WORKING
PAPER

Bibliometric analysis of highly cited publications of health research in England, 1997-2003

Theme specific HCPs in England

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WR-509-DH

July 2007

Prepared for the Department of Health

EUROPE

Preface

This working paper describes a bibliometric analysis to support the process of identifying candidate Biomedical Research Units, as part of the Department of Health's R&D strategy, *Best Research for Best Health* (*BRBH*). It is intended to inform the potential candidates in deciding whether to submit a prequalification questionnaire as part of the Biomedical Research Unit procurement process and inform the deliberations of the selection panel for the Biomedical Research Units. The work presented in this paper was a collaboration between the Centre for Science and Technology studies (CWTS) in the Netherlands, and RAND Europe and follows on from a previous research collaboration to identify potential Biomedical Research Centres as part of *BRBH*.[1]

CWTS is an interdisciplinary research institute housed within the Faculty of Social Sciences of Leiden University, the Netherlands. CWTS specialises in advanced quantitative analysis of science and technology performance and the cognitive and organisational structure of science and technology.[2] Research in short- and long-term programmes is carried out for governments, European Union, national and international research organisations, universities and companies.

RAND Europe is an independent not-for-profit research institute based in Cambridge (UK) whose mission is to help improve policy and decision-making through research and analysis.[3] Part of the global RAND Corporation, it is known for delivering high-quality, objective research and analysis. RAND Europe realises this mission by undertaking objective, balanced and relevant research and analysis; sharing insights and information widely; working in partnership with clients; and collaboratively with others. RAND Europe's in-house teams offer multidisciplinary and multinational research strengths, both substantive and methodological.

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[1] van Leeuwen and Grant (2006). Bibliometric analysis of highly cited publications of health research in England 1995-2004, RAND Europe: Cambridge, WR-368-DH

[2] For more information on CWTS please see www.cwts.nl

[3] For more information on RAND Europe please see www.randeurope.org

Introduction

This paper presents the findings of a bibliometric analysis of biomedical and health research in England, focusing specifically on six specific research areas of high disease burden and clinical need currently under-represented in the portfolios of the Biomedical Research Centres put in place as part of *Best Research for Best Health*. These six areas are:

1. Cardiovascular Disease
2. Deafness and Hearing Problems
3. Gastrointestinal (including Liver) Disease
4. Musculoskeletal Disease
5. Respiratory Disease
6. Nutrition, Diet and Lifestyle (including Obesity)

The choices above were arrived at by the Department for Health (DH) in response to the recommendations of the Cooksey report.[4] Cooksey suggested that there needed to be scope for other NHS/university partnerships to develop, in order to provide a challenge to the established NIHR Biomedical Research Centres in future funding competitions, and thus help to drive excellence in the system. The Cooksey Report also suggested that greater priority should be given to supporting medicines and therapies that tackle unmet health needs in the UK. In order to take forward these recommendations, NIHR intends to establish Biomedical Research Units to undertake translational clinical research in priority areas of high disease burden and clinical need, which are currently under-represented in the existing NIHR Biomedical Research Centres, and in which the country has identified research strengths (Cardiovascular; Deafness; Gastrointestinal; Musculoskeletal; Respiratory; and Nutrition, Diet and Lifestyle).

The purpose of the exercise is to support decision making around selection of Biomedical Research Units in these six research areas. Below we describe the bibliometric approach adopted and the key results.

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[4] HM Treasury (2006). A Review of UK Research Funding.

Methodology

This study follows a very similar methodology to that used to identify publications by English institutions in the top 20% most highly cited papers (HCPs) in the world for biomedical research when the DH originally identified Biomedical Research Units in 2006.[5] Since this report performs a similar function – identifying the distribution of HCPs between English institutions – we have performed the study using the same methodology to ensure comparability.

CWTS maintains a bibliometric database of the majority of scientific publications (including health and biomedical research) for the period 1981 to 2006. This dataset is based on the journals and serials processed for the CD-ROM versions of the Science Citation Index and associated citation indices: the Science Citation Index, the Social Science Citation Index, and the Arts & Humanities Citation Index, extended with six so-called specialty Citation Indices (Chemistry, Compumath, Materials Science, Biotechnology, Biochemistry & Biophysics, and Neuroscience). These indices are maintained by Thompson Scientific (formerly ISI; the Institute for Scientific Information). Currently, CWTS is changing its database towards the Web of Science version (the internet version) of the Citation Index/Indices, which covers the period 1981 to 2007, and has a somewhat different journal set coverage. The construction of this database, and the indicators operating on it, are described in various scientific publications.[6]

Briefly, we identified all publications in selected Journal Subject Categories (JSC), analysed these to identify the top 20% most HCPs in the world, then identified which of these papers had been published by institutions within England. This provides an institution's share of the world's top 20% HCPs. For subject areas, we combined appropriate JSCs (Table 1) by adding together the number of papers by an institution in each JSC and then identifying the percentage of the total number of papers that are attributable to that institution (thus giving a percentage of England's contribution to the worlds top 20% HCPs). Those institutions that already have Biomedical Research Centre Status (with the exception of two Specialist Biomedical Research Centres located

[5] van Leeuwen and Grant (2006).

