BBSRC provided a portfolio of research which aligns to their current Strategic Priority of 'Basic bioscience underpinning health' which in particular encompassed research directly relevant to ageing: lifelong health and wellbeing, regenerative medicine and pharmaceuticals. This resulted in an analysis of 270 awards totalling £28.1M. In 2004/05, BBSRC provided a portfolio of research relating to ageing, which encompassed both directly relevant research in addition to research which underpins ageing, totalling £15.1M (249 records). Using the same methodology in 2009/10 would have provided a figure of £27.9M. Whilst BBSRC has adopted two differing approaches to define their 'health' portfolios in 2004/05 and 2009/10 (a consequence of changes to internal classification and reporting), the impact on the overall analysis is minimal, with the overall profile for BBSRC predominantly focused on underpinning research or aetiology.

A3. British Heart Foundation

The British Heart Foundation ensured that all grants, excluding infrastructure awards, strategic awards and other awards that could not be linked to a Research Activity Code, were included using the same coding criteria as employed in the 2004/05 portfolio. Coding was carried out internally by a small team. All awards were designated as 100% relevant to the cardiovascular disease category.

The number of submitted awards was 940, with a total value of £65,349,646m. 32 awards were excluded from the analysis (totalling around £5.6m) because they were not coded with a research activity. This left 908 awards with a total value of around £59.8m

A4. Cancer Research UK

Cancer Research UK included all active research except the following:

- Anything which cannot be submitted to NCRI (awards without publishable abstracts, capital spend or research infrastructure not linked to a specific research code)
- Individual funding amounts under £1000 where funding terminated soon after the start of the 2009/10 financial year
- Funding for Cancer Research Technology projects and discovery laboratory research
- Cancer information and advocacy funding

The total amount not submitted from the annual research portfolio is approximately £100m. This is the same approach as that taken for compiling the 2004/05 portfolio.

Cancer Research UK codes its research to the Common Scientific Outline (CSO). For this analysis, awards were not coded directly to the CSO, but were translated to the HRCS using a semi-automated approach, by a research manager.

A5. Engineering and Physical Sciences Research Council (EPSRC)

The grants submitted to the analysis included all grants that were coded as being socio-economic theme Health or sector Healthcare (or both) and current during financial year 2009/10. The data also included details of four large off-system investments.

1. Wellcome Trust Centres of Excellence in Medical Engineering
2. Cancer Research UK Cancer Imaging
3. MRC NPRI Phase 3
4. Healthcare Technologies KTN IMRCs.

We did not exclude any particular type of funding, hence the data includes Fellowships, Training grants (Centres for Doctoral Training, Life Science Interface (LSI) Doctoral Training Centres), Standard Research, Networks, Follow-on Fund, Travel, plus a small number of others e.g. Discipline Hopping, Capacity building in Complexity Science, Science & Innovation, Innovative Manufacturing Research Centres. No specifically 'infrastructure' grants are included.

2004/05 data was collected based on the cleaned results of a keyword search of our portfolio. Unfortunately a detailed record of the search was not retained, only the grant list provided at the time.

Coding of the data was outsourced to a contract coder. EPSRC double-checked and agreed that most research would indeed appear under the health category "generic", given that most of what we support is not targeted at specific diseases.

A6. Economic and Social Research Council (ESRC)

ESRC has a record of its past awards coded by the Strategic Challenges set out in the ESRC's current Strategic Plan. This dataset includes all awards with a primary or secondary code in the area of 'Health and Wellbeing' which also picks up relevant awards primarily coded under other strategic challenges such as 'Understanding Individual Behaviour'. The analysis picked up all awards, including large scale data resources, which were live during financial year 2009/10.

ESRC submitted 250 awards, totalling £26.4m. 4 awards were excluded (totalling £75k) with no HRCS codes.

A7. Medical Research Council (MRC)

The MRC routinely codes all awards using the HRCS. This work is carried out by staff in the research programmes group at MRC head office. 50% of awards each year are sent to external coders to duplicate the coding. Differences between internal and external coding are discussed and a consensus categorisation reached.

The 2009/10 data included all MRC grants, studentships fellowships and programmes. Details of MRC studentships were extracted from the JeS student portal, and coded internally. Not all students are registered via JeS and so this will be an under-estimate of the studentships supported by the MRC. An average stipend, taking into account location, was applied to the studentships. 900 studentships active in 2009/10 were included totalling £17m spend.

