Institution: Imperial College London

Unit of Assessment: 02 Public Health, Health Services and Primary Care

a. Context

Since our foundation in 1907, Imperial College has held the application of our work as central to our mission. This includes our work in epidemiology, public health and primary care, where over the past 18 years we have targeted recruitment of research leaders capable of driving the research agenda in key, complementary areas of chronic disease epidemiology (CDE, established 1995), infectious disease epidemiology (IDE, established 2000), clinical trials and evaluation (CTE, established 2010 with creation of the Imperial Clinical Trials Unit) and through the Imperial College School of Public Health (established 2010). Our strategy is to develop a research portfolio with high impact on health services, public health and prevention with the aim of increasing understanding and reducing the burden of disease at a national and global scale. We actively engage with a number of sectors, agencies and beneficiaries to influence healthcare leaders, policies and programmes around the world:

- *Governments and international agencies.* We are actively influencing and shaping public policy and services at a national government and international scale. This includes influencing international health policy responses to infectious disease threats e.g., the 2009 H1N1 flu pandemic, polio elimination and HIV control (IDE); shaping national and international guidelines for improved health e.g. sodium reduction policies for the prevention of cardiovascular disease (CDE); influencing the international agenda for prevention and control of chronic disease, e.g., through the Global Burden of Disease project (CDE).
- *Healthcare providers nationally and internationally*, including the National Health Service (NHS). This involves broad impact on health and welfare, and capacity, cost and value of services through development of clinical guidelines and strategies e.g. blood pressure management in the very elderly (CTE); health care and clinical performance monitoring e.g. analysis of surgical performance (CTE) and healthcare provision e.g. parasitic infections control strategies in sub Saharan Africa (IDE).
- *Society* through, for example, stimulation of and informing public debate e.g. badger culling to prevent TB in cattle (IDE), low-level non-ionising radiation from high-voltage overhead powerlines or mobile phone masts and associations with cancer risk (CDE).

Learning from our successes which include the six impact case studies included in our submission, we are continuing to develop our approaches and mechanisms to support translation of our research findings into tangible impacts at a patient, public health and societal level. We promote a supportive research environment that values translational research and encourages staff in its achievement and make use of mechanisms at College level to facilitate engagement with industry and encourage innovation, e.g. Imperial College Consultants, Imperial Innovations. Lastly, our engagement with society is supported by Imperial Communications, in-house media production teams, media training, and outreach activities, e.g. through the Wohl Reach Out Lab. We plan to further enhance the impact of our research, at all levels, during the next REF period (see below).

b. Approach to impact

We are committed to delivering novel data, analyses and reports to address problems of national and global health significance, in a timely manner, and with great influence. Impact of research forms part of the annual staff review and is considered an important part of recruitment and promotion. Engagement with all beneficiaries is multifaceted and conducive to achieving impacts of reach and significance, as contextualised above, and supported in the following ways:

Policy, regulatory and professional influence is a key component in enabling our most successful research programmes to move into broader implementation. We seek and encourage secondments and joint appointments with national and international Government and policy makers, e.g. secondments to US Centers for Disease Control and Prevention (CDC) Cauchemez (H1N1 influenza pandemic [2009]), Gambhir (whooping cough, 2013-); joint appointments with Public Health England (PHE, e.g. White [UoA1], Head PHE Modelling and Economics Unit). We have made strategic liaison appointments, e.g. IDE liaison officer (Van Kerkhove) linked to multiple World Health Organisation (WHO) departments to coordinate the WHO modelling network for pandemic influenza. Through a dedicated NICE liaison officer linked to the Imperial Academic Health Sciences Network, we provide a challenge function to NICE for guidance or policy, regarding field testing, uptake, and methodology development. During the REF period we have

recruited key opinion leaders e.g. Ezzati (CDE), Ashby (CTE) and supported staff to move onto influential roles, e.g. Garnett (Deputy Director, Global Health, Bill and Melinda Gates Foundation).