[6] Moed et al (1995). New Bibliometric Tools for the Assessment of National Research Performance: Database Description Overview of Indicators and First Applications. Scientometrics, 33, 381-425; van Leeuwen et al (2001). Language biases in the coverage of the science Citation Index and its consequences for international comparisons of national research performance, Scientometrics, 51, 335-346; van Leeuwen et al (2003). The Holy Grail of Science Policy: Exploring and Combining Bibliometric Tools in Search of Scientific Excellence, Scientometrics, 2003, 257-280.

within broadly-based clinical organisations) were then removed from the results. The publications from Universities which are partners in Biomedical Research Centres have been retained in the analysis as they have the option of partnering with a different NHS organisation to submit a Pre-qualifying Questionnaire, provided that they can demonstrate an existing, strong partnership with this NHS organisation and that the Pre-Qualifying Questionnaire does not include any research activity previously used to support a successful application for an NIHR Biomedical Research Centre. The paragraphs below describe the methodology in more detail.

To identify publications in the fields of health and biomedical research within the citation indexes of Thomson Scientific we used the JSCs. The Department of Health identified JSCs that corresponded to the specific research fields requested (see Table 1), and CWTS used these JSCs to identify all articles, letters, and reviews (as is the norm in bibliometric analysis) in these specific fields with the country name 'ENGLAND'.

Table 1. Research areas matching journal subject categories

Research Area	JSCs associated
1. Cardiovascular Disease	Cardiac and Cardiovascular Systems Critical Care Medicine
2. Deafness and Hearing Problems	Otorhinolaryngology
3. Gastrointestinal (including Liver) Disease	Gastroenterology and Hepatology
4. Musculoskeletal Disease	Orthopaedics Rheumatology
5. Respiratory Disease	Respiratory System Allergy
6. Nutrition, Diet and Lifestyle (including Obesity)	Nutrition and Dietetics Endocrinology and Metabolism Food Science and Technology

We then determined the citation distribution of all publications in those fields and selected those publications that belong to the top 20% most HCP in every selected field, excluding self-citations.[7] Note that we are *not* focusing on the top 20% of England's publications in each field, but the contribution of England to the worldwide top 20% most highly cited publications per field. We express the results of this as the percentage of the UK's share of world HCPs that come from each institution.

In the selection of the HCPs, we were restricted to the period 1997-2003, since we want all publications to have the same citation window, which is set at a standard length of four years.[8] This requirement makes that the last year of publication that can be analyzed is 2003, with 2004, 2005, 2006, and 2007 as citation years. This process resulted in 4,854 publications across the six subject areas. For these publications, we cleaned-up the address information available for addresses attached to scientific publication in the citation indexes.

We looked at the concentration of HCP papers in each research theme (multiple ISI fields) to identify world-class biomedical research in each specific field. To do this we examined each field and allocated the share of HCP to the institutions. Because there are collaborations between institutions the total share of HCP by field adds up to more than 100%. To identify potential areas of concentration, we filtered the results looking for institutions with more than 20% of a field, between 10 and 20% of a field and between 5 and 10% of a field.

NHS organisations currently in receipt of NIHR Comprehensive Biomedical Research Centre funding are not eligible to apply for NIHR Biomedical Research Unit funding (as they already have the opportunity to address these priority areas); and NHS organisations currently in receipt of NIHR Specialist Biomedical Research Centre funding are eligible to apply for NIHR Biomedical Research Unit funding only if they are broadly-based clinical organisations, rather than specialist institutions focused on a specific disease area or patient group. Therefore, once the concentrations of HCPs in each research area had been identified, we removed the data from those NHS Trust who already have Biomedical Research Centre status (with the exception of Newcastle Upon Tyne NHS Foundation Trust and Royal Liverpool and Broadgreen University Hospitals NHS Trust, the two Specialist Biomedical Research Centres within broadly-based clinical organisations) at the request of the DH. Since Queens Medical Centre and Nottingham City Hospital have merged to form Nottingham University Hospitals NHS Trust their percentage share of HCPs has been merged in this analysis.

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[7] Self-citations occur if one of the authors of a citing paper also appears in the cited paper. Typically self-citations account for between 20 and 40% of all citations are self citations, depending on the field.

[5] A further limitation was that we had to focus on articles and reviews, given that letters appear in a much lesser quantity in the serial literature (thereby causing problems in the statistical reliability of the analysis).

We would like to stress that there are a number of well-known limitations to bibliometric analyses,[9] and that the results need to be used within that context. With respect to this study, by using JSCs suggested by the DH that contain only journals with field specific publications, we are excluding publications that for example would not be cardiovascular from a cardiovascular analysis. This means that general medical journals are excluded from the analysis.