Details of the EME (Efficacy and Mechanism research programme) portfolio was obtained from NIHR (in total £1m spend in 2009/10).

Annual spend figures are calculated for programmes within MRC Units and Institutes in the same way that they are for the MRC's online research portfolio <http://www.mrc.ac.uk/ResearchPortfolio/index.htm>. The annual programme spend include the salaries of research and technical staff involved in the project, consumables and use of research facilities, together with capital equipment and depreciation. Programme costs also include elements for overheads supported through regional centres, MRC Corporate sections and the MRC Shared Service Centre.

All Research Grants and Fellowship proposals to MRC from 1 September 2005 are on a Full Economic Costing (fEC) basis. Under fEC, Research Organisations (including Universities) seeking funding from MRC must establish the full costs of their research proposals. This includes (e.g.) the costs of Principal and Co-Investigators, all support staff, all equipment and consumables and all accommodation and overheads. MRC make awards at 80% of these full economic costs, and these are the figures shown in this research portfolio system. An average commitment per year for each award was calculated and this "annualised" figure included in the analysis.

The MRC manages awards made under the NPRI (National Prevention Research Initiative) on behalf of organisations participating in this initiative (35 awards totalling £2.8m expenditure in 2009/10, the majority of which were from NPRI phase 1 and 2). This spend was apportioned across all participating organisations according to their contribution to the initiative. 11% remained allocated to the MRC, and as 13.4% was contributed by organisations outside the 12 included in this report, £375k was removed from the analysis.

The MRC financial year runs from 1 April to 31 March. Any award active in the financial year 2009/10 was included in the analysis.

£585.6m of UK research funding and £22.7m of overseas research funding (£608.3m in total) was included in the analysis.

From the 2009/10 MRC annual report it can be seen that the MRC spent £656.3m on extramural and intramural research in that year (excluding £17.8m of international subscriptions). So the analysis had captured approximately 93% of MRC's spend on research, which could reasonably be coded using the HRCS.

A8. Department of Health (England)

HRCS coded spend includes:

- All NIHR research programmes and Department of Health Policy Research Programme Units and projects (non-NIHR)
- All fellowships EXCEPT Academic Clinical Fellowships (these are part of the Integrated Academic Training stream)
- All NIHR Collaborations for Leadership in Applied Health Research and Care (CLAHRCs) spend
- Non-core support costs (i.e research-only spend) from NIHR Biomedical Research Centres and Units (BRCs and BRUs)
- No Clinical Research Network costs or other types of research infrastructure and support (i.e. Clinical Research Facilities, Experimental Cancer Medicine Centres (ECMCs), Flexibility and Sustainability Funding (FSF), the NIHR School for Social Care Research (SSCR), the NIHR School for Primary Care Research (SPCR), or Patient Safety & Service Quality Research Centres (PSSQR)

Data coding and verification:

NIHR research and training programmes are co-ordinated and managed by the NIHR Central Commissioning Facility (CCF), the NIHR Evaluation, Trials and Studies Coordinating Centre (NETSCC) and the NIHR Trainees Coordinating Centre (TCC). At NETSCC, research programmes were coded by programme managers and 20% then checked by external coders, while at CCF all programmes were externally coded (by Andrew Speakman). Coding was done on project abstracts. At TCC, Fellowships were coded by programme managers and 100% checked by a second internal coder. Coding was done on project abstracts/descriptions.

BRCs, BRUs and CLAHRCs were coded by Department of Health and 100% compared to coding by CCF programme managers. In cases of major discrepancy, preference was given to CCF coding as it was tied to actual expenditure. Coding was done on annual reports and assigned project theme plus expenditure (CCF).

NETSCC managed research (£62.4m/625 awards) includes 127 awards with zero expenditure amounts. These awards are Technology Assessment Reports (TAR) that commonly produced to inform NICE Appraisal Committee guidance on the use of new and existing medicines, treatments and procedures within the NHS in England and Wales. They are funded through an overarching agreement, therefore no funding is directly associated with an individual TAR. Note that some NETSCC awards have up to 5 RA codes (the usual number is 4).

