

Institution: University of Bristol

Unit of Assessment: 2 – Public Health, Health Services and Primary Care

a. Overview

Research in this Unit of Assessment is carried out in the University of Bristol (UoB) School of Social and Community Medicine (SSCM), within the University's *Population Health* research theme. Our research is characterised by its multi- and inter-disciplinary nature with extensive national and international collaborations. We aim to support individual scholarship and collaborative working in research of the highest quality, and to pursue and share knowledge and understanding to improve health and well-being in the UK and internationally. Our strengths are best represented by the research groups genetic and molecular epidemiology, aetiological epidemiology, primary care, public health, and health services research. Researchers work seamlessly across these groups, operating within a single coherent organisation (SSCM) that promotes disciplinary excellence as well as multi- and inter-disciplinary working across topic areas, methodological approaches and clinical contexts. We assigned each submitted paper to one research group: many of our submitted staff are therefore members of more than one group. Major *cross-cutting research themes* include mental health, infection, cancer and cardiometabolic health.

Research in *genetic and molecular epidemiology* identifies robust associations of genetic variants with modifiable (non-genetic) risk factors, so that these variants can be used to determine causal effects of modifiable risk factors on disease outcomes, using the Mendelian randomization approach pioneered by Davey Smith. Causal effects are further explored using complementary approaches in *aetiological epidemiology*, conducted in close collaboration with public health and clinical colleagues to ensure knowledge transfer from targets identified to the development of RCTs of relevant interventions. Research in *primary care* focuses on RCTs and other studies of interventions of major importance for the health of individuals and the population. *Public health* links with epidemiology, e.g. through long term cohort follow-up, and with primary care through studies of interventions delivered in primary care intended to improve the health of the population (e.g. physical activity for depression). *Health Services Research* supports the other groups via development and application of research methods, e.g. cutting-edge methods for evidence synthesis, dealing with missing data, and innovative applications of these methods in RCTs.

Headline achievements during the submission period include: the Medical Research Council (MRC) Centre for Causal Analysis in Translational Epidemiology (CAiTE) expanding to become a major University-based MRC Unit – the Integrative Epidemiology Unit (IEU; £23m funding 2013-18); the Avon Longitudinal Study of Parents and Children (ALSPAC) birth cohort study receiving £6m core funding from MRC and Wellcome Trust (WT) and £12m additional project/programme grants; retaining membership of the National Institute for Health Research (NIHR) School for Primary Care Research (SPCR) and being founder members of the new NIHR School for Public Health Research (SPHR); securing renewed funding for the Centre for the Development and Evaluation and Complex Interventions for Public Health Improvement (DECIPHer) and the Bristol Randomized Trials Collaboration (BRTC); establishing and securing renewed funding for the MRC ConDuCT Hub for Trials Methodology Research; and being awarded an NIHR CLAHRC (Collaboration for Leadership in Applied Health Research and Care: £9m from NIHR, 2014-18).

Our submission includes 84 staff, of whom 21 are early career researchers (ECRs). Support from UoB and major funding bodies facilitated considerable expansion of our research during the reporting period and enabled us to achieve the strategic aims outlined in 2008. Our submitted FTEs have increased to 74.6, from 48.2 in the 2008 RAE. Total research income increased from £12.1m in 2008/9 to £16.7m in 2012/13. There is a thriving programme of three- and four-year higher degree studentships funded by NIHR, WT, MRC and others, an internationally-renowned programme of short courses providing training in relevant research methods that are freely available to staff and postgraduate students, and a supportive and collaborative culture to facilitate the conduct of multi- and inter-disciplinary research. In 2013, SSCM secured an Athena SWAN silver award. Career development has been a particular strength, with 67 staff awarded prestigious personal fellowships (total award value £19.0m) in the reporting period - one at professorial level, 46 post-doctoral and 20 doctoral awards. There were six promotions to Professor and seven to Reader, and UoB supported 17 strategic appointments to permanent new posts.

b. Research strategy

Research in this submission, based in the UoB School of Social and Community Medicine (SSCM), spans investigations at the molecular level (including genetic, epigenetic and metabolomic epidemiology), qualitative studies of small groups, large cohort studies and randomized controlled trials (RCTs), and developments of new methodological approaches across the range of academic disciplines and clinical areas – including anthropology, bioinformatics, computational biology, economics, epidemiology, ethics, genetics, geography, mathematical modelling, nursing, oncology, paediatrics, primary care, psychology, psychiatry, public health, sociology, statistics and surgery. We aim to investigate and address the causes, prevention, diagnosis and management of problems of clinical and public health importance. The development and application of novel research methods relevant to these investigations is a key aspect of our approach.

Strategic aims, 2008 to 2013

Overall, our aim was to provide an environment in SSCM in which researchers were able to undertake research of the highest quality, relevance and impact. Below, we list our key strategic priorities, with corresponding major achievements during the reporting period:

To focus the strengths and activities of population health sciences at UoB

In 2010, the Departments of Social Medicine (epidemiology, public health, health services research) and Community Based Medicine (primary care, psychiatry, community paediatrics, ethics), were merged to establish SSCM. The merger has been very successful, enabling focused infrastructure development in two major physical locations within a 10-minute walk (replacing five previous locations), and enhancing opportunities for coalescing activity and further collaboration.

To integrate population health sciences into local collaborative arrangements

Strategic and working relationships have been strengthened by the establishment of Bristol Health Partners (Bristol HP), a formal academic health sciences partnership between NHS organisations, Universities and the local authority. This has formalised joint working with FSF/RCF funding mutually supporting research submissions and capacity-building. The population health approach to improving health and well-being adopted by Bristol HP led to the award of the NIHR CLAHRC_{west} in 2013. New collaborations across UoB (e.g. with engineering and chemistry) have been facilitated through the establishment of the Elizabeth Blackwell Institute – a UoB Research Institute that brings together nearly 400 academics working on health-related research across all Faculties.