Results

Distribution of HCP papers in the selected areas

In Table 2 the share of HCP by area and institution is shown. Those cells highlighted in red had more than 20% of the areas' share, those in orange have between 10 and 20%, and those in yellow between 5 and 10%. By means of illustration, the first yellow cell is for Gastrointestinal Disease/Bart's and the London NHS Trust, with a value of 6.1%. This means that 6.1% of HCPs classified within the Gastrointestinal Disease area have an address associated with Bart's and the London NHS Trust. To simplify reading of Table 2, in Table 3 we have listed the top five institutions within each area (based on percentage share of HCPs).

As shown in Table 2, none of the NHS Trusts have more than 20% of the top 20% HCPs in any given area. There are three organisations that have over 10% of an area's HCPs though, with Royal Brompton and Harefield NHS Trust having over 10% of two areas (Cardiovascular Disease and Respiratory Disease).

Annex A shows the distribution of HCPs amongst the candidate institutions for each subject area. This allows a quick comparison of how all the institutions match up in any single area. Red blocks indicate Universities; blue blocks indicate NHS Trusts; and green blocks indicate 'other' institutions that are neither Universities nor Trusts but nevertheless produce research for healthcare (such as Cancer Research UK).

[9] Moed, H.F. (2005). *Citation analysis in research evaluation*. Dordrecht (Netherlands): Springer, 346 pp. (especially pages 1-69).

Table 2: Percentage share of HCPs in selected subject areas, 1997-2003

	Cardiovascular Disease	Deafness and Hearing Problems	Gastrointestinal (including Liver) Disease	Musculoskeletal Disease	Respiratory Disease	Nutrition, Diet and Lifestyle (including Obesity)
NHS Organisations						
Barts and the London NHS Trust	3.1	2.0	6.1	3.4	4.2	6.6
Birmingham Children's Hospital NHS FoundationTrust	0.4		0.6		0.5	0.3
Cardiothoracic Centre Liverpool NHS Trust	0.4				0.5	
Central Manchester and Manchester Childrens University Hospitals NHS Trust	1.5	7.1	0.7	2.2	1.9	1.8
Chelsea & Westminster Hospital NHS Foundation Trust	0.1		1.0	0.2	0.1	0.3
Christie Hospital NHS Foundation Trust			0.4			1.2
Heart of England NHS Foundation Trust	0.4	1.0	0.4	0.2	1.8	0.4
King's College Hospital NHS Foundation Trust	1.0		5.0	2.5	1.4	0.8
Leeds Teaching Hospitals NHS Trust	1.2	7.1	5.0	4.7	1.8	0.8
Mayday Healthcare NHS Trust	0.4					
Newcastle upon Tyne Hospitals NHS Foundation Trust	1.7		1.5	1.2	0.8	0.9
North Bristol NHS Trust	0.1		0.3	0.7	0.3	0.2
North West London Hospitals NHS Trust	0.5		8.9	0.2		0.7
Nottingham University Hospitals NHS Trust	1.1	10.1	8.5	1.9	5.1	0.7
Oxfordshire & Buckinghamshire Mental Health Partnership NHS Trust						0.1
Papworth Hospital NHS Foundation Trust	1.5			0.2	1.2	
Plymouth Hospitals NHS Trust	0.1			0.2		0.1
Royal Berkshire NHS Foundation Trust	0.1				0.3	
Royal Brompton & Harefield Hospitals NHS Trust	14.8	1.0	0.1	0.5	19.0	0.4
Royal Free Hampstead NHS Trust	2.5		6.5	5.9	2.7	1.3
Royal Liverpool & Broadgreen University Hospitals NHS Trust	0.1		0.4		0.4	0.3
Royal Liverpool Children's NHS Trust	0.3				0.4	0.1
Salford Royal NHS Foundation Trust	0.2	2.0	0.4	1.0	0.1	0.4
Sandwell & West Birmingham Hospitals NHS Trust	0.1		0.1	1.0	0.3	0.1
Sheffield Children's NHS Foundation Trust			0.1	0.2	0.1	0.1
Sheffield Teaching Hospitals NHS Foundation Trust	0.4	1.0	1.2	0.5	0.3	0.9
Southampton University Hospitals NHS Trust	1.6		2.1	2.5	7.3	1.8
St George's Healthcare NHS Trust	10.4		1.2	1.0	8.6	1.8
United Bristol Healthcare NHS Trust	1.0		0.9	0.7	1.2	0.2
University Hospital Birmingham NHS Foundation Trust	1.8	3.0	5.2	0.5	2.3	0.6
University Hospital of North Staffordshire NHS Trust	0.1			0.2	0.3	0.3
University Hospital of South Manchester NHS Foundation Trust	0.7		1.3	0.2	2.1	0.4
University Hospitals of Leicester NHS Trust	0.8		0.1	0.2		
Walton Centre for Neurology & Neurosurgery NHS Trust	0.1					0.1
West Hertfordshire Hospitals NHS Trust						0.1
West Middlesex University Hospital NHS Trust	0.1				0.1	
Universities						
Birckbeck College London					0.1	
Brunel University	0.1				0.1	
Imperial College London	20.8	1.0	6.1	4.2	33.7	4.6
Institute of Cancer Research	0.1	1.0	1.3	0.2		0.6
Kings College London	3.9	1.0	6.1	3.9	6.6	6.2
London School of Hygiene & Tropical Medicine	1.1		0.6	0.5	1.6	2.0
Newcastle University	1.0	7.1	5.5	1.7	1.2	3.6
Oxford Brookes University						0.9
Queen Mary, University of London	0.5		0.6	1.5	0.3	1.2
University College London	8.3	8.1	9.6	11.1	4.9	9.2
University of Bath			0.3	1.5	0.1	0.6
University of Birmingham	2.6	7.1	2.8	5.2	0.5	4.9
University of Bradford	0.1					0.1
University of Bristol	2.7	3.0	1.0	5.7	2.1	5.1
University of Cambridge	3.2	5.1	2.7	0.7	2.1	9.3
University of Durham	0.1		0.3			0.1
University of East Anglia			0.3	1.2		0.1
University of Exeter	0.1				0.1	0.5
University of Hull	0.8	1.0	0.1		0.3	0.3
University of Keele	0.1	2.0	0.1	3.2	0.1	0.7
University of Kent	0.1					0.3
University of Leeds	1.9	2.0	3.0	12.1	0.5	3.3
University of Leicester	2.4	1.0	0.4		1.1	0.8
University of Liverpool	0.6	2.0	2.1	0.2	1.8	1.0
University of London Institute for Education					0.1	
University of London School of Pharmacy	0.1		0.1		0.1	0.1
University of Manchester	1.3	8.1	3.7	18.7	2.7	5.8
University of Nottingham	1.3	8.1	3.4	2.2	4.9	1.6
University of Oxford	5.1	2.0	4.5	4.4	3.6	6.9
University of Plymouth					0.1	0.2
University of Reading	0.1					3.6
University of Salford				0.2	0.1	
University of Sheffield	0.6		1.2	1.2	0.3	5.2
University of Southampton	3.1	6.1	3.6	2.0	10.5	7.1
University of Surrey	0.4		0.1		0.3	1.8
University of Sussex	0.1					0.1
University of Warwick			0.3	0.2		0.9
University of York	0.1		0.1			1.2
Other Institutions						
Cancer Research UK	0.3	1.0	2.8		0.1	0.1
Central Public Health Lab			0.6	0.5	1.0	0.1
National Institute for Medical Research	0.1			0.2		0.1