We encourage participation on beneficiary boards, committees and panels to help shape policies, regulations and professional guidelines. Examples in the REF period include WHO Emergency Committee (Ferguson); WHO polio eradication advisory panels (Grassly); WHO Malaria strategy advisory committees (Ghani); WHO Onchocerciasis Elimination Programme for the Americas (Basenez); WHO Advisory Committee for Information Technology for Patient Safety (Majeed); Department of Health (DoH) Pandemic Influenza Scientific Advisory Group (Ferguson); DoH Committee on Carcinogenicity (COC) of Chemicals in Food, Consumer Products and the Environment (Rushton, Vineis); DoH Public Health Information and Intelligence Task Force (Majeed); Government Chief Scientific Officer Blackett Review on Biological Detection (Elliott); European Medicines Agency (Ashby); UK Commission on Human Medicines (Ashby); NHS Connecting for Health Evaluation Programme (Car). Ashby, Ferguson and Rushton have been recognised with OBEs for their work. We also actively encourage our early career researchers to forge links with policy makers (e.g. Royal Society Policy Exchange Programme [O'Reilly]).

We position the MRC Centre for Outbreak Modelling and Analysis (IDE) to have an international role to provide 'call up' for rapid analysis of emerging and novel infectious disease risks (e.g. H1N1), and consequently built close relationships with WHO (and other UN bodies, e.g. UNAIDS), US CDC, China CDC. The MRC-PHE Centre for Environment and Health (CDE) through the UK Small Area Health Statistics Unit (SAHSU) has a remit to provide authoritative analyses for government concerning environmental health risks e.g. health effects associated with incineration, waste disposal and chlorination of the water supply. Results are fed into the relevant government scientific committees, e.g. Committee on Toxicity (SAHSU studies of landfill sites and disinfection by-products in the water supply) and COC (SAHSU study on Municipal Solid Waste Incinerators). We house the Dr Foster Unit at Imperial College (CTE) to support comparative analyses of healthcare performance used by health authorities and government. We have established the Centre for Health Policy, a joint venture between our Faculty of Medicine and Business School within the Imperial Institute for Global Health Innovation (IGHI). This enables governments, clinical leaders and decision-makers worldwide to bridge the gap between research and policy by undertaking applied policy analysis, training the next generation of health policy-makers and holding annual symposia on healthcare policy, e.g. the World Innovation Summit for Health.

We have contributed to developing a wide range of software (e.g. MalariaTools, Outbreaker, EpiBase, Spectrum) to assist public health professionals and policy-makers to improve situational awareness and decision-making in responding to infectious disease threats (IDE). We (CDE) have developed advanced Bayesian statistical analysis freeware, WinBugs and GeoBugs, in collaboration with Cambridge University, with wide application in the pharmaceutical industry (UoA 10 case study). The BUGS software is also used in systematic reviews that inform NICE appraisals. Originally developed for use in the UK, we have extended the use of the SAHSU Rapid Inquiry Facility freeware platform (which enables the rapid investigation of health effects associated with sources of environmental pollution) to a number of European countries through the EU-funded European Health and Environment Information System (EUROHEIS), and to the United States, in support of the CDC-funded US Environmental Public Health Tracking Program. We (CTE) co-lead the Benefit Risk workstream of PROTECT, a public-private research partnership of academic, regulatory agencies, pharma companies and patient organisations under the EU Innovative Medicines Initiative to inform better decision-making in the licensing of medicines. This close liaison ensures the outcomes build on our technical expertise, such as the use of WinBugs, to address the challenges faced by all partners in the regulatory environment.