To develop and expand research centres of international excellence

We focused considerable effort on further development of areas with existing international profiles, and a major achievement was the conversion of the MRC CAiTE Centre into the MRC Integrative Epidemiology Unit (IEU) at UoB. Other key achievements were: further substantial funding for the NIHR School for Primary Care Research and UKCRC DECIPHer Centre; and the establishment of the NIHR School for Public Health Research and MRC ConDuCT Trial Methodology Hub.

To maintain and develop cohort studies with biological samples and exposure data as research resources to share with the wider scientific community

Substantial WT/MRC funding was awarded to develop the multi-generational ALSPAC cohort and to provide a framework to share data and bio-resources from this and other major UK cohorts, for example the 1958 birth cohort and the Born in Bradford study.

To develop and expand research areas with strategic appointments

We made 17 permanent new academic appointments (“strategic appointments”), seven at professorial level. This expansion of staff, across all research groups, reflected support provided by UoB to leading researchers gaining substantial external research funding for Centres and Units.

To support staff at all levels in developing research careers

This was achieved by 67 externally-funded personal research fellowships; doubling places on the SSCM short-course programme; and 46 new doctoral studentships funded by NIHR, WT, MRC and EU.

To complete and publish the wide range of methodological and substantive research programmes and projects funded during the previous assessment period

These achievements are detailed below within our research groups. We use square brackets to refer to individual papers in the submission: for example [Davey Smith 1] refers to REF output 1 by Professor George Davey Smith.

Achievements by research group

Genetic and molecular epidemiology

The outstanding achievements of MRC CAiTE were reflected in £78.2m grant income, >400 papers published and its wide recognition as an international beacon of causal analysis. These achievements led to the establishment of the MRC IEU, Director Davey Smith, in June 2013, based on £23m 5-year funding from the MRC (£11m) and UoB (£12m). The IEU's innovative multi-disciplinary programmes are underpinned by core methodological research that will fuel a step-change in causal analysis methods and their application in defining the role and interrelationships of genetic, epigenetic, proteomic and metabolomic variation, together with lifestyle and environmental risk factors, on complex disease outcomes. Other achievements in *Genetic and molecular epidemiology* were:

- *Large programme grants* including: £1.5m (WT) for the Born in Bradford birth cohort bioresource, £1.5m (MRC) for the UK 1958 birth cohort bioresource, and £1.5m (BBSRC) for integrated epigenomics to enhance and facilitate access to bioresources; and to complete genome-wide association studies: £2.3m (WT) for pregnancy phenotypes; £1.1m (WT) for extreme obesity, and £2m (23andMe) for genome-wide genotyping of ALSPAC participants.
- *New strategic appointments* establishing UoB as an international centre of excellence for genetic and molecular epidemiology were Professors Relton (Epigenetics), Ala-Korpela (Computational Medicine and Metabolomics), and Burton (Genetics, Omics data analysis); and Drs Drenos (Computational Medicine) and Zuccolo (Genetic Epidemiology). Evans and Timpson were promoted to Reader.

Key findings from submitted publications in molecular and genetic epidemiology

- In major collaborations we identified genetic determinants of: cardiometabolic outcomes [Ala-Korpela 1; Gaunt 1 2 3; Drenos 1 3 4; Higgins 3; Shin 1]; asthma, atopy and dermatitis [Granel 1; Henderson 2 4; Northstone 1; Paternoster 1; Relton 2]; musculoskeletal phenotypes, including ankylosing spondylitis, bone mineral content and bone mass [Evans 1, 2 3; Paternoster 2]; birth size and infant/childhood growth [Davey Smith 3; Timpson 1 4; Relton 4]; and myopia [Williams 1].
- We developed Mendelian randomization methods and applied these to determine causal effects of alcohol intake on blood pressure [Lewis 2] and offspring cognition [Zuccolo 1].
- We determined the prevalence of pathogenic mitochondrial DNA mutations in European populations and the relationship of mitochondrial DNA haplogroups with ischaemic stroke [Elliott 1; Relton 3].
- We developed methods for harmonising genetic, omic, lifestyle, environmental and socio-economic data, to enable valid inferences without compromising anonymity [Burton 3 4].

Aetiological epidemiology

The ALSPAC birth cohort study has undergone major development since RAE2008. MRC and WT made a strategic award of £6m core funding (2011-14). An additional £12m was awarded for project/programme grants (from WT, MRC, UK medical charity funders, EU and US NIH) to collect new data and enhance the cohort through data linkage. These enabled investigations of the health of the mothers, fathers and offspring of original cohort members, making ALSPAC unique in having detailed genomic, molecular, social, lifestyle and clinical data on three generations. ALSPAC has led the way in making data available to the international scientific community. Other achievements in *Aetiological epidemiology* include:

- *Large programme grants*: £1.5m joint UKRC funding to explore healthy reproductive ageing; £1.2m from WT to explore the impact of the perimenopause on cardiometabolic, cognitive, mental and musculoskeletal health; £1.3m from the MRC to determine the causal effect of

intrauterine and childhood levels of vitamin D on future health.

- *New strategic appointments* were Professor Murtagh (Social Studies of Health Science) and Drs Kordas (Nutritional and Environmental Epidemiology), Jeffreys (Epidemiology) and Fraser (Cardiometabolic and Reproductive Epidemiology).