Table 3: Top five institutions within a research area by HCPs by area

Field	Institution	% HCPs
Cardiovascular Disease	Imperial College London	20.8
	Royal Brompton & Harefield Hospitals NHS Trust	14.8
	St George's Healthcare NHS Trust	10.4
	University College London	8.3
	University of Oxford	5.1
Deafness and Hearing Problems	Nottingham University Hospitals NHS Trust	10.1
	University College London	8.1
	University of Manchester	8.1
	University of Nottingham	8.1
	Central Manchester and Manchester Children's University Hospitals NHS Trust	7.1
Gastrointestinal (including Liver) Disease	University College London	9.6
	North West London Hospitals NHS Trust	8.9
	Nottingham University Hospitals NHS Trust	8.5
	Royal Free Hampstead NHS Trust	6.5
	Bart's and the London NHS Trust	6.1
Musculoskeletal Disease	University of Manchester	18.7
	University of Leeds	12.1
	University College London	11.1
	Royal Free Hampstead NHS Trust	5.9
	University of Bristol	5.7
Respiratory Disease	Imperial College London	33.7
	Royal Brompton & Harefield Hospitals NHS Trust	19.0
	University of Southampton	10.5
	St George's Healthcare NHS Trust	8.6
	Southampton University Hospitals NHS Trust	7.3
Nutrition, Diet and Lifestyle (including Obesity)	University of Cambridge	9.3
	University College London	9.2
	University of Southampton	7.1
	University of Oxford	6.9
	Bart's and the London NHS Trust	6.6

