

**Unit-level environment template (REF5b)**

<b>Institution:</b> St George's, University of London
<b>Unit of Assessment:</b> 2 Public Health, Health Services and Primary Care
<b>1. Unit context and structure, research and impact strategy</b>

**1.1 Unit Context and Structure**

This submission presents research activity in public health, primary care and health services research at St George's, University of London (SGUL) based on the Population Health Research Institute (PHRI), one of three SGUL Research Institutes formed after restructuring in 2013 to prioritize areas of internationally recognized research strength. PHRI (directed by Professor David Strachan until 2016 and then by Professor Peter Whincup) was formed from the Population Health Research Centre (established 2010). It has 46 core staff members, including 19 academic staff (11 Professors, 2 Readers, 3 Senior Lecturers, 3 Lecturers), 21 research staff (including 6 Postdoctoral Researchers), 4 teaching staff and 2 administrative staff. Academic and research staff bring both quantitative and qualitative research skills, with special expertise in epidemiology, medical statistics, public health, primary care, health services research and evaluation, behavioural medicine, medical sociology and anthropology. Academic staff include 6 clinicians, of whom 2 hold honorary consultant contracts with Public Health England (PHE), 3 are practising General Practitioners and one holds an honorary clinical consultant.

PHRI research addresses population health aspects of specific conditions (cardiovascular disease, type 2 diabetes, eye disease, respiratory and allergic diseases, mental illness and their determinants) and also includes research on life course and environmental epidemiology and on ethnic health inequalities. This REF2021 submission is based on 19 academic staff (14.67 FTE) of whom 3 (16%) are at Lecturer grade. This reflects appreciable growth and rejuvenation from REF2014, when our submission was based on 14 staff (11.57 FTE), of whom only one (7%) was at Lecturer grade. PHRI academics and researchers work seamlessly within a single coherent organization emphasizing both disciplinary excellence and multidisciplinary working. PHRI is home to the Cochrane Airways Group and interfaces with several other organizations including the St George's University Hospital NHS Foundation Trust (SGUHFT), the South West London and St George's (SWLSTG) Mental Health NHS Trust and King's Health Partners, which led the NIHR Collaboration for Leadership in Applied Health Research and Care (CLAHRC) South London (2014-2019), recently renewed as the NIHR Applied Research Collaboration (ARC) South London (2019-2024).

**1.2 Unit Research and Impact Strategy****1.2.1 Overview**

SGUL has an established tradition of population-based research, flagged for special mention in RAE2001 and underpinning strong submissions at RAE2008 and REF2014. Our strategic aim during 2013-2020, defined at REF2014, has been to build on existing strengths in population-based research 'to carry out population-based research which is intellectually stimulating, financially sustainable, respected nationally and internationally, and which has a positive impact on public health policy and/or health care practice'. Considerations influencing UoA2 research strategy in 2013-2020 have included our established expertise in population-based research, our size (small compared with many UoA2 units), the characteristics of our local, national and international study populations (largely urban populations with marked ethnic diversity and characteristic chronic disease challenges), the increasing availability of large-scale data resources dovetailing with areas of research interest and the increasing need for applied population health research into areas including the quantification of disease burdens, risk stratification and chronic disease prevention. As a small unit, we have maintained a strongly collaborative ethos, using collaboration to strengthen critical mass, expertise, access to data resources and external scientific reach. Securing investment in population health research, both in staff (particularly Lecturers) and in research resources have been important objectives of research strategy, together with

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strengthening the culture in which research is undertaken. Below, we review the specific elements of that strategy and its achievements during 2013-2020.

#### **1.2.2 Increasing focus on defined areas of research strength, emphasizing robust research methodology**

We have focused increasingly on specialized research areas, selected on the basis of their fit with PHRI-based expertise, their importance as public health challenges for local, national and international populations and their potential for research and policy impact. At REF2014, we noted particular strengths in chronic disease epidemiology, in life course, environmental, primary care and genetic epidemiology and in evidence-based healthcare; these have remained at the core of our research activity. In the SGUL Operational Plan for Research and Enterprise (2019), we identified specific disease areas (cardiovascular disease, type 2 diabetes, eye disease, respiratory and allergic diseases, mental illness) and disease determinants (particularly physical inactivity), which, together with life course and environmental epidemiology and ethnic health inequalities, constitute priority research areas. We focused research and research funding bids in these areas and emphasized the use of robust research methods, particularly natural experiments, randomized controlled trials, systematic reviews and meta-analysis, providing protected research time and support for investigators working in these areas. In addition, medical statistics (a key PHRI discipline, led by **Morris**) was defined as a cross-cutting theme, strengthening links across SGUL and with SGUHFT, particularly its newly formed Translational and Clinical Research Institute (TACRI).

#### **1.2.3 Emphasizing use of large-scale national data resources in research**

We have emphasized the use of large-scale, high-value national data resources to complement research based on primary data collection studies in defined populations. We have prioritized securing funds both from grant funding bodies and from SGUL to provide access to key large-scale data sources including the Clinical Practice Research Datalink (CPRD), UK Biobank and the National Child Measurement Programme for England (NCMP).

#### **1.2.4 Strengthening applied health research**

There has been a growing recognition of the importance of applied health research in developing, testing and applying strategies to improve population health. PHRI researchers have strong expertise relevant to applied health research in areas of chronic disease prevention and mental health improvement. We have therefore aimed to strengthen our research contributions in applied population health research.

#### **1.2.5 Maintaining and extending research collaborations**

We have aimed to maintain and to enhance local, national and international collaborations, to extend our research expertise, academic reach and available data resources. Participation in collaborative research has been facilitated by providing protected time and resources to underpin collaboration (including underwriting travel costs when required) and improving communication facilities to enable online collaborator meetings. We have also encouraged Interdisciplinary research collaborations, with specific support for the development of interdisciplinary pilot projects from Wellcome Trust Institutional Strategic Support Funds.