Key findings from submitted publications in aetiological epidemiology

- The effects of in utero exposures: low levels of maternal pregnancy urinary iodine are related to low offspring cognitive function [Emmett 3]; taking folate supplements in pregnancy is related to reduced speech delay in children [Davey Smith 2]; moderate alcohol consumption in pregnancy is related to lower offspring cognitive function [Lewis 1]; variation in pregnancy vitamin D is not an important determinant of offspring bone mineral content [Lawlor 3].
- Effects of pregnancy characteristics on future health in offspring and mother, including early pregnancy BMI, gestational weight gain, hypertensive disorders and gestational diabetes [Fraser 1 2; Macdonald-Wallis 1; Lawlor 1].
- Resuscitation at birth is associated with lower IQ in later childhood [Gunnell 1].
- Methods for modelling repeat measurements were developed and used to describe relationships of different patterns of infant/childhood growth with future cardiometabolic risk [Howe 1] and haemostatic risk factors [Hughes 1]; and better understanding of childhood wheezing by identifying childhood wheezing phenotypes and determining the relationship of these to atopy, lung function and airway responsiveness [Henderson 1].
- We identified interventions for reducing socioeconomic inequalities [Ferrie 1] and determined the effects of work sickness absence and retirement on major health outcomes [Ferrie 2 3].

Primary care

The Centre for Academic Primary Care (CAPC) is one of the eight leading English centres that form the NIHR School for Primary Care Research. Its research has two broad themes: diagnosis and management of clinical problems; and organisation and delivery of primary care. The centre received renewed funding for the NIHR SPCR in 2012, which led to £2m in new projects. Its research won the Royal College of General Practitioner's Research Paper of the Year award twice during the assessment period [Peters 1, Hickman 1] and four times since 2000. Other achievements in *Primary care* included:

- *Large research awards* including: five NIHR Programme grants on respiratory infections in primary care (TARGET. £1.6m), domestic violence (PROVIDE. £1.8m), early detection of cancer in primary care (DISCOVERY. £1.9m), telehealth for long term conditions (HEALTHLINES. £2.0m), and appropriate use of antidepressants (PANDA. £2m). Also £1.1m from MRC for a multi-centre RCT of PhysioDirect services; £1.8m from NIHR HTA for an RCT adding mirtazapine to SSRIs for treatment resistant depression; £3.3m from NIHR HTA for the diagnosis of urinary tract infection in children. These studies have recruited >25,000 patients.
- *New strategic appointments* in Primary Care were Professor Feder and Dr Kessler. Hay was awarded an NIHR Research Professorship (£1.2m) in paediatric respiratory tract infections. Hay and Macleod were promoted to Professor, and Purdy and Wiles to Reader. Through strategic partnership with the PCT, >£1.5m FSF/RCF funds were invested in capacity-building in academic primary care.

Key findings from submitted publications in primary care

- RCTs in primary care mental health demonstrated that: Cognitive Behaviour Therapy (CBT) is cost-effective for depression in patients who have not responded to antidepressants [Wiles 2]; CBT delivered by a therapist online using live messaging is effective and cost-effective [Kessler 1 2]; addition of noradrenaline reuptake inhibitors to SSRIs does not improve outcomes in severe depression [Wiles 1]; promoting physical activity does not lead to improved depression outcomes [Wiles 3]; a collaborative care intervention provided by trained lay counsellors improves recovery from common mental disorders in primary care patients in India [Araya 1].
- Infection: we showed an association at individual patient level between prescribing of antibiotics in primary care and antimicrobial resistance for up to 12 months [Costelloe 1]; in childhood fever, paracetamol and ibuprofen are superior to either alone with no significant

increase in cost [*Hay 1 2*].

- Other key findings: an intervention to help general practices to identify and respond to domestic violence led to a 6-fold increase in referral to specialist advocacy services [*Feder 1*]; opiate substitution therapy substantially reduced high mortality in people addicted to opiates [*Hickman 1*], but net survival benefit only occurred with longer term treatment [*Macleod 1*]; women with ovarian cancer usually have symptoms reported in primary care before diagnosis that can be used to select for further investigation and potentially earlier diagnosis [*Peters 1*]; multimorbidity is common in general practice and patients are less likely to receive continuity of care, even though they have most to gain from it [*Salisbury 3*]; six lessons in the Alexander technique has long-term benefits for patients with long term back pain and is cost effective [*Sharp 3; Hollinghurst 1*]; management of patients with musculoskeletal problems referred for physiotherapy is more cost effective when based on initial telephone assessment and advice than when they are placed on a waiting list for face to face care [*Salisbury 2; Hollinghurst 2*].

Public Health

The *Centre for Public Health* comprises DECIPHer - a UKCRC Public Health Research Centre of Excellence, and the NIHR School for Public Health Research (£2.1m). DECIPHer is a strategic collaboration between Bristol, Cardiff and Swansea Universities, established in 2009 (Bristol £1.5m): it has achieved renewed five-year funding from 2014 (£1.8m). The *Centre for Academic Mental Health* hosts research programmes on suicide prevention, depression, and alcohol and substance misuse with an MRC addiction cluster. Other achievements in *Public health* included:

- *Major research programmes*: £1.8m NIHR programme of clinical and public health research to guide health service priorities for preventing suicide in England; \$2.27m from US NIH to examine the impact of breastfeeding on adolescent neurocognitive and respiratory function; £0.6m from MRC for the Antiretroviral Therapy (ART) Cohort Collaboration of HIV cohort studies in Europe and North America; £1m from MRC and US NIH to identify causal pathways to substance dependence and misuse in young people; £1.5m from NIHR for the school-based Active for Life Year-5 RCT; £1.1m from DH to evaluate interventions to increase diagnosis and treatment of hepatitis C infection.
- *New strategic appointments* were Professor Vickerman and Dr N Martin (both Infectious Disease Modelling) and Dr Horner (Sexual Health). Hickman and R Martin were promoted to Professor and Lambert and May to Reader.