We promote **public debate of our research**, through training of our researchers in media and presentational skills, supported by an active Communications team, daily news features on our website, and active engagement through e.g. the Science Media Centre. We present our research at Science Fairs, including 'The Big Bang', Science Museum, the annual NIHR Imperial BRC Research Festival (aimed at patients, their relatives and carers), Cheltenham Science Festival, British Science Association; give public lectures (e.g. at the Royal Society); undertake school and other outreach activities including an open-day exhibition (2013) held on the concourse of Paddington station. Each group presents their research at the annual Imperial Festival and Fringe events; in Easter 2013, 10,000 members of the public engaged with the hands-on demonstrations,

lectures, debates and performances. Our staff appear regularly in the print and broadcast media to present and explain their findings to a wide audience (e.g. *Ferguson* [H1N1 flu pandemic case study], *Donnelly* [badger culling]). As a further example, our study (2013) on cardiovascular disease and aircraft noise near London Heathrow airport was widely reported in the press and broadcast media both in the UK and overseas. We produced a press release, a video abstract on the Imperial and *BMJ* websites and arranged a press conference at the Science Media Centre, to ensure fair and accurate reporting of our study in the media. It featured in Prime Minister's question time (9 October 2013) reflecting the societal impact of this work.

Imperial College runs specific outreach schemes to raise aspirations in higher education and science in particular. Examples include the 'Reach Further Programme' in the Wohl Reach Out Lab which targets secondary schools; over 20,000 visits have been made since the labs opened in 2010. We utilise Wellcome Trust Institutional Strategic Support Fund (ISSF) monies to expand the Reach Out programmes to schools in North West London. Wellcome Trust ISSF funding supported the PPE Tricycle which has won a gold medal in the prestigious Internal Council for Advancement and Support of Education Circle of Excellence awards. The MRC-PHE Centre for Environment and Health has established an outreach programme as a vehicle to enable its junior and intermediate level researchers to engage in public dissemination events.

We continuously foster **successful partnership and knowledge transfer with industry** to realise effective development and distribution of our discoveries, and maximise commercial impact. Imperial Consultants is the UK's leading academic consultancy provider, with a turnover of £16.5M (2010/11), of which over £5M relates to the Faculty of Medicine. We encourage staff to capitalise on their specialised knowledge and expertise by undertaking external consultancy work; in 2011/12 UoA2 researchers undertook consulting projects for 34 distinct commercial clients. Since 2009, a Corporate Partnerships Manager has been embedded within the Faculty of Medicine, working with Imperial Innovations, to identify, facilitate and manage the development of strategic industry alliances (through corporate level interaction, strategic co-investment, and person-to-person engagement). Recent examples include our major alliances with MedTech/equipment manufacturers, Waters and Bruker, to support programme development, training, and knowledge transfer programmes as part of the MRC-NIHR National Phenome Centre (CDE). Our approach to increasing engagement with industry also involves supporting rapid trial initiation and delivery of studies to time and target. Our Joint Research Office provides advice and assistance with contract negotiation and the financial management of a project through its lifetime. We have developed a new database system and workflows: the number of new commercially-sponsored clinical studies opening for recruitment has increased from 40 in 2008/09 to 78 in 2012/13. Since 2008/09, 313 new commercial studies have been initiated. The College, through Imperial Innovations plc actively supports academic staff to create, build and invest in pioneering technologies, combining the activities of technology transfer, company incubation and investment. We host drop in sessions for academics to discuss tentative ideas for exploitation as well as more structured departmental briefings on e.g. intellectual property management and start-up formation. In 2011/12 Imperial Innovations invested £37.9M in 29 companies, appraised 377 inventions and filed 51 patents.

c. Strategy and plans:

During the next REF period we will implement and monitor our strategy of contributing to better health in the population through strengthening the public health science base, training the next generation of public health leaders, and influencing health policies and programmes around the world. At the heart of our strategy is the belief that achieving impact is intrinsically linked with our excellent science, and our development of people. We will focus on a number of key beneficiaries:

Government and international agencies: We will continue to provide critical national rapid-response capacity for responding to emerging risks through the renewal of our MRC Centres. We will deepen existing partnerships with public health organisations (e.g. PHE, via NIHR Health Protection Research Units) and maintain and develop our influencing role through membership of government committees and advisory boards. Through secondments to help influence policy, we will build new partnerships with agencies in developing and emerging economies including China and India. Our research (Elliott, Neal and Kooner [UoA1]) is helping to provide information relating to the burden of cardiovascular disease in these countries. We will expand the advisory role of IGHI on health policy and continue to contribute to the World Innovation Summit for Health, an annual meeting convened by IGHI in which global political and thought leaders in health convene

to discuss major issues of health policy.