#### **1.2.6 Investing in population health research**

An important priority has been to secure investment in population health research, both from SGUL and from SGUL's Wellcome Trust Institutional Strategic Support Fund award, in order to support staff recruitment and staff development, enhance research momentum and strengthen research facilities. We have worked closely with SGUL to facilitate new academic appointments, especially new Lecturer appointments, and to strengthen promotion and career development opportunities, to reinforce the sustainability of PHRI research disciplines. We have also sought opportunities to recruit early career researchers through a combination of predoctoral, doctoral and postdoctoral fellowships.

#### **1.2.7 Strengthening research culture**

Strengthening PHRI research culture (including the elements of research integrity, ethics and governance) has been an important priority, supported by SGUL research and information governance and the SGUL Ethics and Integrity Office. Regular training on information governance has been undertaken (completion >90%) and periodic seminars on ethics and research integrity

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have been provided. With support from both SGUL and PHRI funds, investigators have aimed to make all peer-reviewed research publications freely available, through a combination of 'gold route' and 'green route' publication options. Research data sharing is strongly encouraged, with the support of an SGUL data sharing facility (Figshare); several PHRI investigators have shared research study data in support of collaborative research projects. Research engagement has been actively encouraged; several PHRI investigators have contributed to SGUL-wide research engagement initiatives, particularly SGUL 'Spotlight on Science' public engagement events.

**1.3 Unit Achievements**

Headline PHRI achievements during the REF period have included the following:-

**1.3.1 Successful progression of research projects in all key research areas, with an emphasis on use of robust research methods**

Substantial research initiatives have been initiated or continued during 2013-2020 in all priority research areas; many studies have used robust research methods, with an increasing emphasis on natural experiments, randomized controlled trials and systematic reviews with meta-analysis. A natural experimental design has been used to investigate the influence of the built environment on physical activity (ENABLE London Study, based on the 2012 Olympic Village site) (**Owen, Rudnicka, Cook, Whincup**). Randomized trials have been used to evaluate a range of interventions designed to increase population physical activity levels in primary care (PACE Trials) (**Harris, Cook, Ussher, Whincup**), to reduce the risk of food allergy (EAT Trial) (**Perkin**), to increase maternal smoking cessation in pregnancy (**Ussher, Harris**), to prevent emerging type 2 diabetes risk (**Donin**) and to examine the role of peer worker support in mental health care (ENRICH Trial) (**Gillard**). Systematic reviews by the Cochrane Airways Group have identified and evaluated effective strategies for asthma treatment and prevention using randomized, controlled trial evidence (**Cates, Fortescue**). Systematic reviews have been used to quantify the health effects of air pollution, using data from large-scale cohort studies and time series studies (**Atkinson, Butland**) and have also addressed the health effects of childhood obesity (**Owen**), the prevalence, global variation and determinants of eye disease and sight loss, using novel Bayesian methodology (**Rudnicka, Owen, Cook**) and the effects of primary care-based interventions on physical activity (**Harris, Cook, Fortescue**). Through these and other research initiatives, PHRI secured an average annual grant income of £1.6m between 2013 and 2020 and its investigators published 801 papers, of which 84 (11%) were in the top 1% and 213 (27%) were in the top 5% of citations for their field and year. Many UoA2 research outputs returned at REF2021 are based on research projects referred to in this section.

**1.3.2 Acquiring and using large-scale national research data resources**

Successful acquisition of primary care data from the Clinical Practice Research Datalink (CPRD) with mortality data linkage was supported by SGUL investment (£150,000 between 2016-2019) and has facilitated innovative and efficient studies addressing key research issues, including the cardiovascular health effects of bereavement (**Carey, Harris, Cook**), the burdens of infection in patients with diabetes (including potential benefits of tight metabolic control) (**Critchley, Carey, Cook**), the health effects of air pollution (**Atkinson, Butland**) and the effect of NHS health checks for people with learning disability on health and health service use (**Carey, Harris, Cook**). The acquisition of UK Biobank data has facilitated studies of the respiratory health of UK adults (**Strachan**) and the potential of retinal vascular imaging in prediction of vascular health and disease (**Rudnicka, Owen**). Data from NCMP have been analysed to re-evaluate the burdens of childhood overweight and obesity in ethnic minority population groups (**Nightingale, Whincup**). Several REF2021 UoA2 outputs are based on these projects, which provided appreciable research income; £600,960 for CPRD, £444,735 for UK Biobank and £107,000 for NCMP analyses.

**1.3.3 Strengthening applied population health research**

Applied population health research in PHRI has been strengthened by active participation in the new applied research collaborative NIHR CLAHRC South London research programme (2014-2019), which facilitated new applied health research projects on the assessment of childhood overweight and obesity (**Nightingale, Whincup**), the early prevention of type 2 diabetes (**Harris, Owen, Donin, Whincup, Rudnicka**), and the management of psychosis (**Ussher, Gillard**). In addition, **Gillard** provided specialist advice on Patient and Public Involvement (PPI) in NIHR CLAHRC research. Participation in CLAHRC provided £264,000 in direct research income, with a

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further £295,000 of co-funding raised from other sources. Continuing involvement in the public health and multimorbidity theme of the successor NIHR Applied Research Collaboration (ARC) South London is now facilitating further research on type 2 diabetes prevention in 2019-2024, providing £150,000 in direct research income (**Whincup, Donin, Owen, Harris**).