Key findings from submitted publications in public health

- We developed a cost effective, peer-led smoking prevention intervention for secondary schools [*Campbell 1 4*].
- We quantified the impact of the global economic crisis on suicides in Europe and worldwide [*Gunnell 2 4*].
- Collaborations of cohort studies of HIV-infected patients in Europe and N. America identified the minimum CD4 threshold for initiation of ART [*Sterne 2*], and showed that life expectancy increased by 13 years between 1996 and 2005 [*May 2 3*]; prognostic models for sub-Saharan Africa accurately predicted mortality after starting ART [*May 1*].
- Nutrition: the largest ever RCT of human lactation showed that increasing the duration and exclusivity of breastfeeding did not prevent overweight/obesity at age 11.5 years [*R Martin 1*]; a routine public health nutritional intervention is associated with a modest beneficial effect on cardiovascular risk factors in Indian adolescents [*Ben-Shlomo 1*].
- Infection: we produced coherent estimates of age-specific incidence and prevalence of Chlamydia in England [*Horner 4*]; a synthesis of screening trials demonstrated that 15% (95% CI 5%, 25%) of incident Chlamydia progresses to PID [*Horner 2*]; we identified low global coverage of effective interventions to prevent HIV among people who inject drugs [*Hickman 2 3*]; increasing hepatitis C antiviral treatment is critical to prevention of HCV [*N Martin 1; Vickerman 1 3*].

Health Services Research

Health services research includes substantive and methodological research in RCTs, evidence syntheses and applied health research. It includes the BRTC - a UKCRC clinical trials unit since

2007, renewed by NIHR in 2013 for 5 years (£1.2m); the MRC ConDuCT Hub, established in 2009 (£1.9m) and renewed as ConDuCT-II, 2014-19 (£2m), for methodological research for RCTs, particularly with surgical interventions with the Royal College of Surgeons Bristol Centre for Surgical Trials, 2013-17 (£0.5m); and the *Children's Burns Research Centre* – a 5-year UoB-led consortium (with Universities of West of England, Cardiff and Bath, and North Bristol NHS Trust), funded (£1.5m) by The Healing Foundation and Welsh government. There is a Centre for Research Synthesis and Decision-Making (*CReSyDa*). Other achievements include:

- Funding for RCTs: NIHR HTA ProtecT trial of treatments for prostate cancer (£19.6m 2008-2016), CR-UK/DH CAP prostate cancer screening trial (£4.5m 2008-2016), and NIHR HTA By-Band RCT comparing gastric bypass or banding for morbid obesity (2012-2020, £1.6m).
- Other programmes: NIHR Nutrition Biomedical Research Unit, a partnership between the University Hospitals Bristol NHS Foundation Trust and UoB (2012-16; £4.5m) that is developing diet and lifestyle interventions to improve health in clinical populations; NIHR CLAHRC_{west} to translate evidence into practice (2014-18; £9m).
- *New strategic appointments* were Professor Higgins (Evidence Synthesis), and Drs Churchill (Mental Health) and Welton (Biostatistics, Health Economics). Hollingworth and Tilling were promoted to Professor and Metcalfe to Reader.

Key findings from submitted publications in health services research:

- RCTs: Cytosponge, a possible new screening technique for Barrett's oesophagus was well tolerated and accurate [*Blazeby 1*]; surgery was more effective than non-surgical treatment in carpal tunnel syndrome [*Hollingworth 1*]; cetuximab was detrimental to survival in oesophageal cancer and cannot be recommended [*Blazeby 2*]; needs assessments in cancer patients were not cost-effective in reducing distress [*Hollingworth 3*]; and nurse-led telephone follow-up was suitable for patients with breast cancer [*Hollingworth 4*].
- Methodological research: we empirically demonstrated that the average bias associated with defects in RCTs varies with type of outcome [*Sterne 3*]; integrating qualitative research into RCTs improves recruitment through enhancing informed decision-making and exploring preferences [*Donovan 1, Lane 1*]; we developed a capability index for older people for use in economic evaluations across the health and social care boundary [*Peters 2*]; and developed novel methods for evidence synthesis, including a widely-used tool to assess risk of bias in RCTs [*Higgins 2*], a Bayesian framework for synthesising surveillance and other data [*Ades 1 and 3*] and a method for synthesising qualitative findings [*Campbell 2; Malpass 1*].
- Applied health research: systematic reviews estimated HIV prevalence using an evidence synthesis approach [*Ades 1*] and assessed (1) the effectiveness of tocolytics for delaying pre-term labour [*Caldwell 1*]; (2) new antidepressants [*Higgins 4; Churchill 1 4*]; and (3) psychological interventions in coronary heart disease [*Welton 2*]. Empirical research led to the development of tools to predict live births and harms following in-vitro fertilisation [*Lawlor 2 4*] and documented harms from prostate cancer diagnosis [*Donovan 3 4, Lane 2 4*]; the underuse in relation to need of coronary angiography [*Feder 2*] and hip replacement in deprived groups [*Ben-Shlomo 4*], the secular decrease in mortality after hip replacement [*Ben-Shlomo 3*], inequalities in providing choice of breast reconstruction surgery [*Potter 1*], violent behaviour during psychosis [*Amos 4*] and lack of population health benefit of increases in US medical expenditure for spine problems [*Hollingworth 2*].

Future strategic aims and goals for research

Our overall aims are to complete and publish our existing research portfolio, and consolidate and develop our existing disciplinary and subject area research initiatives in population health within the broader remit of improving patient outcomes and public health. We will continue to foster a strong and supportive research-active culture that enables us to drive forward strategic long-term priorities and respond to shorter-term health service and funder requirements. It will be particularly important over the next few years for us to create lecturer and senior lecturer posts for the brightest of our fellowship-holders, and continue to ensure that there are opportunities for postgraduate students and junior researchers to gain postdoctoral research fellowships. We expect to increase our capacity to conduct research of international significance, with clear impact on patient care and public health, and greater involvement of patients and members of the public in setting our

priorities for research.