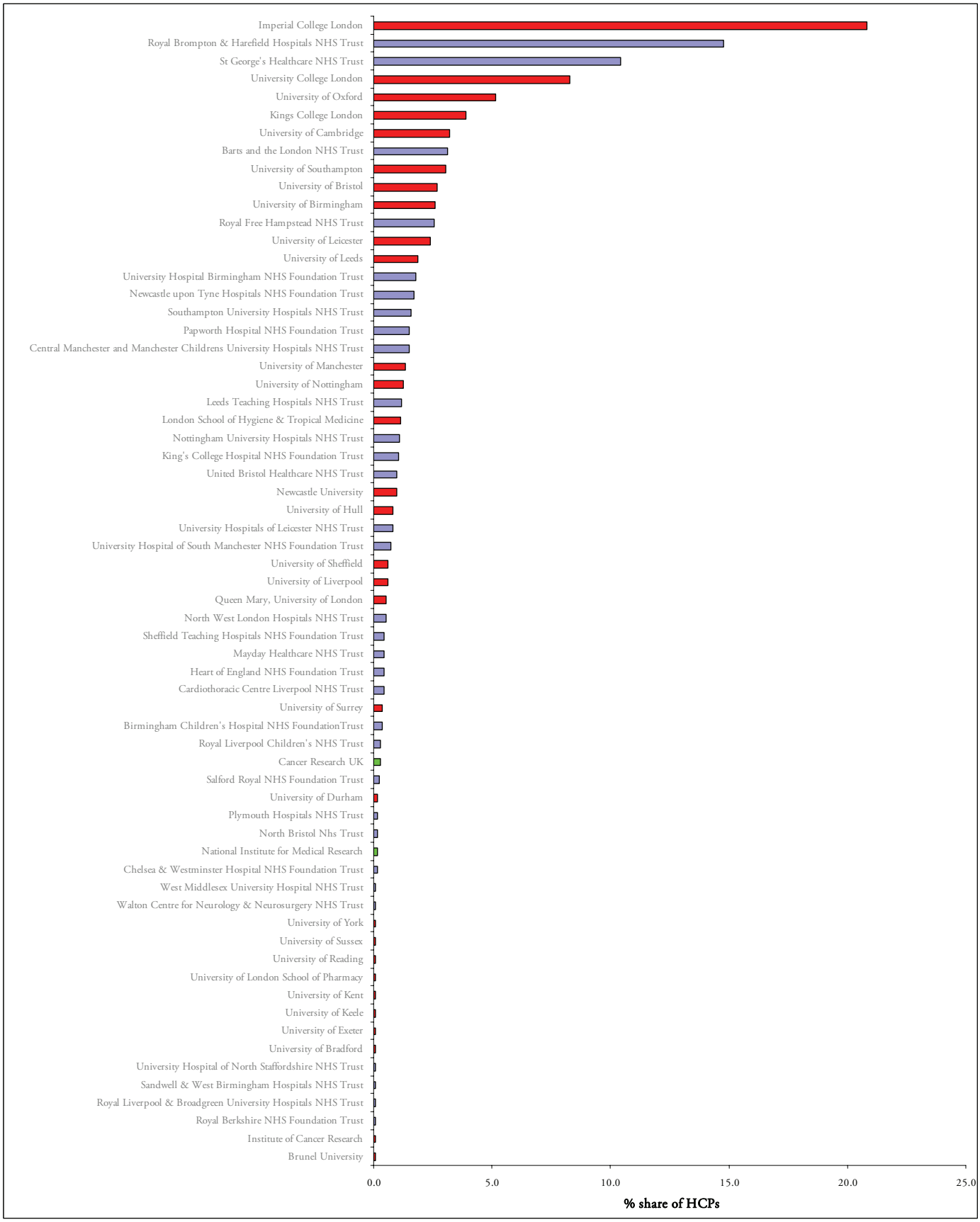
Annex A: Profiles of HCP share in subject categories

This annex shows the distribution of HCPs across research organisations (where those organisations had at least one HCP (if the organisation is not represented by publications then it will not appear within the distribution). Each subject category (Box 1) is shown. Within each distribution red blocks are Universities, blue blocks are NHS Institutions, and green blocks are independent research centres.