**1.3.4 Strengthening collaborative and interdisciplinary research**

We have strengthened collaborative research during 2013-2020. PHRI became a collaborating centre in the UK-Medical Research Council (MRC) Centre for Environment and Health in 2014, joined the NIHR CLAHRC South London (2014-2019) and has been a member of the UK Centre for Tobacco and Alcohol Studies. PHRI investigators have led and participated in major national and international collaborations and specific collaborative research projects, addressing the epidemiology and prevention of respiratory disease (**Strachan**), the health effects of air pollution (**Atkinson, Butland**), smoking cessation during and after pregnancy (**Ussher**), chronic diseases in low and middle income countries (**Critchley**), primary care interventions to increase physical activity (**Harris**) and the influence of the built environment on health (**Owen**). With the arrival of **Morris** (2018), a major new research collaboration, EUROLINKCAT, led from PHRI, has brought together 22 congenital anomaly registries in 14 European countries to study the determinants, prevention and longer-term outcomes of congenital anomalies. Collaborative interdisciplinary research initiatives have been established with investigators in other SGUL Research Institutes (UoA1), bringing together epidemiologists, clinicians and basic scientists to investigate the prevention and control of asthma in low- and middle-income countries (**Perkin** working with Cooper in the Infection and Immunity Research Institute [IIRI]) and the control of sexually transmitted infections (**Oakeshott** working with Sadiq in IIRI). More details of PHRI collaborative research activities are in Section 4.

**1.3.5 Securing new investment in population health research**

Support has been obtained both from SGUL and from a Wellcome Trust Institutional Strategic Support Fund award to SGUL (section 3) to create new PHRI posts, including a non-clinical Lecturer in Medical Statistics and Epidemiology post in 2017 (**Nightingale**), a new Lecturer in Evidence-Based Practice in 2019 (**Fortescue**), a new Senior Lecturer post in Clinical Epidemiology in 2017 (**Perkin**) and a new Professorship of Medical Statistics in 2018 (**Morris**). We have supported career progression, promoting 9 PHRI academic staff during 2013-2020, which allowed us to increase the proportion of senior academic posts held by women (section 2.4.1). PHRI has hosted two competitive NIHR Postdoctoral Research Fellowships, an NIHR Predoctoral Fellowship and an NIHR In Practice Fellowship in Primary Care, as well as supervising and supporting >10 Academic Clinical Fellows (ACFs) in Primary Care. A well-resourced PHRI personal development programme has been maintained. In 2015-16 PHRI was allocated funding to refurbish population health research facilities as part of a university-wide investment programme (£2.25 million). This provided new high-quality office accommodation, freezer and archiving facilities, with meeting rooms with online conferencing facilities. The close proximity of these facilities to other SGUL Research Institutes has simplified cross-disciplinary working.

**1.3.6 Achieving recognition for an outstanding PHRI researcher**

The outstanding research record of one PHRI investigator (**Strachan**) led to his inclusion in the Thomson-Reuter / Clarivate List of Highly Cited Researchers between 2014 and 2018 and in the top 1% of scientists based on citation metrics reported in PLoS Biology in 2019.

**1.4 Facilitating the achievement of impact from research**

Our emphasis on important population health challenges in areas of established expertise and using robust research methods has prioritized research with potential for policy impact. The two impact cases presented for UoA2 are drawn from distinctive, established PHRI research areas in environmental epidemiology (**Atkinson**, 'Outdoor air pollution and mortality: systematic reviews supporting the UK Government Air Quality Strategy') and the epidemiology of respiratory and allergic diseases (**Perkin**, 'Early introduction of allergenic foods and the prevention of food allergy in infancy'). Both cases involved robust research methods, one (**Atkinson**) using evidence from systematic review and meta-analytic approaches and the other (**Perkin**) using a randomized controlled trial to investigate the timing of allergenic food introduction on the incidence of food allergy in early childhood. A regular review process within PHRI identified the strategic importance of these projects for impact prioritization, facilitating financial support for open access

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publication of key reports, and enabling key investigators to participate in major national and international conferences and to attend relevant national and international guideline and policy committees. Investigators were able to draw on the expertise and support of experienced PHRI investigators, particularly from the Cochrane Airways Group, which has a strong track record in maximizing research impact, particularly through influencing clinical guidelines (**Cates, Fortescue**). Close liaison with the SGUL Communications Directorate has prioritized media exposure of key project publications. This strategy has yielded both the submitted impact cases and identified further research activities with emerging impact, including strategies for effective prevention and treatment of asthma (**Cates, Fortescue**), rapid automated assessment of sight threatening diabetic retinopathy using retinal images (**Rudnicka, Owen**), simple accurate assessment of body fatness in children of ethnic minority origins (**Nightingale, Whincup**). These projects and other emerging research narratives continue to receive priority support to maximize ongoing research impact.

**1.5 Future strategic goals for research and impact**

Future strategic goals will be closely aligned with those defined during 2013-2020 and updated in the SGUL Operational Plan for Research and Enterprise (2019). Building on our successes of 2013-2020, we will continue to develop, fund and conduct innovative and robust research to inform population health, in focused areas of strength with high potential for impact and policy relevance. We will aim for a balance of projects using both established large-scale data resources and primary data collection in observational and interventional studies. Cardiometabolic disease, respiratory and allergic diseases, life course and environmental epidemiology and health services research will continue to be important research areas. Within these areas, key research priorities will include: - (i) improving chronic disease risk prediction; (ii) development and evaluation of novel strategies for chronic disease prevention across the life course; (iii) development and testing of strategies for accurate identification and prevention of sight-threatening eye disease, particularly diabetic retinopathy; (iv) identifying and evaluating strategies for preventing and managing asthma and food allergy. Membership of NIHR ARC South London will facilitate coproduction of research through increasing patient and public involvement in research. New collaborations will support our strategic aims and strengthen research capacity and research culture. We will invest in creating new Lecturer posts and seek externally funded fellowships at all levels to promote training of the next generation of population health researchers. We are strongly committed to equitable career development and a strong, inclusive and open research culture.