Our key future strategic research aims are to:

- Achieve the mission of the MRC/UoB IEU, secure substantial additional grant funding associated with its research programmes, develop new areas for integrative epidemiology, and work towards renewed and increased funding in 2018.
- Obtain further substantial funding for the ALSPAC study, including additional funding for data collection and analysis, development of methods to ascertain health and social outcomes through data linkage, and facilitating availability of the resource to the UK and international scientific community.
- Ensure renewal of our membership of the NIHR Schools for Primary Care Research and Public Health Research.
- Establish our position as one of the UK's top three centres for academic primary care by addressing important research questions on delivery of care outside hospitals.
- Develop and expand our portfolio of RCTs, in particular via the new RCS Centre for Surgical Research and within the Centres for Academic Primary Care, Mental Health and Public Health, supported by an expanded BRTC and high quality research on trial methodology through the MRC ConDuCT-II Hub.
- Complete and publish the NIHR ProtecT RCT of treatments for prostate cancer and linked CR-UK/DoH CAP trial of screening: both will undertake their primary outcome analysis in 2015-16.
- Strengthen and expand public involvement in our research, with clear and well-resourced strategies and support networks for increased participation and greater opportunities to set, as well as contribute to, our research agenda.
- Build local and national capacity by continuing to obtain funds for, and deliver, the highest standard of multidisciplinary doctoral, postdoctoral and senior training.
- Ensure that the fair and supportive culture for research continues, including submitting an application for a gold Athena SWAN award.
- Continue to forge strong strategic and working relationships with partners in local NHS organisations, Universities and local authorities, and facilitate translation of research into practice through the CLAHRCwest, Health Integration Teams (see Section e) and the West of England Academic Health Sciences Network.

c. People

Staffing strategy and staff development

This UoA includes 84 staff (74.6 FTE) including 21 ECRs. Academic staff in SSCM are managed in four sections, each with a senior academic Head. Sections cut across research groups and buildings to enable provision of support and mentorship and facilitate collegial relationships and research collaborations, overseen by the Head of School (Donovan until July 2012; Sterne from August 2012). The merger of the Departments of Social Medicine and Community Based Medicine occurred smoothly in 2010, with universal agreement about the benefits of physical proximity, cohesion of activities and increased opportunities for collaboration. Research subgroups have continued or coalesced, with many new initiatives. Current subgroups are disciplinary (e.g. bioinformatics and computational medicine, data linkage, evidence synthesis, health economics, medical statistics and social science) or subject-based (e.g. child health, ethics, genetic epidemiology, mental health, primary care, prostate cancer, public health, suicide and surgery).

We hold an annual Population Health Symposium including the 'Stephen Frankel' Lecture: speakers have included the Nobel Laureate, James Heckman (2011) and Sir Simon Wessely (2012). Termly research fora feature presentations on aspects of the School's research in progress. Weekly School seminars host external, internationally excellent speakers, and we hold a wide range of special seminars delivered by visitors to our Research Centres.

A supportive culture promotes research excellence amongst all staff and full compliance with the Concordat. The School received an Athena SWAN silver award in 2013. Research staff move to permanent contracts after four years in a research role, and movement of staff between projects is

facilitated by bridging funds available through the Elizabeth Blackwell Institute (WT Institutional Strategic Support Fund). Three staff were awarded funding through MRC Centenary awards and 40 staff through Research Capability Funding from local NHS Trusts. Women returning from maternity leave have protected research time for at least six months. Equality of opportunity and diversity are strongly fostered by the Head of School, Heads of Section and two Equalities Leads. All staff participate in annual review meetings with their line-manager: these focus on achievements over the past year, plans for the current year, and career development. All academic staff contribute to undergraduate and postgraduate teaching; senior staff can apply for University Research Fellowships to support teaching/administrative leave (awarded to four staff in the reporting period).

Research staff are strongly encouraged to apply for personal research fellowships, and those doing so are provided with support and mentoring. Sixty-seven prestigious personal fellowships were awarded in the reporting period, with funders including NIHR (34), MRC (13), Wellcome (4), ESRC (4), CRUK (3) and Oak Foundation (3). During the reporting period 26 research staff were promoted to senior research positions, and 11 to Lectureships or proleptic appointments. Six staff were promoted to Professor and seven to Reader. Free places on our renowned programme of short courses in research methods are available to all staff: places increased from 446 in 2007/8 to 857 in 2012/13.

Clinical (26) and non-clinical (58) staff are fully integrated within the School and its research groupings. Staff administrative and management roles are calibrated to take into account of clinical commitments and responsibilities. We are the training base for academic primary care, psychiatry, public health, community paediatrics and surgery, with 35 academic foundation doctors (AF2s), 37 academic clinical fellows and seven academic clinical lecturers in these specialities during this reporting period. Inclusion of academic surgery in SSCM reflects the academic focus of Bristol's Professor of Surgery (Blazeby) on complex RCTs in surgery and quality of life research.

Research students

With one of the largest concentrations of doctoral training in the UK, we provide a strong, supportive and distinctive environment for providing a new generation of scientists with the breadth of skills that will place them at the forefront of population health research and policy. Between January 2008 and July 2013, 96 postgraduate research (PGR) students (PhD/MD) registered in SSCM, funded by MRC (20%), WT (21%), NIHR (16%) and others. UoB provides studentships through Centenary and School funds. Studentships are advertised internationally (overseas students: 12%). We recruit the most capable students from a wide range of disciplines.