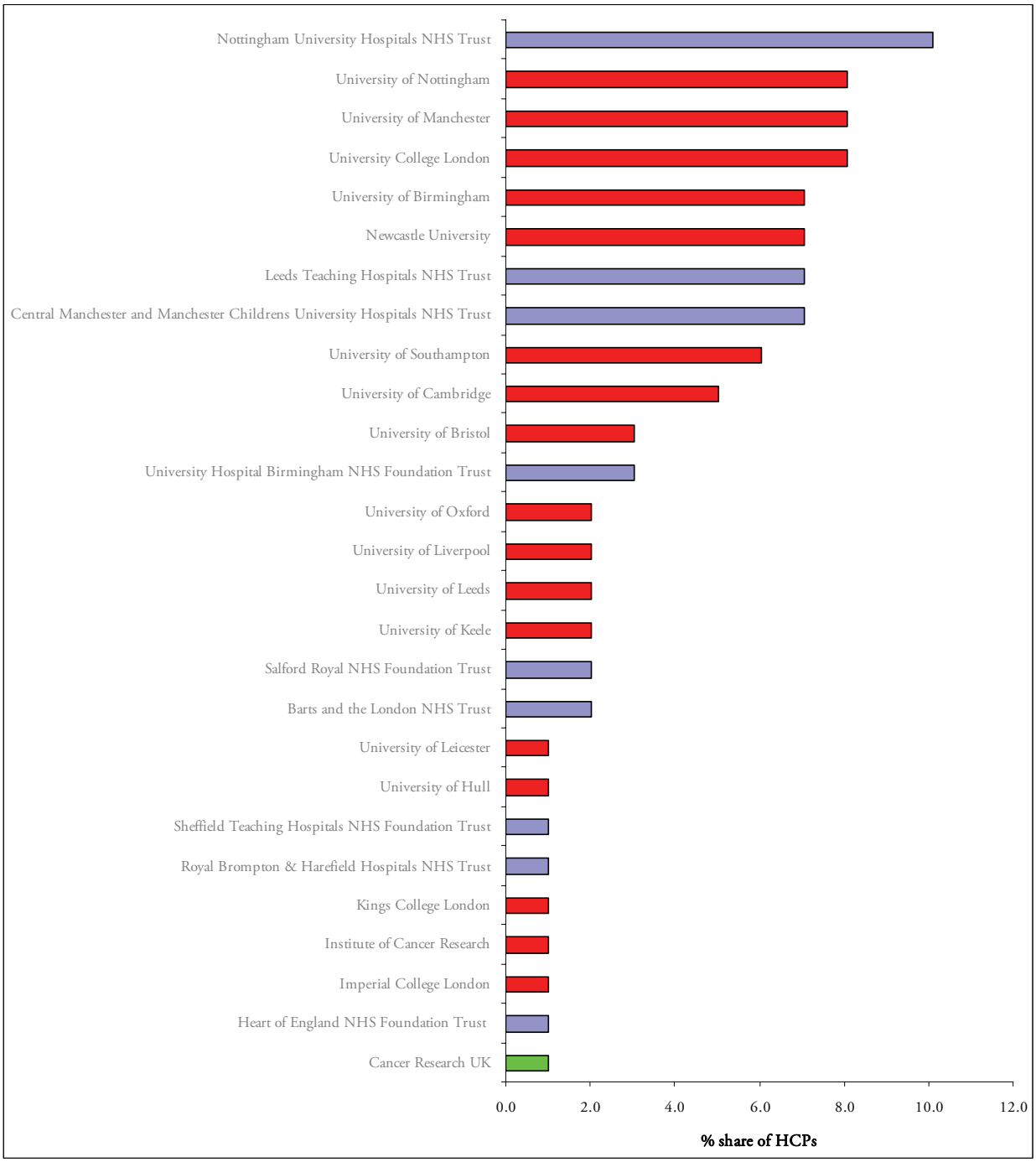
Box 1. Research subject areas

- Cardiovascular Disease
- Deafness and Hearing Problems
- Gastrointestinal (including Liver) Disease
- Musculoskeletal Disease
- Respiratory Disease
- Nutrition, Diet and Lifestyle (including Obesity)