**2. People****2.1 Staffing Strategy**

The development of SGUL Research Institutes from 2013 has encouraged stronger research prioritization, with all Research Institute academics encouraged to devote 80% of their time to research (confirmed in the SGUL Operational Plan for Research and Enterprise in 2019). The Research Institute structure has provided an effective framework for strategic management and the support and oversight of staff performance and development. Our staffing strategy has two key objectives, (i) recruitment and development of early career academic staff, particularly Lecturers (endorsed in the SGUL Operational Plan) and (ii) the development and progression of established academic and research staff. Our staffing and staff development strategies are underpinned by SGUL-wide commitments to equality, diversity and inclusiveness, to the VITAE Concordat to support the career development of researchers and to the principles of the European HR Excellence In Research Award (HREIRA).

Since REF2014, we have made new appointments consistent with our strategy, recruiting new Lecturers in Medical Statistics and Epidemiology (**Nightingale**) and in Evidence-Based Practice (**Fortescue**). In addition, a new Senior Lecturer (subsequently Reader) in Clinical Epidemiology (**Perkin**) and a new Professor of Medical Statistics (**Morris**) have been recruited. Internal promotions have led to 4 new Professors (**Owen, Harris, Rudnicka, Atkinson**), 2 new Readers (**Cates, Perkin**) and 3 new Senior Lecturers (**White, Butland, Carey**). Of our 19 category A staff, 17 (89%) are on open contracts and 2 (11%) are employed on contracts of <5 years duration, with defined pathways to open contracts.

**Unit-level environment template (REF5b)****2.2 Staff Development Strategy**

Our staff development strategy is underpinned by SGUL core values (commitment, openness, respect and engagement) and by SGUL commitments to the VITAE Concordat and HREIRA in underpinning academic and research careers for all staff. Key elements of our staff development strategy have included:-

**2.2.1 Commitment to career planning**

We aim to secure longer-term support for promising academic and research staff, where necessary using bridging support funds provided by PHRI and by SGUL under the control of the Deputy Principal (Research and Enterprise). Since 2014, these resources have enabled us to provide short-term continuity for 4 PHRI research staff (all female), who all secured longer-term funding and continued their research careers within PHRI.

**2.2.2 Effective annual personal development review (PDR)**

Annual PDRs have occurred in PHRI since 2014, allowing review of academic progress, definition of goals for the coming year and agreement on personal development needs. The annual PDR process has been consistently completed by >98% of all PHRI staff, with high levels of satisfaction reported in periodic staff surveys.

**2.2.3 Staff development programme**

This programme provides opportunities for all academic and research staff opportunities to attend training and educational courses (including Masters programmes where appropriate) and conferences. We have been able to meet all training requests made, providing on average £8,700 annually for staff development support since 2018, mainly to Lecturers and research staff. Leadership training is also encouraged, both through Aurora (attended by 2 PHRI staff) and other training schemes. A recently appointed Professor of Primary Care Research (**Harris**) attended the International Primary Care Research Leadership Programme (Oxford) with PHRI support and was subsequently appointed PHRI Deputy Institute Director.

**2.2.4 Programme of learning and networking opportunities**

Our weekly seminar programme includes both internal and external speakers and provides regular opportunities for staff to present new research concepts and projects for critical review. This is complemented by a monthly University Seminar Series (to which PHRI contributes) and an Institution-wide Research Day each autumn, which provides strong networking opportunities.

**2.2.5 PHRI investigator group**

Established in 2015, this group includes all PHRI academics and meets regularly to review opportunities for research funding, strategic investment and collaboration and to identify research projects with potential to generate research impact. The group offers collaborative support with preparation of funding applications, particularly for Lecturers. It also reviews succession planning for key roles within the Institute and identifies opportunities to provide continuity of support for research staff on short-term contracts.

**2.2.6 Support for specific staff groups**

All PHRI Lecturers are supported by a PHRI senior academic and have regular progress reviews with the Deputy Principal (Research and Enterprise) and the Institute Director. They can also receive coaching through an SGUL-wide mentorship scheme. In addition, SGUL-wide support groups have been established for Senior Lecturers, Lecturers and Postdoctoral Researchers, which meet regularly and liaise directly with the Deputy Principal (Research and Enterprise). Continuing skills development for post-doctoral researchers are provided through Postgraduate Certificate in Healthcare Research Skills and Methods training, supported by an individual mentor.

**2.3 Strategy for Research Students**

Opportunities for doctoral research students are provided in PHRI, with 5 internal and 2 external students registered between 2013-2020. Since 2016, SGUL has participated in the joint UK-MRC London Intercollegiate Doctoral (LID) Training Partnership with London School of Hygiene and Tropical Medicine (LSHTM) (£2.0 million during 2016-2021) which funds recruitment of up to 7.5 PhD studentships/year, emphasizing projects analysing large data resources and complex interventions. Studentships are widely advertised and recruitment carried out using best equality and diversity practice. In addition, promising PHRI pre-doctoral researchers have been

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successfully supported to apply for NIHR doctoral training fellowships and PhD studentships. PHRI doctoral students are actively supported by trained supervisors, with regular scheduled supervision meetings and a 6-monthly review by the PHRI Postgraduate Co-ordinator. PhD students attend the mandatory SGUL Graduate School Skills Programme (GSSP), mapped against the Vitae Researcher Development Framework. This includes modules on good research practice, research integrity, ethics, time management and public engagement and on core disciplines (statistics, research methods, project planning and critical appraisal). PHRI PhD students present their work periodically within PHRI and Fellowship interview practice is offered. A bespoke SGUL-wide scheme providing an independent mentor is offered to all PhD students. All PHRI doctoral students registered between 2013-2020 have submitted their theses on time. Two former PHRI doctoral students were appointed to Lecturer positions in PHRI during the REF period (**Donin, Nightingale**), after a period as postdoctoral researchers.