Of 50 students who started PhDs between 2005 and 2009, 43 (86%) successfully completed their doctorate. Since 2000, 10 PhD students have progressed to Professor, one to Reader and nine to Lecturer/Senior Lecturer. Of the 17 most recently completed students, 15 (88%) now work in the academic sector, with one each in the health and private sectors. In the 2013 PRES survey 94% (44/47) of SSCM students were satisfied with their PGR experience (sector average 82%). Ratings of quality of supervision (91%), resources (95%), research culture (84%), progress assessment (80%), responsibilities (85%), research skills training (95%) and professional development (77%) all exceeded sector averages. Immersing our students in SSCM's culture means they experience first-hand the benefits of interdisciplinary working. This is reflected in the high number of publications (mean=3) amongst students who commenced four-year PhDs in 2008/9 and 2009/10.

Working within the Faculty of Medicine and Dentistry Doctoral Training College, we continue to improve our postgraduate training and offer access to world class research and training opportunities. Each student is jointly supervised by at least two academics, allowing for broad intellectual input and providing support for less experienced supervisors. Many are jointly supervised with other Schools; for example the MRC Bristol Centre for Systems Biomedicine provides interdisciplinary training for scientists from mathematical disciplines. External partnerships provide opportunities for placements (e.g. six months at Eli Lilly UK, three months' internship at WT, and one month international exchange at the University of Cape Town).

Induction, initiated by the postgraduate team (two directors, four tutors, administrator), includes information on research governance, health and safety, training opportunities and PGR degree regulations. Documentation of supervision meetings, an initial six-month and annual progress

reviews (including independent assessment based on report and presentation) provide a robust system for monitoring and supporting progress. High quality supervision is maintained through annual training workshops for supervisors. There is a well-functioning feedback system (including meetings with students, student representatives and a bespoke web-based student survey). The School's policies and student culture have been consistently commended by the Faculty Quality Enhancement Teams. Students have access to central counselling, disability, health, financial and careers services. Units in academic writing and oral skills are available for international students. All new students have a designated PGR student 'buddy' to provide advice and pastoral support.

Our monthly graduate studies training programme provides core skills including thesis planning and writing; time management; presentation skills; and post-doctoral funding. Sessions are well attended and receive high feedback scores (overall 8.1 out of 10). Tailored training in specialist research skills including: critical appraisal; systematic reviews and meta-analysis; qualitative research; epidemiology; statistics; economic evaluation; genetics and genomics; and epigenetics is provided through our short course programme: in 2011/12 PhD students took 131 places on 24 courses. Feedback is excellent (8.6 out of 10 for both content and quality of tutoring).

All students have the opportunity to present work in progress at bi-annual interdisciplinary PhD symposia. Students are strongly encouraged to present research at national and international conferences. We provide opportunities and training for students to gain teaching experience during the latter years of their studies. Participation in public engagement events such as Science Festivals and media activities is encouraged. Suzi Gage, a current student, won the 2012 UK Science Blog prize for her 'Sifting the Evidence' blog.

d. Income, infrastructure and facilities

Income

Total research income of £73.1m during the reporting period reflected substantial expansion following the establishment of the School of Social and Community Medicine: 2008/9 £12.1m, 2009/10 £13.2m, 2010/11 £15.3m, 2011/12 £15.8m and 2012/13 £16.7m. The total combined income from NIHR (reported under category 14: "Specific funders of health research"), and the Department of Health and the NHS (reported under category 4: "UK Government" and excluding local NHS funding) was £27.9m, increasing from £3.9m in 2008/9 to £7.6m in 2012/13. Total income from NIHR was £12.2m. Other major funders included MRC (£19.0m), Wellcome Trust (£9.1m), ESRC (£2.4m), US National Institutes of Health (£2.2m), Cancer Research UK (£1.9m), the European Union (£1.5m) and the British Heart Foundation (£1.1m). We also received more than £2.8m FSF/RCF funding from local NHS trusts (not included in our overall financial return)

Infrastructure

There is excellent infrastructure and superb facilities for the conduct of research. Approximately 400 staff and 80 postgraduate students are cohesively located in two specifically-configured buildings containing state-of-the-art research, teaching and biobanking facilities:

A £4m extension to Canynge Hall, jointly funded by the Wolfson Foundation and UoB, was completed in 2008, with space to accommodate 46 staff and a new state-of-the-art educational centre, including an 80 seat lecture theatre, new teaching and meeting rooms, and a 39 desk computer suite. These new facilities enabled us to increase places on our postgraduate short courses from 446 in 2007/8 to 857 in 2012/13).

A £5m refurbishment of *Oakfield House* was undertaken between 2008-10 to provide a long term base for ALSPAC clinics and video-conferencing facilities, and establish the genetics laboratories.

The SSCM laboratory includes the ALSPAC laboratories with robotic facilities for DNA processing and cell line production, and enhanced capacity for genetic and epigenetic analysis, including Illumina array technology. The expanded biobanking facility processes, stores and manages sample collections, including blood, 40,000 DNA samples and 15,000 lymphoblastoid cell lines, including over two million samples from the ALSPAC, other Bristol-based, and UK 1958 cohorts. Contracts for the 1946 cohort and Born in Bradford birth cohort biobanks have recently been secured with funding to establish a DNA bank for the Millenium cohort. The *Accessible Resource for Integrated Epigenetic Studies (ARIES)* is a BBSRC-funded project to deliver epigenomic data

on linked DNA samples from 1,000 ALSPAC mothers (antenatal and 20 years post-pregnancy) and children (birth, 7 and 18 years) selected from phenotype rich probands, and associated data pipeline to enable online access for scientists. The SSCM laboratory is licensed by the Human Tissue Authority, with their recent audit describing the facility as “exemplary”.

As part of its contribution to IEU, UoB invested in staff (Ala-Korpela and Drenos) and £1m in a *Nuclear Magnetic Resonance Metabolomics Facility*, located in the School of Chemistry. It is equipped with two automated Bruker AVANCE III spectrometers, (one 500 MHz, one 600 MHz), to undertake high-throughput metabolomic analysis of human and animal serum samples.