CCF managed research programmes includes the Policy Research Programme (PRP) (£80m/560 awards). Two PRP Units had zero expenditure amounts, since they were response-mode work for another Unit and thus came under the existing budget.

TCC managed awards (£13.3m/215 awards) have no special notes.

BRC/BRU/CLAHRC research spend (£44.8m/180 awards) is based on coding research themes at each location and does not include core costs used for infrastructure support. The total spend including core support comes to £139.9m.

Research spend

The NIHR supports research infrastructure through several mechanisms. These include clinical research networks managed by the Clinical Research Network Coordinating Centre (£285m/46 awards); as well as Clinical Research Facilities (CRF), Experimental Cancer Medicine Centres (ECMC), National Schools and Patient Safety & Service Quality Research Centres (PSSQR) (£25.5m). This infrastructure spend is included in Table 1.

A9. HSC R&D Division, Public Health Agency, Northern Ireland

The HSC R&D Division, Public Health Agency, Northern Ireland has made the effort to maximise reporting on the use of all funds that fall within the reporting criteria. The HSC R&D budget is small relative to other UK Health Departments and has diminished in real terms since the last reporting period. All research grant funding, capacity building (Fellowship & Studentship), knowledge transfer and dissemination and clinical research network infrastructure funding has been included in the 2009/10 analysis.

R&D support units with a generic remit, and Trust R&D research office expenditure have not been included.

Almost all data was coded by experienced external coders, but has not undergone any additional verification.

126 awards, totalling £9.5m included in the analysis. 18 awards (£1.4m) were excluded as no codes available.

A10. Chief Scientist Office, Scottish Government Health and Social Care Directorates

Process

In determining the portfolio to be included in the current analysis CSO used the same criteria as used for the 2004/05 analysis, to allow comparisons to be made. All directly funded awards that could be directly attributed to a set of defined research objectives were included as follows:

- research grants
- personal research awards (pre and post-doctoral)
- funding to research units
- programme grants in applied health research

- funding for specific research centres
- contributions to national research initiatives (NPRI, LLHW, TIRI, PCRI, NAEDI)
- clinical research network funding *

* At the time of the 2004-5 analysis CSO funded one clinical research network, in cancer, and since then have funded 6 additional networks. Funding to these networks was included as a demonstration of increased investment in clinical research.

The significant balance of CSO funding is allocated as infrastructure funding to support research in the NHS, including that funded by other partners in this analysis.

CSO submitted data on 273 individual awards. These were coded by a professional coder experienced in the use of the HRCS. Resources were not available for a full-scale quality assurance exercise, but a sample of coded awards checked were in agreement with in-house coding.

In 2009-10 Scotland contributed £2.682 to the overall budget for the research Programmes managed by NETSCC on behalf of the UK. This figure is not reflective of the actual funding allocated to research in Scotland in 2009-10, rather is a percentage share of the overall funding allocated. The research funded in Scotland through NETSCC programmes was not coded by NETSCC therefore has not been accounted for in the overall analysis, nor the calculation of the geographical distribution of spend described in Chapter 6. The percentage and amounts of funding allocated to Scotland and shown in Figure 7 and Table 8 are therefore minor underestimates of the true Scottish figures.

A11. National Institute for Social Care and Health Research (NISCHR)

As NISCHR has developed considerably since the last report in 2004/05, it contributed a much larger dataset for inclusion in the 2009/10 report. Data included:

- Project funding
- Studentship/Fellowship funding
- Funding to research units
- Contributions to national research initiatives (e.g. NPRI, LLHW, NAEDI, agreed NETSCC programmes)
- Clinical research funding, such as Registered Research Group awards

In total 163 awards have been included, totalling £16.09m.

Additional support for health research is provided through NISCHR's NHS R&D funding allocations. This funding (some £15.08m) has not been included in the detailed analysis, but has been reported as additional infrastructure spend in Table 1.

Coding was undertaken and checked by NISCHR staff who had previously received Health Research Classification System and coding training.