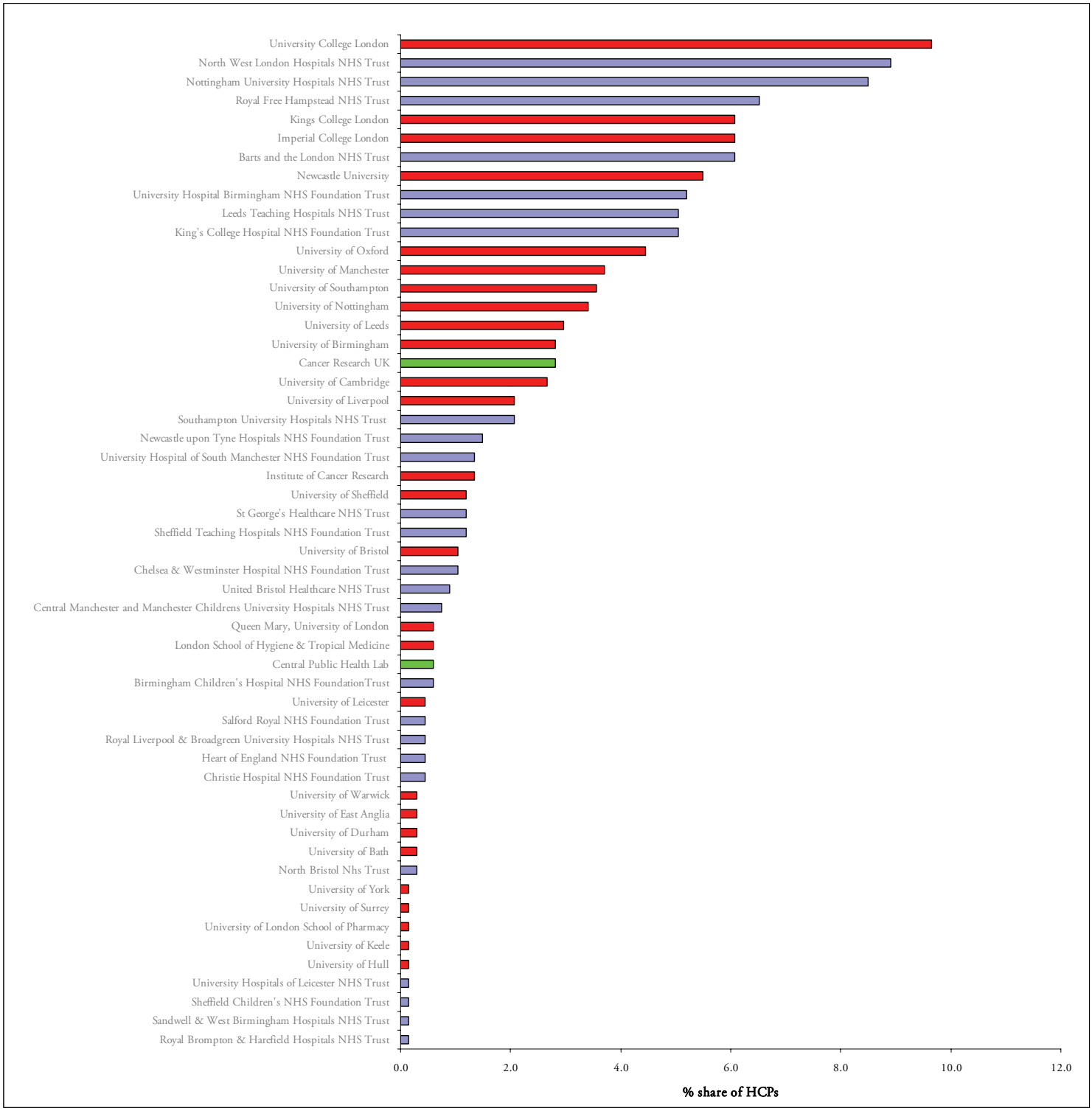
Cardiovascular disease



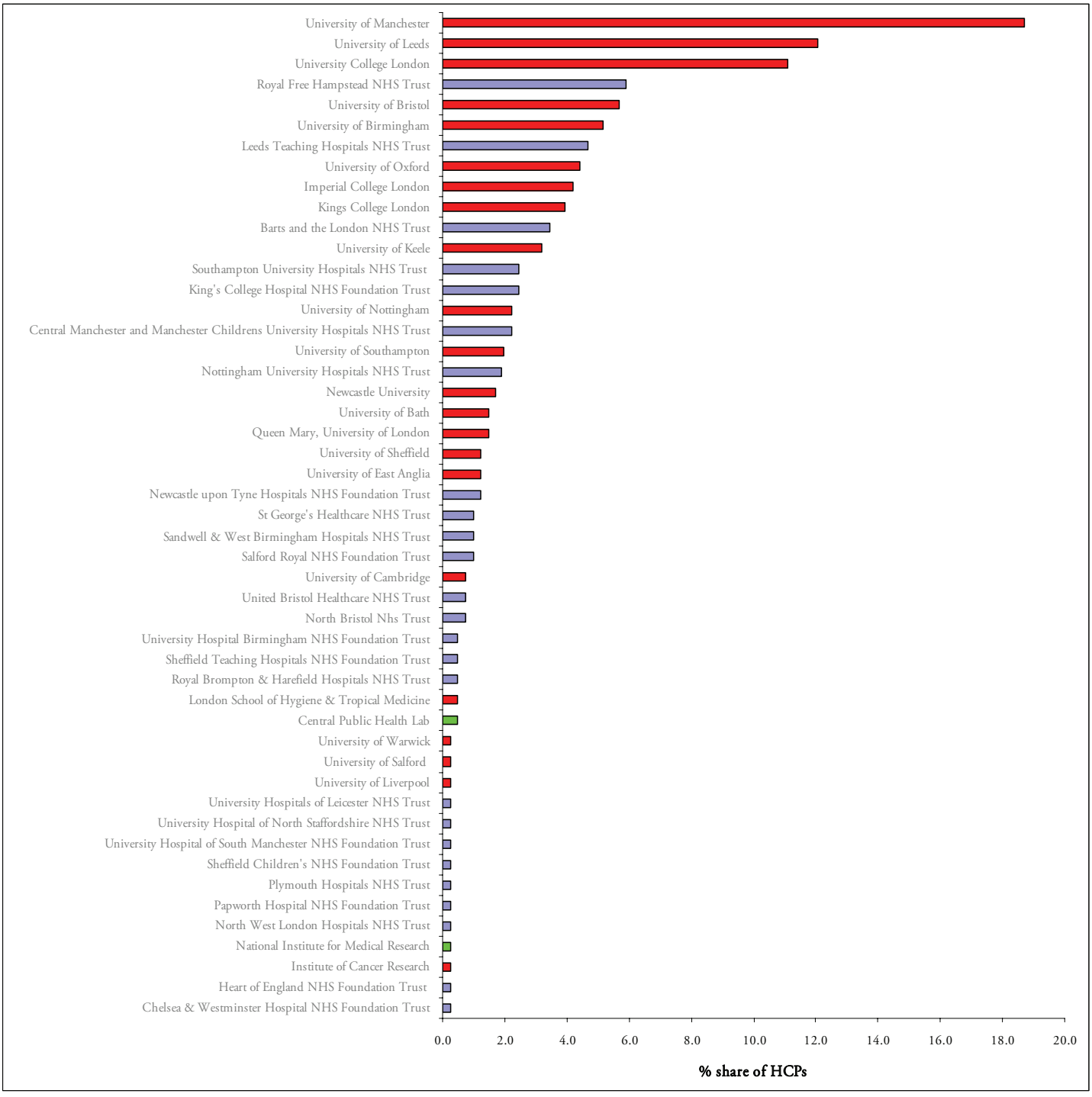
Deafness and hearing problems



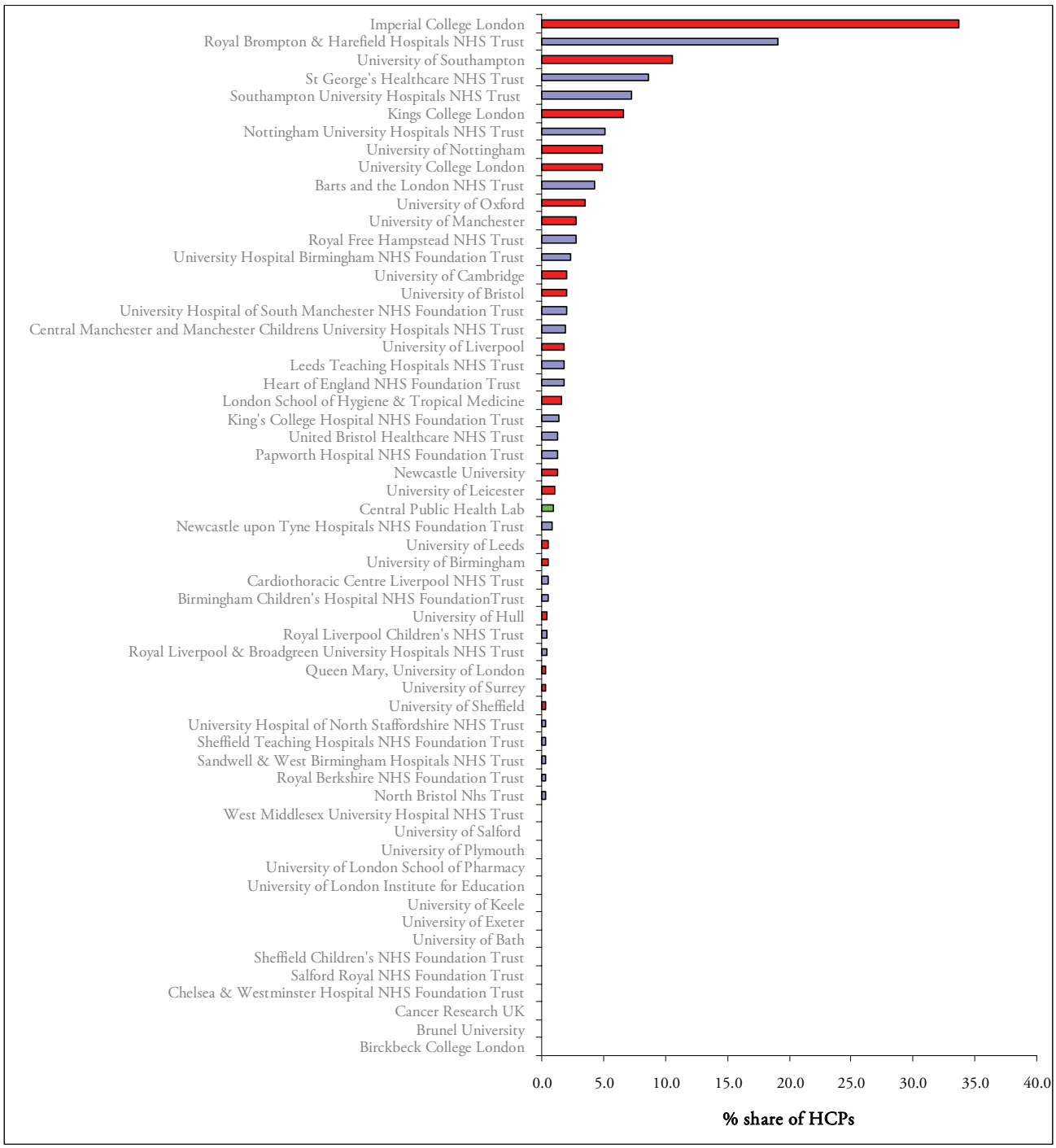
Gastrointestinal (including Liver) Disease



Musculoskeletal Disease



Respiratory Disease



Nutrition, Diet and Lifestyle (including Obesity)