The University has invested substantially in centralised *high performance computing* (HPC) systems: “BlueCrystal” (currently 416x8-core nodes, 28.4TFlop/s, soon to be upgraded); research data storage facility “BluePeta” (IBM DS3400/DCS9900 900TB RAID6). These are linked via 1 Gigabit fibre connections to six SSCM high-performance servers used for advanced computation, and to other School servers that provide database and web services.

Computing support is provided by central IT Services, with a rapid-access Service Desk supported by zone teams embedded in SSCM to permit in-depth understanding of research needs. SSCM has invested in key personnel to provide database management and application development.

The *Bristol Randomized Trials Collaboration (BRTC)* hosts a computer-based randomisation system that can be accessed via both telephone and the web, allowing random allocation schemes including stratification and minimisation. BRTC has a set of model standard operating procedures (SOPs) which can be adapted as required.

The new *Bristol Clinical Research and Imaging Centre (CRICBristol)*, a £13m strategic collaboration between UoB and the University Hospitals Bristol NHS Foundation Trust, provides research-dedicated human imaging facilities including a 3 Tesla Siemens Magnetron Skyra MRI scanner (funded by Wolfson), recovery and anaesthesia suites, a sleep laboratory and clinical research rooms. Facilities can be used with healthy individuals, patients, children and infants.

The UoB *Research and Enterprise Development (RED)* includes >80 research support staff who work with academics and researchers to help sustain and grow research activity. The RED *Research Governance* Team ensures that there is a robust quality assurance system so that integrity, ethics and excellence are at the core of our research activities and embedded in our culture. We are committed to ensuring that we act at all times in accordance with the principles described in Universities UK’s Concordat to support Research Integrity. Policies, training, audit and monitoring programmes are integrated into our research, supported by a research governance lead and officer, with a research Governance Committee that meets termly to oversee governance issues and run a two-day research governance short course that all new research staff are required to attend.

e. Collaboration and contribution to the discipline or research base

Staff in this UoA lead and contribute to many national and international projects and programmes.

Within UoB, the Elizabeth Blackwell Institute (EBI) provides a platform for collaboration with arts, science and engineering, for example the £12m EPSRC Sphere programme developing remote sensors for use in home-care settings. We have been instrumental in the establishment of *Bristol Health Partners* (Bristol HP) – a formal academic health sciences partnership between the Universities, NHS trusts and Bristol City Council providing a collaborative environment for integrating research, innovation, clinical practice and education to improve local public health and healthcare delivery in a population health context. Local academics, commissioners, clinicians, and members of the public have formed ‘Heath Integration Teams’ (HITs) to develop NHS-relevant research programmes and service improvements. HITs led by this UoA include: respiratory tract infections (Hay); sexual health (Macleod); self harm (Gunnell); addictions (Hickman); avoiding hospital admissions (Purdy); and psychological therapies in primary care (Wiles/Churchill). Applied health research designed by the HITs will be delivered by the recently awarded CLAHRCwest (Director, Donovan) and implemented through the Academic Health Sciences Network.

We forge strategic partnerships with other UK institutions to share resources and expertise, for example linking with Cardiff through DECIPHer and the not-for-profit company DECIPHer-IMPACT

(public health), the partner organisations in the NIHR Schools for Primary Care and Public Health Research, the Severnside Alliance for Translational Research (SARTRE), and the Centre for the Improvement of Population Health through e-Records Research (CIPHer). Our major research centres and programmes each have a wide range of national and international collaborations. Formal major academic collaborations include ARIES (PIs Davey Smith and Relton), a BBSRC-funded resource for epigenomic information across the lifecourse; UK10K (PI Richard Durbin, WT Sanger Institute), a WT-funded project to analyse genetic data on 10,000 people; and the ART Cohort Collaboration (PI Sterne), which combines data from 19 HIV cohort studies in Europe and North America and has strong links with other major collaborations in N America Europe and Southern Africa. Internationally, we have sustained, close links with leading institutions, including: Universities of Hong Kong, Karolinska, Colombo, Taipei and Philippines (suicide prevention research); Norwegian University of Science & Technology (child development, women's health, mental health epidemiology, prostate cancer); Duke University (telehealth interventions); Minsk Maternal and Child Health Research Centre and McGill University (lifecourse and perinatal epidemiology); University of New South Wales and UC San Diego (infectious diseases modelling and addiction epidemiology); Robert Koch Institute, Germany and National Centre for Pharmacoconomics, Ireland (modelling of vaccination strategies); University of Melbourne and McMaster University (domestic violence); International Agency for Cancer Research, Fred Hutchinson Cancer Research Center, USA, Cardeza Foundation Hematologic Research, and Thomas Jefferson University (cancer); Utrecht University (childhood infections); and Public Health Foundation of India (multimorbidity). Our UoA supports visiting scholars, including bidding successfully for university-wide visiting professorships, and initiatives such as the Genomic & Epigenomic Complex Disease Epidemiology (GEOCODE, 2010-2014) International Research Staff Exchange Scheme.

We influence national and international policy through working with international organizations: WHO (policy on suicide, interventions in people who inject drugs, intimate partner violence and sexual abuse); European Centre for Disease Prevention and Control (ECDC) and the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) (interventions in people who inject drugs). We have increasing links with industry, including advising ADN Pharma on development of personalized genetics services (Day); leading nutritional research sponsored by Danone, Plum Baby, and Pfizer Nutrition (Emmett); collaboration with Syngenta to evaluate whether their new formulation of paraquat was associated with reduced toxicity in humans (Gunnell); collaborating with Merck to measure insulin levels from dried blood spots (R Martin); working with Pfizer and Merck using novel causal analysis methods to prioritise therapeutic targets for drug development (Relton, Davey Smith); and collaborating with Siemens to improve their technology for identifying liver fibrosis using ultrasound (Lawlor).