A12 Wellcome Trust

The data provided by the Wellcome Trust is the annualised commitment for active grants in 2009/10. The period 2009/10 is defined as the Wellcome Trust financial year 1 October 2009 to 30 September 2010. The interpretation of "annualised commitment for active grants" is as follows:

(A)The report includes all grants which were active for any time period during 2009/10. The number of months that each grant was active for in 2009/10 ("B") was calculated, using the start and end dates of the grant. The proportion of each grant that relates to 2009/10 ("C") was calculated, by taking "B" as a proportion of the total length of the grant in months. The annualised

commitment for each grant in 2009/10 (“D”) was calculated, by taking “C” multiplied by the total commitment value of the grant. This process was necessary because the Wellcome Trust accounts for grant activity on a full commitment basis.

The calculation above converts full commitment basis to “annualised commitment for active grants”. The data for 2009/10 was prepared on the same basis as the data previously provided for 2004/05.

Exclusions

Support and Direct expenditure

All support and direct expenditure is excluded from the analysis

Sanger Institute

Grants to the Wellcome Trust Sanger Institute have been excluded. The Trust made intercompany grants to the Institute of £78.3 million in 2009/10 (source: Financial Statements, note 10)

Other excluded grants

The Trust has also made the following grants and programme related investments, which are excluded from the detailed listings:

Institution	Amount Awarded (£m)	Commitment for 2009/10 (£m)	Notes
Wellcome Trust / DBT India Alliance	5.6	5.6	This is an annual award covering a 12 month period
Hilleman Laboratories, India	0.6	0.6	In this case, the commitment for 2009/10 is assumed to be the cash paid in that year
Stevenage Bioscience Catalyst Ltd	6.0	2.0	This award covers a three year period
Diamond Light Source Ltd	5.0	5.0	This is an annual award covering a 12 month period

Minor coding discrepancies

The Wellcome Trust 09/10 dataset has been provided to Andrew Speakman and coded according to UKCRC classifications. It should be noted that of the 2,242 records included in the “Active grants exc awarded 0910” data for 2009/10, there are:

19 records where the RA% does not add up to 100%

3 records where the HC% does not add up to 100%

These have been highlighted in the 2009/10 output in the check columns on the right hand side (for example, “HC% OK” will show as false for 3 records)

Appendix 2 Non UK funding

Information relating to the support of research projects and programmes outside of the UK was compiled in this exercise. Both the Wellcome Trust and the MRC have significant overseas research programmes, primarily in Africa. To carry out a comprehensive analysis of the UK contribution to global health research then further stakeholders such as the UK Department for International Development (DFID) that are significant sponsors of this work would need to provide HRCS coded research portfolios. In addition international subscriptions, such as UK's contribution to the European Molecular Biology Laboratory (EMBL) in Heidelberg would need to be included.

Table 9: Non UK Funding

Funding Organisation	Number of awards	Total 2009/10 spend (£m)
Wellcome Trust	196	35.7
MRC	47	22.7
Cancer Research UK	6	0.3
ESRC	3	0.5
NIHR (CCF)	2	<0.1
NIHR (NETSCC)	13	0.2
Total	267	59.5