**2.4 Equality, Diversity and Inclusion****2.4.1 Equality and Diversity practice in PHRI**

SGUL is fully committed to Equality, Diversity and Inclusion (EDI) employment practices, as emphasized in the SGUL Strategic Plan (2017-2022); these are overseen by the Dean for Equality, Diversity and Inclusion. SGUL has held an Athena Swan Silver Award since 2018 (achieved by only 16 other UK universities) and is a Stonewall Diversity Champion and a Disability Confident Employer. PHRI has made substantial progress in equality (particularly gender equality). The PHRI Institute Director is a member of the Athena Swan Self-Assessment Team (SAT). The PHRI Institute Management Team (IMT) is gender balanced and consults widely on decisions. PHRI has supported EDI principles in the domains of staff recruitment, retention, development and promotion. EDI considerations are addressed in assessing staff for promotion and defining career opportunities; practical Institute support is provided for promotion applications. Among PHRI academic staff, gender balances have changed favourably during 2014-2020. The proportion of female Professors has increased from 2/6 (33%) to 5/11 (45%) while the proportion of female Senior Lecturers has increased from 0/3 (0%) to 2/3 (67%) and the proportion of female Lecturers has risen from 1/2 (50%) to 3/3 (100%). Examples of good EDI practice have included:- (i) unbiased recruitment practice, based on external advertisement of all substantive roles, systematically gender-mixed recruitment panels and mandatory training in unconscious bias for all interviewers, with inclusion of a Diversity Representative interview panel member; (ii) strong support for flexible employment and working arrangements (including remote working and implementation of family friendly policies), taken up by 80% of female and 20% of male PHRI staff pre-COVID); (iii) anticipatory advice and support for staff on short-term contracts, including the use of PHRI funds (and SGUL bridging funds) to facilitate continuity of employment; (iv) high priority given to staff development for all staff, coupled with an open and transparent application process and approval of all requests for support; (v) an inclusive and systematic approach to reviewing promotion opportunities, aiming to provide equity across gender, ethnicity and other protected characteristics; (vi) special provision for disabled staff, including flexibility of working arrangements, parking support and other measures. PHRI aims to facilitate return to work after periods of absence associated with maternity or parental leave, ill-health or caring; flexible working arrangements are provided and constructive use of Keeping In Touch (KIT) days during maternity leave is encouraged. Special support is provided to allow PHRI academic and research staff with family commitments to attend conferences and academic meetings, providing financial support to cover carer travel and support costs where needed.

**2.4.2 Equality and diversity considerations in construction of the UoA2 REF2021 return**

This submission has been prepared in accordance with the SGUL REF2021 Code of Practice. A panel of internal output assessors was appointed, which all PHRI academic staff were encouraged to apply to join. All applicants (3 professors, 2 female, both with previous EDI training) were included and trained in the scoring of scientific quality of research outputs, using criteria based on REF2021 output quality guidance. Selection of outputs for review was based on papers proposed by individual staff members (encouraged to provide up to 6 strongest papers for consideration); any omitted papers with strong citation criteria (top 5% in specific field) were added for consideration. The highest graded paper for each individual academic was selected, followed by papers with the highest overall quality ranking, until the appropriate number of papers had been

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identified. Academic staff were then consulted about the draft selection and given an opportunity to propose final amendments for reassessment by the panel. All academic staff were given the opportunity to put forward a draft research impact case; cases were assessed using criteria based on REF guidance on impact case quality by the SGUL Research Impact Case Committee.

**3. Income, infrastructure and facilities****3.1 Unit Income**

PHRI research income during 2013-2020 has been raised from a wide range of funding bodies, including UK-MRC, AMRC medical research charities, the European Union and UK Governmental agencies, particularly the National Institute of Health Research (NIHR), which accounts for >50% of total research grant income. We have raised research funds both for primary data collection projects and also for projects using existing large-scale databases to conduct innovative research. During 2013-2020, UoA2 grant income was £10.9 million (~£1.6 million/year) from 53 grant awards to PHRI investigators. Among these, large primary data collection projects included (i) the ENABLE-London Study (Examining Neighbourhood Activities in Built Living Environments in London), which used a natural experimental design to investigate the influence of the built environment on physical activity (**Owen, Rudnicka, Cook, Whincup**) (£1.4 million); (ii) the PACE (Pedometer Accelerometer Consultation Evaluation) Trials, examining the effect of pedometer-feedback interventions on physical activity levels in primary care (**Harris, Cook, Ussher, Whincup**) (£1.3 million) and (iii) the ENRICH Trial (Enhanced discharge from inpatient to community mental health care) which examined the effect of peer support on the experience of hospital discharge in patients hospitalized for mental illness (**Gillard, White**)(£936,000). Projects based on large scale data resources included (i) the EUROlinkCAT Study (Establishing a linked European cohort of children with congenital anomalies), investigating causes and prevention of congenital anomalies (**Morris**) (1.9 million Euros to SGUL, 7.3 million Euros in total), (ii) the ConcepTION Study, using routine health data to study medication safety in pregnancy and breastfeeding (**Morris**) (£300,000), (iii) research using UK Biobank data, investigating the UK burden of respiratory disease (**Strachan**) and the potential value of retinal imaging in the prediction of chronic diseases (**Owen, Rudnicka, Strachan, Whincup**) (£444,735 combined) and (iv) research based on CPRD, investigating the health effects of air pollution, burdens of infection associated with diabetes, the health and health service use of adults with learning disability and time trends in neuromuscular dystrophies (**Atkinson, Carey, Cook, Critchley, Harris**) (£600,960 combined). In addition, the NIHR CLAHRC South London funded research on type 2 diabetes prevention, psychosis management and PPI activity (**Whincup, Owen, Donin, Gillard, Ussher, Harris**) (£264,000 from 2014-2019); its successor, NIHR ARC South London (2019-2024) is providing continuing support for PHRI diabetes prevention research (£150,000). The Wellcome Trust Institutional Strategic Support Fund (award to SGUL (£1.0 million for 2016-2021, extended to 2022 with £200k of additional support) has supported PHRI staff investment, provided protected academic sessions for clinicians and funded pilot projects.