Healthcare providers nationally and internationally including the NHS: We will further facilitate health impact through translation and uptake of our discoveries in the health service and clinical practice, e.g. through the renewal of our Academic Health Sciences Centre and Network and NIHR infrastructure (NIHR Imperial BRC and BRUs, and North West London CLAHRC). We shall continue to develop health solutions for African countries through our Wellcome Trust Global Health Research Centre. To facilitate evaluation of the cost and value of our impact on health care providers, our health services research base will be expanded in conjunction with Imperial College Health Partners (ICHP) and Imperial Business School. We will capitalise on our global developments, e.g. the Imperial Diabetes Centre in Abu Dhabi, Qatar Biobank and the new Lee Kong Chian Medical School (a partnership between Imperial and Nanyang Technological University, Singapore), to reach out to new healthcare settings and address/deliver bespoke solutions geared to different populations for improved treatment and prevention strategies.

Society: In addition to our continued activities to stimulate and inform public debate, we will work with ICHP and our NIHR Imperial BRC-Funded Imperial Patient Experience Research Centre to align patient and public involvement across primary to tertiary care settings, including enabling patient participation in review of applications; creation of Patient and Public Groups to contribute to key research design, delivery and project management; input into patient information sheets, grant and ethics applications; patient and carer contribution to reporting and dissemination with the intention of utilising this contribution to improve health. We will extend this aligned programme to local communities as part of our new Imperial West campus development. This is a major new investment by Imperial College to develop an academic translational hub on a 34 acre site in West London adjacent to our Hammersmith Hospital clinical site.

Commerce: We will extend the reach and significance of our impact on commerce through our appointment (2012) of a Director of Pharmaceutical Liaison within Imperial Clinical Trials Unit. This will help to further develop our profile and recognition as a world class academic partner for the design, delivery and dissemination of commercial clinical studies.

Training and Staff Development: We will further strengthen the focus of our training programmes on societal impact and increase the provision of fellowships, secondments and joint appointments.

We monitor progress in relation to supporting, enabling and achieving impact through the College and AHSC Research Committees. Through the College Research Strategy Office, the College has invested in Impact Officers to track the potential impact of our research endeavours.

d. Relationship to case studies:

Our approach to impact, across our research groups, has emphasised close alignment between our researchers and policy makers, healthcare providers and the public. We have had important **impact on international health policy** by translating the results of our research through initiating, developing, and maintaining close strategic relationships with a wide range of policy makers, and public sector organisations, to influence policy, guidelines and services leading to significant health improvements. For example, long-standing research by Elliott (CDE) on salt levels and blood pressure led to his co-authorship of systematic reviews for WHO underpinning WHO efforts to develop and promote strategies on sodium reduction and potassium intakes in populations worldwide (case study). Researchers from IDE have helped determine international response a) on the strategic use of oral poliovirus vaccines to finally eradicate endemic poliovirus transmission; b) to the H1N1 pandemic through detailed modelling (as soon as the earliest data became available) with results used extensively by the UK government, WHO and the US CDC; c) by WHO and UNAIDS for global HIV surveillance (case studies). We have had significant **impacts on international public policy and debate**; for example, our reporting on the potential outcomes of badger culling and other control strategies, has underpinned governmental planning for bovine TB control (case study). Our lead role in the HYVET trial (case study) exemplifies CTE working with industry to answer an important therapeutic question regarding antihypertensive therapy in the very elderly, from design through conduct and analysis of this large international clinical trial. This has rapidly **informed international treatment guidelines**. Both the staff involved and the expertise acquired in carrying out this and other influential trials have been pivotal in launching the Imperial Clinical Trials Unit. Our supportive environment and embedded culture directed at translation from research to impact has enabled us to deliver internationally important studies in response to healthcare needs, public health priorities and pharmaceutical opportunities.