Appendix 3 Overall UK Expenditure on Health Related Research and Development

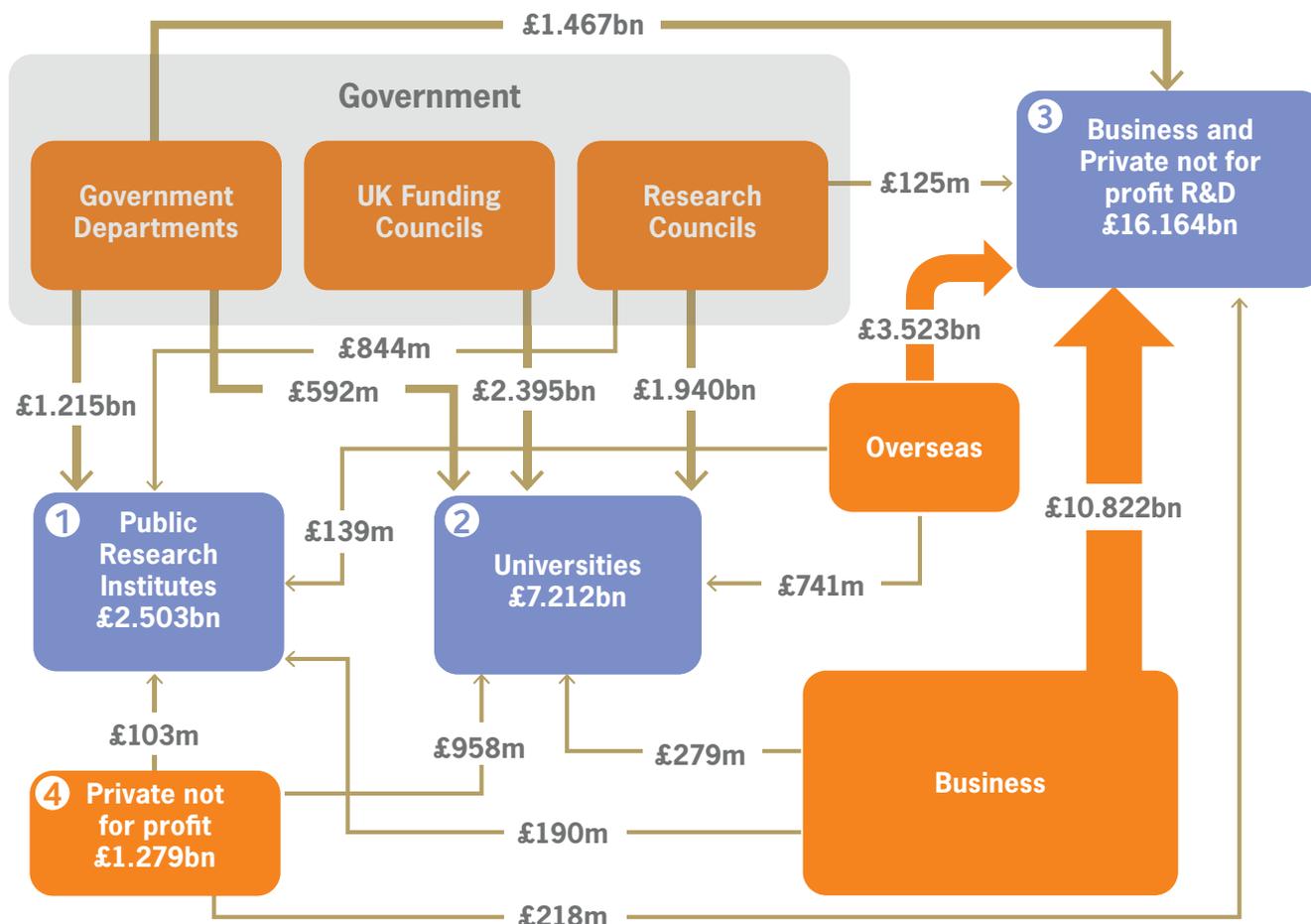
Summary

For the first time we have described the total expenditure on health related research and development by UK publicly and charitably funded research institutions and UK businesses. We estimate that in 2009/10 this expenditure was approximately £8.1bn. 60 percent of this research and development activity was performed by the business sector. The detailed analysis of public and charitably funded research in this report focusses on approximately 30 percent of the overall UK expenditure on health related research and development (£2.4bn). We suggest that the remaining £1bn comprises research funded by smaller UK charities, funding from organisations based outside the UK, quality-related funding to Universities, and NHS support for clinical academics (see section 2.4). As a significant proportion of research and development reported by UK businesses is performed outside the UK, the data analysed in this report is likely to cover in detail just over 50% of the health relevant research conducted in the UK in 2009/10. Additionally, due to the focus of business research and development on applied work, we suggest that the detailed analysis in this report covers the overwhelming majority of basic and early translational research performed in the UK in 2009/10.

Funding flows in the UK

Each year the ONS publish estimates of expenditure on research and development¹. The data is gathered from surveys of businesses and government departments. This information allows the flow of funds from research funders to research performing sectors to be estimated, but this is not disaggregated further into specific areas of research such as health. In its 2010 report *The Scientific Century*² the Royal Society set out this data graphically. The following figure adapts the Royal Society diagram to include 2009 GERD data. Health relevant R&D expenditure is a subset of boxes 1, 2 and 3 as explained in the following text.

1 2009 Gross Domestic Expenditure on Research and Development (extracted from March 2012 data release) <http://www.ons.gov.uk/ons/rel/rdit1/gross-domestic-expenditure-on-research-and-development/2010/tsd-gerd.html>
2 <http://royalsociety.org/policy/publications/2010/scientific-century/>



Total GERD for 2009 was £25.880bn. In 2004 GERD was £20.242bn indicating growth of 12% in real terms over 5 years.

