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Research investments for UK infectious disease research 1997–2013: A systematic analysis of awards to UK institutions alongside national burden of disease

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Accepted 12 October 2017

Available online

KEYWORDS

Funding;
Investments;
UK;
Infection;
Infectious disease;
Financing

Summary Introduction: Infectious disease remains a significant burden in the UK and the focus of significant amounts of research investment each year. The Research Investments in Global Health study has systematically assessed levels of funding for infection research, and here considers investment alongside UK burden of individual infectious diseases.

Methods: The study included awards to UK institutions between 1997 and 2013 that were related to infectious disease. Awards related to global health projects were excluded here. UK burden data (mortality, years lived with disability, and disability adjusted life years) was sourced from the Global Burden of Disease study (IHME, USA). Awards were categorised by pathogen, disease, disease area and by type of science along the research pipeline (pre-clinical, phase I-III trials, product development, public health, cross-disciplinary research). New metrics present relative levels of funding by comparing sum investment with measures of disease burden.

Results: There were 5685 relevant awards comprising investment of £2.4 billion. By disease, HIV received most funding (£369.7m; 15.6% of the total investment). Pre-clinical science was the predominant type of science (£1.6 billion, 68.7%), with the UK Medical Research Council (MRC) the largest funder (£714.8 million, 30.1%). There is a broad temporal trend to increased funding per annum. Antimicrobial resistance received (£102.8 million, 4.2%), whilst sepsis received £23.6 million (1.0%). Compared alongside disease burden, acute hepatitis C and measles typically were relatively well-funded, whilst pneumonia, syphilis and gonorrhoea were poorly-funded.

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Conclusions: The UK has a broad research portfolio across a wide range of infectious diseases and disciplines. There are notable strengths including HIV, some respiratory infections and in pre-clinical science, though there was less funding for UK-relevant trials and public health research. Compared to the UK burden of disease, syphilis, gonorrhoea and pneumonia appear relatively neglected. Investment analyses can assist support policymakers to increase the equity of the UK R&D landscape.

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Introduction

In the UK, prevalence and incidence of infectious diseases have broadly declined across the latter years of the 20th century and early part of the 21st century, with greater burdens being observed in chronic conditions and diseases of ageing.¹ However, there remains a significant burden attributed to the infectious aetiology and emerging health concerns ensuring issues around infection stay high up the policy agenda. Antimicrobial resistance is a priority area for the UK Chief Medical Officer,² as well as global organisations such as the World Health Organisation and political stakeholders in other high-income areas.³⁻⁵ There are several thousand deaths in the UK each year from acute respiratory illness attributed to viral pathogens such as influenza, respiratory syncytial virus (RSV) and bacterial pneumonias.¹ The burden of tuberculosis is particularly significant in London, and there are increasing proportions of multi-drug resistant cases, with XDR cases having been observed.⁶ The challenge of preventing and managing transmission in healthcare environments is ongoing,⁷ and further infectious outbreaks occur in institutional settings such as schools, care homes and prisons.^{8,9} The incidence of several sexually transmitted infections, such as gonorrhoea and syphilis, is increasing among the UK population,¹⁰ and rates of ongoing HIV transmission and numbers living with HIV remain high.¹¹ Enteric disease is common in primary care and community settings.¹² The annual cost of treating infection-related complications in the UK is estimated at £6 billion.¹³

The Global Burden of Disease (GBD) study estimates the burden of communicable and non-communicable diseases at international and national level. A 2013 analysis described in detail the disability-adjusted life years (DALYs) attributed to 259 causes of disease in the UK,¹ whilst other analyses considered global burdens.^{14,15} National data relating to other measures of disease burden (including mortality and years lived with disability, YLD) can also be extracted from online data repositories (<http://vizhub.healthdata.org/gbd-compare/>; <http://ghdx.healthdata.org/gbd-data-tool>), hosted by the Institute for Health Metrics and Evaluation who carry out the GBD Study.

The Research Investments in Global Health (ResIn) study has systematically analysed public and philanthropic UK investments for infectious disease research, and compared these investments against the global burden of disease; this has provided quantification of the UK R&D portfolio, and highlighted national research strengths and gaps.^{16,17} Here, we report on UK-specific infectious disease research investment data across 1997 to 2013, and compare with metrics of UK disease burden, in order to identify relative spend of R&D funds on each infection and to gain an

insight into areas of research strength and weakness in the UK.

Methods

The methods for the ResIn project are described in detail elsewhere,^{16,17} and in further publications at www.researchinvestments.org/publications. Briefly here – research investment data across 1997–2013 (inclusive) relating to human infectious disease was obtained from 586 public and philanthropic funders of health research. Award data was obtained either by direct request to the funding agency, downloaded from the funder's website, or extracted from other openly-available sources such as the (now-archived) Department of Health National Research Register and clinicaltrials.gov. Information collected included the award title, abstract or further supplementary information such as a lay or technical summary, name of leading institution and principal investigator, amount of funding awarded, and the year of award. Each award was individually scrutinised to ascertain relevance to infection, and to assign to a number of categories. Categorisation was carried out manually by authors Head and colleague Joseph Fitchett, with further checks by a number of other colleagues, and datasets were distributed to all authors for review and comment. Categories included disease, pathogen, and discipline (e.g. modelling, economics), as well as broad areas such as antimicrobial resistance and global health. We also categorised by type of science, the position along the R&D pipeline (pre-clinical research, phase I–III trials, phase IV and product development activity, public health, and cross-disciplinary research). Cross-disciplinary research was defined as awards that clearly covered more than one type of science (e.g. pre-clinical science leading into a phase I trial, as part of the same project). This category has only been included in the 2011–2013 data and not retrospectively categorised across the rest of the dataset (due to lack of staff capacity). Awards must have been led by a UK institution. Projects with a clear zoonotic component were included; animal health projects were excluded. Where projects were awarded in international currencies, they were converted to UK pounds using the average exchange rate from the year of the award, and all included awards were adjusted for 2013 inflation.

For this UK-focused manuscript, we excluded awards related to global health since the focus of those projects would be outside of the UK. This exclusion covered all awards from the Bill & Melinda Gates Foundation. All other awards were assumed to have relevance to the UK. Burden data specific to the UK was sourced from the GBD Study online repositories (<http://vizhub.healthdata.org/gbd-compare/> and <http://ghdx.healthdata.org/gbd-data-tool>). Burden

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