**3.2 Unit Research Facilities**

In 2016, PHRI acquired refurbished accommodation, supported by an SGUL-wide investment programme (£2.25 million). This provided high quality office accommodation (480m<sup>2</sup>) with natural lighting for all staff members and students. It also included a 100m<sup>2</sup> air-conditioned freezer storage area, containing 18 upright and 6 chest freezers. These freezers maintain biological samples from PHRI field studies and are protected by 2 independent security systems provided by SGUL (one hardwired, one Wi-Fi based). PHRI also has exclusive use of a 40m<sup>2</sup> storage area (for archiving and field equipment). High quality meeting and seminar rooms (127m<sup>2</sup>), including both audio and video conferencing facilities are also provided. These facilities are available to all staff and students to use, and currently meet all storage and archiving needs. The close proximity of the new accommodation and facilities alongside the other Research Institutes has facilitated the development of interdisciplinary collaboration. The meeting rooms and conferencing facilities have enabled the management of major collaborative studies, particularly online Investigator meetings (e.g. for ENABLE-London and EUROlinkCAT collaborations).



Unit-level environment template (REF5b)3.3 Research Infrastructure3.3.1 Structures for research support

SGUL research is directed by the Deputy Principal (Research and Enterprise), who chairs Research Committee, which reports directly to SGUL Executive Committee and SGUL Council. Research is supported by the Joint Research and Enterprise Service (JRES), whose Director reports to the Deputy Principal (Research and Enterprise). JRES manages SGUL research grants, providing high-quality pre-award and post-award support to PHRI investigators. It also oversees the research governance framework, provides oversight of research and data governance and compliance with regulatory, legal and contractual commitments.

3.3.2 Information Technology and Library Facilities:

PHRI depends on key institutional infrastructure including Information Technology Services (ITS) and Library Services (LS). An addition to basic facilities, ITS maintains on-site high-performance computing (HPC) for academic and research staff and students, consisting of several computing clusters, used for all forms of predictive modelling, data analysis and simulation. The HPC currently has 272 cores, 4 GPU nodes with 20000+ GPU cores and 1.5Tb of RAM. A secure Data Safe Haven (DASH) is provided on the University computing network, which provides a secure processing area for Personal Identifiable Information conforming to Data Security and Protection Toolkit (formerly IG Toolkit) / ISO27001 auditing and security requirements. SGUL information security policies, procedures and standards are compliant with the NHS Data Security and Protection Toolkit (allowing investigators to access patient data for research from the UK National Health Service) with Cyber Essentials Plus certification. Literature search services are provided through the Clinical and Research Enquiry Service (CARES), and training for systematic reviews provided. The Figshare data-sharing facility allows PHRI investigators to make research data accessible to other bona-fide research users, regulated by the Research Data Management Service with the support of the SGUL Research Data Support Manager.

3.3.3 Central Research Resources

Central SGUL research resources support expenditure on major research equipment, provide bridging support for research staff and support open access publication of key research. The University Capital Investment fund (£400,000 per annum) has allowed maintenance and upgrading of the PHRI freezer facility (including the provision of back-up freezers). The SGUL research staff bridging fund (£70,000/year) under the control of the Deputy Principal (Research and Enterprise) has enabled us to provide employment continuity for 4 strategically important staff on short term research funding, who were then able to secure longer-term funding continuity. SGUL funding has supported Gold Open Access publication for strategically important PHRI research publications (£65,500 committed between 2013-2020).

**4. Collaboration and contribution to the research base, economy and society**4.1 Collaborations, networks and partnerships4.1.1 Collaborations at Institutional Level

Collaboration has been a key element of PHRI research strategy, strengthening critical mass and expertise, providing access to data resources and increasing scientific reach. Collaboration (local, national and international) has been actively supported through PHRI workload planning, protecting investigator time, underwriting travel costs and supporting collaborator meetings. Since 2014, PHRI has been a collaborating centre in the UK MRC Centre for Environment and Health with Imperial College and King's College London, investigating air pollution and health (**Atkinson, Anderson, Butland, Strachan, Cook, Whincup**) and a participating centre in the NIHR CLAHRC South London and its replacement, the NIHR ARC South London. Several PHRI investigators were members of specific CLAHRC research themes, including diabetes (**Whincup, Harris, Owen, Donin, Rudnicka**), psychosis (**Gillard, Ussher**) and public and patient involvement (**Gillard**). PHRI has been a member of the Department of Health UK Centre for Tobacco and Alcohol Studies, including its Senior Management Group (**Ussher**) and is a partner in the joint UK MRC London Intercollegiate Doctoral (LID) Training Partnership with LSHTM (2016-2021) (**Strachan, Morris, Critchley**). PHRI investigators have collaborated with local NHS Trusts, including the St George's University Hospitals NHS Foundation Trust (with which SGUL shares a campus) and with

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SWLSTG Mental Health NHS Trust. Important PHRI research collaborations in which SGUL investigators have played key leadership roles (2013-2020) are summarized below.

**4.1.2 Collaborations on cardiovascular disease and type 2 diabetes in low and middle income countries**

With colleagues in Qatar, **Critchley** has jointly led collaborative research investigating the emerging type 2 diabetes epidemic in the Middle East and its associations with tuberculosis. She was co-investigator on a major EU-funded project 'Concurrent Tuberculosis and Diabetes Mellitus' (TANDEM). She is co-investigator on a new European & Developing Countries Clinical Trials Partnership funded consortium (PROTID 2020-2026), which will conduct the first randomized trial of preventive treatment for latent tuberculosis in people living with diabetes. Reports from the collaboration have been published (Clinical Infectious Diseases, WHO Bulletin, Lancet Diabetes and Endocrinology and Chest).