Using this overall framework and further information about the composition of spend we can compile an estimate of the total health related research expenditure in the UK for 2009/10.

Research and development performed by the business sector

In the GERD figure above the box labelled ③ includes Business and Private not for profit research and development performed in the UK. ONS produce annual reports on UK BERD³ corresponding to the privately performed research in the GERD figure above. The BERD data is gathered via a survey of approximately 5000 firms in the UK. Helpfully ONS break this expenditure down by product group. The “pharmaceuticals” product group is by far the most significant element of this expenditure, and the most relevant to health. BERD in the product group “pharmaceuticals” was £3.239bn in 2004, and £4.434bn in 2009 (indicating a 20% growth in real terms over the five years, and that approximately 25-30% of UK BERD is supporting development of new and existing pharmaceuticals). Just using spend on pharmaceuticals will of course under-estimate the private sector research and development spend relevant to health.

It should also be noted that the box labelled ③ in the GERD figure above includes private, not for profit (PNP) research and development. The ONS estimate research performed in the PNP sector from a variety of sources, and these estimates are under review. In 2009 the estimate for research performed in the whole PNP sector was £667m.

We do not have data available that breaks down research performed in the not for profit sector in a way that would allow us to easily estimate health relevant spend. There are significant numbers of not for profit research institutes, charitably funded and

3 SB2 Expenditure on R&D Performed in UK Businesses: Detailed Product Groups, 2003 to 2010 <http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcn%3A77-237838>

independent of Universities or public sector organisations with relevance to health research in the UK (for example the CRUK London Research Institute). Our detailed analysis identifies at least £120m of project and programme funding for UK based non-MRC, non-HEI institutions. In addition the Wellcome Trust has identified £78m of infrastructure funding to the Sanger Institute.

The majority of funding for research from the PNP sector is likely to be relevant to medicine. The AMRC report⁴ that its member charities funded medical research (excluding capital spend) totalling £634m in 2004/05 and £1,078m in 2009/10. If we compare this to the total funding for research and development from the not for profit sector in the box labelled ④ of the GERD figure above, then medical research may account for almost 85% of spend from this sector in the UK (1.078/1.279). It cannot be assumed that a similar proportion of the research performed in the PNP sector is relevant to health, but it does seem reasonable to estimate that expenditure is somewhere between the £200m captured in our analysis and £500m. Taking the middle of this range results in a total estimate for health research performed in the business and PNP sectors (Box ③ in the figure above) of £4.8bn.

Research Performed in the University Sector

In the box labelled ② in the GERD figure above we can see that over £7bn of research and development was performed in the University sector in 2009/10 (the 2004/05 figure was £5.0bn). The ONS use Higher Education Research and Development (HERD) figures estimated by the Higher Education Funding Councils annually to compile this element of the GERD figures. The Higher Education Statistics Agency (HESA) provides detailed financial data direct from UK Universities, which set out expenditure by cost centre⁵. Cost centres 01 (clinical medicine) to 08 (pharmacy and pharmacology), excluding 03 (veterinary sciences) are relevant to health research and this totals £1.023bn in 2004/05 and £1.758bn in 2009/10 (a 59% growth in real terms over the five years, and in line with the overall growth in HERD). From this data health research represents between 20-25% of the research performed in the University sector (20% in 2004/05, 24% in 2009/10).

Public Sector Research Institutes

The third set of research performers in the GERD figure are public sector research establishments (the box labelled ① in the GERD figure above). This includes all public sector research performers, and for health research these mainly consist of hospitals and MRC research Units and Institutes. There are no figures available for health relevant research in this sector, however the main health relevant funding provided to these organisations will come from Department of Health and MRC. MRC Unit expenditure was approximately £0.3bn (whether from the MRC or other sources) and NIHR funding to NHS Trusts was approximately £0.8bn⁶ in 2009/10.