Dissemination of findings is enhanced by the UoB *Centre for Public Engagement*. Activities include a broad array of media including press and broadcast media, interactive exhibitions and public lectures as well as production of literature and web-based information specifically geared to study participants and lay audiences; many researchers give media interviews and public talks and lectures. Large studies such as ALSPAC and DECIPHer have well-honed involvement and engagement strategies including a range of participant advisory panels, and press releases result in coverage across the world. Our approach to *Patient and Public Involvement (PPI)* builds on the internationally recognised PPI excellence in the Centre for Child and Adolescent Health, ALSPAC, the domestic violence research group, ProtecT and DECIPHer, and has been successfully organized locally by the People and Research West of England (PRWE) collaboration. Our PPI in suicide research was used as one of ten examples of good practice by Involve (2013). New resources from the CLAHRC_{west}, WEAHSN and Bristol HP will further develop the activities of the PRWE group and provide support for a PPI/E academic lead, research and management staff to organize and expand networking, learning and development opportunities. We are forging links with local and national patient/public/user groups (including INVOLVE, HealthWatch and local health and wellbeing boards) and harnessing existing capacity in the Research Design Service South West and strategic clinical networks to ensure enhanced PPI and engagement in future research.

Our staff have given many named, key note and plenary lectures including the Society for Social Medicine John Pemberton Lecture (Lawlor) and the IEA John Snow Lecture (Davey Smith).

Members of this UoA make numerous other contributions to national and international research, with key examples highlighted below:

Chairing of research councils or similar national or international funding bodies

MRC/NIHR Methodology Research Programme Panel (Peters); Health Research Awards, and Population Health and HSR Expert Committee, Irish HRB (Peters); MRC Strategic Skills Fellowship Panel deputy Chair for Biostatistics (Sterne); MRC Economic Impact Panel (Peters); NIHR RDS Selection (Peters); Welsh Government's NISCHR Senior Faculty Members Selection (Peters); Welsh NISCHR Health Research Grants (Peters,); NIHR Doctoral Fellowship Scheme (Hickman); Joint UKRCs Lifelong Health and Wellbeing research (Lawlor).

Chairing of national or international research or health strategy panels

NICE programme/guideline development group: Hepatitis B and C (Hickman), domestic violence (Feder); Independent Monitoring of National Cervical Screening Programme, NZ (Jeffreys); EORTC QoL grant committee (Blazeby); British Paediatric Surveillance Unit (Emond); WHO intimate partner violence (Feder), Adv Council Misuse Drugs working group on primary prevention of HCV (Hickman); NIHR applied research programme grants (cardio-metabolic sub-panel) (Feder).

Membership of research councils, national or international funding bodies

In the review period, UoA staff were members of >30 national/international funding bodies, including: MRC: Methodology Research (Lawlor), Molecular and Cellular Medicine (Lawlor), Health Services and Public Health Research (Lawlor), Population and Systems Medicine (Lawlor), Strategic Skills Fellowships (Sterne); NIHR: HTA Clinical Evaluation and Trials (Blazeby, Sterne, Hay), HTA Commissioning Board (Donovan), EME (Campbell), HSR (Donovan), RfPB Southwest (Blazeby, Gunnell, Hollinghurst, Horner, Macleod, Metcalfe, Ridd, Wiles), School for PCR (Salisbury), Public Health Research (Gunnell), HS&DR (Salisbury), Senior Investigators Appointments (Peters, Donovan), HTA Interventional Procedures (Purdy), NIHR PgfAR (Feder, Kessler, Hay). Other memberships include: RAE2008 and REF2014 (Donovan, Lambert, Peters). CR-UK Population Research (Donovan, Martin); WT ERGs (Campbell, Davey Smith).

Membership of health strategy panels

UoA staff were members of >25 national/international strategy panels, including eight NICE guideline development groups in behaviour change, self-harm, gastroenteritis in children, infertility, depression, cardiovascular risk assessment, eczema, care for mental disorders (Campbell, Evans J, Hay, Lawlor, Kessler, May, Purdy, Ridd); also MHRA (Gunnell, vice chair Pharmacovigilance EAG; R Martin, Independent Scientific Advisory Committee); Human Fertilisation and Embryology Association (Lawlor), and Advisory Council on Misuse of Drugs (Hickman).

Leading positions in professional subject associations or learned societies

Chair, RSS Medical Section (Sterne) and RSS Primary Health (Peters); Oversight Group of the NIHR Trial Managers Network (Lane); Executive, Society of Academic Primary Care (Salisbury); Chair, RCGP Research Paper of the Year panel (Salisbury); President, Forensic Psychiatry Research Society (Amos); Chair, British Association for Community Child Health (Emond); Vice Chair, International Society for Prevention of Perinatal and Infant Death (Blair).

Editorial / Associate editorial positions and editorial board membership

International Journal of Epidemiology - editor-in-Chief (Davey Smith), editors (Lawlor, Ben-Shlomo, Relton, Higgins, May, Howe); co-editor Paediatric Perinatal Epidemiol (Peters); deputy regional editor Addiction (Hickman); assoc. editor: BMC Women's Health (Jeffreys), Heart (Feder), J Forensic Psychiatry Psychology (Amos).

Academic awards and other honours received

In recognition of their outstanding contribution to health research two staff members have been awarded OBEs (Golding, Donovan). There are three Fellows of the Academy of Medical Sciences (Davey Smith, Donovan, Lawlor), five NIHR Senior Investigators (Gunnell, Peters, Donovan, Lawlor, Sterne). Dr Howe was awarded the Neville Butler Memorial Prize for excellence in Paediatric research in 2011 and Dr Macdonald-Wallis was awarded the Scopus Young Researcher UK Award for the Medical Sciences, 2013. UoB was awarded a 2013 Queen's Anniversary Prize for work including that of Blair on reducing sudden infant death.