**4.1.3 Collaborations on ophthalmic epidemiology**

PHRI investigators (**Owen, Rudnicka**) have collaborated with colleagues in the Institute of Ophthalmology, UCL and with Moorfields Eye Hospital to investigate retinal architecture and its associations with later cardiovascular morbidity. Collaboration with the NHS (Homerton University Hospital, Guy's and St Thomas NHS Trust) have allowed them to investigate the scope for improvements in the NHS Diabetic Eye Screening Programme.

**4.1.4 Collaborations in respiratory disease epidemiology, management and prevention**

**Strachan** led the collaborative Respiratory Health of the Nation project with Imperial College London, Nottingham and Edinburgh Universities supported by the British Lung Foundation (2014-15). He has also been co-investigator on collaborative studies of common and rare genetic variants in respiratory health (PIs Hall and Tobin, Universities of Nottingham and Leicester). Following his involvement (1990-2012) as a founder member of the International Study of Asthma and Allergies in Childhood (ISAAC), **Strachan** has been a Steering Group Member of the Global Asthma Network (GAN), working to raise the profile of asthma and to promote global access to essential asthma medications; he co-authored Global Asthma Reports (2014 and 2018). PHRI is home to the **Cochrane Airways Group (Cates, Fortescue)** which prioritizes, supports and conducts collaborative systematic reviews (publishing ~20/year) to underpin the evidence base for effective treatment for asthma and chronic obstructive pulmonary disease.

**4.1.5 Collaborations on the health effects of air pollution**

**Atkinson** and **Butland** have participated in the international comparative evaluation of Spatio-Temporal Exposure Assessment Methods for estimating the health effects of air pollution (STEAM) with King's College London, Imperial College London, the University of Athens, Harvard University (PI Katsouyanni). **Butland** is a collaborator in the MELONS Study, investigating the consequences of measurement error in long-term personal exposure models for air pollution. **Atkinson** and **Carey** have participated in a Europe-wide collaboration, 'Effects of Low-Level Air Pollution: A Study in Europe (ELAPSE)' funded by the US Health Effects Institute to examine the health effects of long-term, low level air pollution exposure on health in 22 cohort studies in 11 countries.

**4.1.6 Collaborations on congenital anomalies**

**Morris** is PI of the EUROlinkCAT collaboration (2017-2021), based on 22 congenital anomaly registries in 14 European countries, which is enabling health and educational outcomes of European children with congenital anomalies to be studied throughout childhood. She also leads EUROCAT, a network of 39 congenital anomaly registries in 21 European countries and hosted by the Joint Research Council and is co-investigator on collaborative studies of the determinants and prevention of congenital anomalies, including ConcepTION and ZIKAPLAN. ConcepTION (PI Sturkenboom, University of Utrecht, Netherlands) is using routine health data and patient-reported information to reduce uncertainty about medication safety in pregnancy and breastfeeding, while ZIKAPLAN (PI Wilder-Smith, University of Umeå, Sweden) is investigating the severity, impact and preventability of Zika infection.

**4.1.7 Collaborations on health and the built environment**

The ENABLE-London Study (**Owen, Rudnicka, Cook, Whincup**) used the transformation of the 2012 Olympic Village to investigate the impact of the built environment on physical activity levels

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and included national and international collaborators at the Universities of Bristol and Glasgow, and RMIT University, Australia. Key reports have been published in Lancet Public Health and other journals.

**4.1.8 Collaborations on smoking cessation during pregnancy**

**Ussher** led the London Exercise And Pregnant smokers (LEAP) collaborative trial evaluating the effectiveness of physical activity in smoking cessation (2012-2015) and has collaborated on several large smoking cessation trials, including a multicentre trial of physical activity assisted reduction in smoking (TARS), the Cessation in Pregnancy Incentives Trial, Helping Pregnant Smokers Quit: A Multi-Centre RCT of Electronic Cigarette and Nicotine Patches and BabyBreathe, an NIHR-funded trial supporting mothers to remain smoke-free postpartum.

**4.1.9 Collaborations on interventions to increase physical activity**

**Harris** led 2 collaborative trials (PACE-UP and PACE-LIFT) investigating strategies for increasing physical activity levels in adults in primary care. These trials involved both national and international collaborators (University of Oslo, Norway); reports were published in PLoS Medicine and other journals.

**4.1.10 Collaborations on ethnicity and child obesity**

**Nightingale** and **Whincup** led a collaborative research project on overweight-obesity in children of different ethnic backgrounds, establishing a collaborative data resource based on all published UK studies with deuterium dilution assessments. This was used to develop ethnic-specific BMI adjustments and prediction modelling for assessing body fatness in children of different ethnic origins (published in BMJ and IJO). **Whincup** is also co-investigator on the Born in Bradford Birth Cohort Study.