Several elements will be missing from this spend:

- Overseas funding to non-MRC research organisations. From the GERD figure this should be less than £139m in 2009/10.
- Non-England Health Department spend on research in public sector organisations outside of England (e.g. Health Boards in Wales, Scottish Health Trusts). We can extract this from the data collected for HRCS coding, and confirm that this is negligible for the purpose of this estimate (Northern Ireland £6m, Wales >£1m, Scotland £1.5m)
- Non-profit spend in non-MRC research organisations. From the GERD figure this should be approximately £88m (85%⁷ of £103m).
- Non-MRC and NIHR spend on health research, within the public sector. As the total Government spend on R&D within government departments is £2.5bn, and MRC and NIHR account for £1.3bn of this, a maximum of £1.2bn can be spent

4 Who funds medical research in the UK? (AMRC website) http://www.amrc.org.uk/value-charitable-investment-in-medical-research_value-charities-contribution-to-uk-success-in-life-sciences_who-funds-medical-research-in-the-uk

5 Data obtained from the HESA online database (subscription required)

6 These figures taken from 'SET statistics' a summary of key science, engineering and technology indicators prepared by the Department of Business Innovation and Skills in collaboration with the Office for National Statistics <http://www.bis.gov.uk/assets/biscore/science/docs/s/11-499a-set-statistics-2011.xls> The figure for MRC intramural spend agrees with the MRC 2009/10 annual report (£291m) http://www.mrc.ac.uk/consumption/idcplg?ldcService=GET_FILE&dID=31774&dDocName=MRC007851&allowInterrupt=1

7 AMRC funding is approximately 85% of total private, non-profit funding for research and development.

this way. As 18% of all Government R&D expenditure is orientated toward health⁸ then health relevant expenditure is likely to be approximately £220m.

This provides an estimate of health relevant research and development spend in public sector research institutes of £1.5bn.

The total expenditure on health relevant research and development by UK-based research performing organisations

Putting the three elements together we obtain a 2009/10 estimate of health relevant research and development of £8.1bn. This comprises:

Performing sector	2009/10 estimate of health relevant spend (£bn)	% of total health relevant GERD
Business and private not for profit	4.8	59
University	1.8	22
Public research institutes	1.5	19
Total	8.1	100

It should be noted that there are significant differences between the business expenditure on research and development and the remainder of the UK's gross expenditure on research and development.

Firstly the proportion of both the public research institute and University research expenditure outside the UK is small. In contrast the proportion of the UK business sector's expenditure on research and development outside the UK is significant. From the BERD data⁹, £2.4bn of the pharmaceutical research and development expenditure is noted as extramural (spent outside of the business). £1.5bn of this is reported as spent outside of the UK, just £0.9bn is spent in the UK.

Secondly the focus on development, rather than fundamental research is (as might be expected) very different in the business sector. Again from the BERD data¹⁰, of £4.2bn analysed expenditure, just £200m is directed toward basic research, £2.1bn directed toward applied research and £1.9bn directed toward experimental development.

⁸ ONS surveys note the proportion of research and development orientated toward health using the OECD definition from the FRASCATI manual.

⁹ <http://www.ons.gov.uk/ons/rel/rdit1/bus-ent-res-and-dev/2009-edition/index.html> Table 6

¹⁰ SB2 Expenditure on R&D Performed in UK Businesses: Detailed Product Groups, 2003 to 2010 <http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tc%3A77-237838> see Table 5

Appendix 4 Details of 2009/10 fEC uplift to Research Councils

Research Council	Total 2009/10 fEC uplift (£m) ¹ [A]	Total expenditure on research awards taken from 2009/10 annual report [B]	Expenditure included in this analysis (see Table 1) [C]	% of fEC uplift attracted by health relevant research grants [D] ²	Estimated fEC uplift (£m) attracted by health relevant grants ³
MRC	42	-	-	100	42
BBSRC	44	193 ⁴	28	14	6
EPSRC	106	530 ⁵	89	6	6
ESRC	15	91 ⁶	26	29	4

1 fEC additions to CSR 07 allocation (DIUS evidence to ad hoc select committee on science and technology, 2008) <http://www.publications.parliament.uk/pa/cm200809/cmselect/cmdius/170/170we73.htm>

2 For MRC it is assumed that as 100% of MRC grants and programmes are included in the analysis, then 100% of the fEC uplift is also included, for all other Councils the figure in column C is divided by the figure in column B.

3 Calculated using figures in column D and column A

4 BBSRC Annual report 2009/10 http://www.bbsrc.ac.uk/web/FILES/Publications/bbsrc_annual_09_10.pdf key funding data table (page 6) funding to Universities (responsive grants and research initiatives)

5 EPSRC Annual report 2009/10 <http://www.epsrc.ac.uk/SiteCollectionDocuments/Publications/corporate/EPSRCAnnualReportAndAccounts2009-10.pdf> assumption is that all EPSRC funding is made to Universities, total net research expenditure (£530m).

6 ESRC Annual report 2009/10 http://www.esrc.ac.uk/_images/Annual%20Report%2009-10_tcm8-13375.pdf Table 4 page 103, assumption is that all ESRC funding is made to Universities, total for "research programmes", "centres", "resources" and "grants".

Appendix 5 Details of Mapping between WHO DALY rates and HRCS codes

Mapping table¹

GBD Code	GBD Cause	UK DALY 2002	Percent of all causes	Map to combined Health Categories	UK DALY 2004 ²	Percent of all causes
W002	IA Infectious and parasitic diseases	105.1431	1.39	Infection	108.3879	1.40
W038	IB Respiratory infections	234.6689	3.11	Infection	129.6266	1.68
W042	IC Maternal conditions	24.33531	0.32	Reproductive Health	33.33599	0.43
W049	ID Perinatal conditions	99.17395	1.31	Reproductive Health	103.8518	1.35
W053	IE Nutritional deficiencies	41.52674	0.55	Metabolic and Endocrine	29.20879	0.38
W060	IIA Malignant neoplasms	1167.938	15.46	Cancer	1203.587	15.59
W078	IIB Other neoplasms	18.31276	0.24	Cancer	20.52721	0.27
W079	IIC Diabetes mellitus	99.78144	1.32	Metabolic and Endocrine	139.1727	1.80
W080	IID Endocrine disorders	94.65417	1.25	Metabolic and Endocrine	98.43704	1.28
W081	IIE Neuropsychiatric conditions	1970.567	26.08	Neurological, Mental	2057.784	26.66
W098	IIF Sense organ diseases	334.0163	4.42	Ear, Eye	543.1561	7.04
W104	IIG Cardiovascular diseases	1297.376	17.17	Blood, Cardiovascular, Stroke	1248.875	16.18
W111	IIH Respiratory diseases	690.5472	9.14	Respiratory	638.1849	8.27
W115	III Digestive diseases	383.6892	5.08	Oral and Gastrointestinal	392.7073	5.09
W120	IIJ Genitourinary diseases	92.23495	1.22	Renal and Urogenital	71.69588	0.93
W124	IIK Skin diseases	14.40889	0.19	Skin	16.0398	0.21
W125	III Musculoskeletal diseases	306.3884	4.06	Musculoskeletal	316.8752	4.11
W131	IIM Congenital anomalies	87.29591	1.16	Congenital	94.02701	1.22
W143	IIN Oral conditions	53.48171	0.71	Oral and Gastrointestinal	48.34681	0.63
W149	IIIA Unintentional injuries	307.4862	4.07	Injuries	289.1276	3.75
W156	IIIB Intentional injuries	132.0119	1.75	Injuries	135.3803	1.75
W000	All causes	7555.039	100.00	-	7718.335	100.00

¹ Source <http://www.who.int/healthinfo/statistics/bodgbddeathdalyestimates.xls> (see worksheet DALY 2002 United Kingdom column)

² 2004 Data obtained from <http://apps.who.int/ghodata/?vid=140001#>

Exact UK DALY percentages underlying Figure 6 2009/10 re-analysis

	2002 WHO data %	2004 WHO data %
Skin	0.19	0.21
Congenital	1.16	1.22
Renal and Urogenital	1.22	0.93
Reproductive Health	1.63	1.78
Metabolic and Endocrine	3.12	3.46
Musculoskeletal	4.06	4.11
Ear, Eye	4.42	7.04
Infection	4.50	3.08
Oral and Gastrointestinal	5.79	5.71
Injuries (NB excluded from figure)	5.82	5.50
Respiratory	9.14	8.27
Cancer	15.70	15.86
Blood, Cardiovascular, Stroke	17.17	16.18
Neurological, Mental	26.08	26.66
Total	100.00	100.00

2002 WHO DALY data was used in the previous UKCRC report which examined health research spend from 2004/05. In this report we have updated the comparison using the 2004 WHO data. Both are presented in the table above so that changes in disease burden can be noted.



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