**4.2 Evidence of how staff interacted with key research users, beneficiaries and audiences to develop research impact**

PHRI investigators have worked closely with research users and beneficiaries to maximize research impact. **Atkinson** (Impact Case 'Outdoor Air Pollution...') served on Department of Health Advisory Committees on air pollution and health, notably the Committee on the Health Effects of Air Pollution (COMEAP) and its subgroup on the Quantification of Air Pollution Risks (QUARK). His involvement provided timely evidence on the adverse health consequences of outdoor nitrogen dioxide exposure to inform government policy on exposure reduction strategies. In addition, **Atkinson** has also been an independent reviewer of the US Health Effects Institute air pollution research programme (2016-2020) and consultant to the World Health Organization. **Perkin** (Impact Case 'Early introduction...') disseminated the Enquiring about Tolerance (EAT) Trial results at major international scientific meetings in the UK, Europe, Australia and Japan, leading to new infant feeding guidelines in the UK and other countries; he was a member of the British Society of Allergy and Clinical Immunology Guideline Group which developed, published and disseminated new UK infant feeding guidelines influenced by the EAT Trial. **Cates and Fortescue** (Cochrane Airways Group) have provided best evidence on effective treatment and care for asthma and chronic obstructive pulmonary disease and have developed strong relationships with research users, including people living with respiratory disease and their carers, healthcare providers and clinical guideline producers. The Cochrane Airways Group is represented on the British Thoracic Society Guideline Group and the Scottish Intercollegiate Guideline Network (SIGN). The Group works closely with the National Institute for Health and Care Excellence (NICE) and has influenced many national and international guidelines, recently on vitamin D in the management of asthma and on the effectiveness of combination therapy and antibiotic treatment for chronic obstructive pulmonary disease. It maintains a strong social media network presence (>5000 followers) which inform priority setting for the Group, ensuring that reviews address areas of concern for patients and carers. **Morris** is a member of the MHRA Commission Expert Working Group on optimizing data on medicine use during pregnancy and a member of the National Congenital Anomaly and Rare Disease Registration Service Expert Scientific and Clinical Advisory Panel and has been a member of key expert scientific committees on congenital anomaly prevention, including a European Medicines Agency report on 'Long-Term Effects of Medicines taken before, during pregnancy and breastfeeding'. **Critchley** was scientific adviser to a joint World Health Organization-International Union Against Tuberculosis and Lung Disease initiative on the public health response to combined epidemics of tuberculosis and type 2

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diabetes and co-wrote their joint report with the World Diabetes Foundation 'Management of Diabetes Mellitus-Tuberculosis. A Guide to Essential Practice'. **Strachan** was an editorial team member for the Global Asthma Network and lead author of 2 chapters in Global Asthma Reports (2014 and 2018).

**4.3 Wider contributions to the economy and society, including evidence of the wider activities and impact of research**

Research by **Harris** and **Ussher** on increasing physical activity levels in adults have featured in an NIHR review of effective physical activity interventions and been included in the Royal College of General Practitioners' online physical activity and lifestyle toolkit and on the Moving Medicine website ([www.movingmedicine.ac.uk](http://www.movingmedicine.ac.uk)) for health practitioners. Research by **Rudnicka** and **Owen** on the efficacy and cost-effectiveness of automated retinal image processing in patients with diabetes has led to collaboration with PHE, the UK National Screening Committee and the NHS on the implementation of automatic retinal image processing in the National Diabetic Eye Screening Programme (DESP). **Nightingale** and **Whincup** have developed novel methods for accurately identifying overweight-obesity in children of ethnic minority origins and have worked with local authorities in South and East London to develop best practice strategies for the assessment of overweight-obesity in these children.

**4.4 How the Unit engages with diverse communities and publics through its research**

PHRI research has provided opportunities for engagement with diverse research populations, including East Village residents (formerly the 2012 Olympic Village) in East London (**Owen, Rudnicka**), South London primary school children (**Donin, Whincup, Nightingale**), pregnant women smokers in South London (**Ussher**), adult participants in physical activity trials in London and Oxfordshire (**Harris**) and people with learning disability and their carers in South London (**Carey**), the last highlighted by NIHR Involve as a model of PPI practice in research. Participant and public involvement with these study populations has included involvement in study aims and design, discussion on the experience of participation, sharing of study results and discussion of their implications. The results of the Test-n-Treat trial in ethnically diverse teenagers (**Oakeshott**) had important implications for sex education provision for young people and was highlighted by the London Impact Initiative. An evaluation of the detection of sight-threatening diabetic eye disease included ethnically diverse East London populations (**Rudnicka, Owen**). Many PHRI investigators (**Strachan, Perkin, Atkinson, Harris, Owen, Ussher**) have participated in SGUL 'Spotlight on Science' events, which have high levels of engagement with the London public and are supported by SGUL with Wellcome Trust funding.

**4.5 Evidence of the Unit's contribution to discipline sustainability**

PHRI staffing strategy has focussed strongly on longer-term career development for PHRI staff. Most current PHRI Professors (7/11) started their research careers in junior roles at SGUL, suggesting that SGUL-based career development provided has contributed substantially to staffing sustainability in population health research disciplines. During 2013-2020, PHRI investigators have undertaken activities sustaining core population health research disciplines, participating as supervisors in the joint UK MRC London Intercollegiate Doctoral (LID) Training Partnership with LSHTM as well as supervising predoctoral fellows, PhD students, postdoctoral researchers and research fellows. Many PHRI academics have examined PhD theses (>20 theses examined). **Strachan** is an appraiser for public health clinical academics with honorary PHE contracts. PHRI primary care academics (**Harris, Oakeshott**) have trained >10 NIHR and Health Education England Academic Clinical Fellows (ACFs) in Primary Care, providing academic supervision, career development advice, research project support, and supporting NIHR In Practice Fellowship applications. They also regularly organize the annual regional Society of Academic Primary Care (SAPC) conference, which academic primary care trainees attend. **Critchley** has provided teaching on epidemiology and population health for the 'People's University' in low- and middle-income countries. **Morris and Critchley** have hosted visiting Erasmus scholars from universities in Germany and Turkey.

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#### 4.6 Wider Roles Undertaken by Unit Members

**Ussher** was Senior Editor for the journal *Addiction* (2009-2020) and **Morris** is a Board Member for the *Journal of Medical Screening* (2018-2021). **Strachan** was UK Biobank Outcomes Advisory Group member (2012-2017). **Rudnicka** and **Owen** have been founder members of the UK Biobank Eye and Vision Consortium since 2012 and **Owen** has been a member of the UK Biobank Physical Activity Working Group since 2014. **Carey** was a scientific member of the Independent Scientific Advisory Committee on MHRA database research (2017-2020). Recent funding panel memberships have included the NIHR Public Health Research Programme (**Owen**, 2015-2020), the UK Prevention Research Programme Expert Review Group (**Owen**, 2017-2020), NIHR HTA Primary Care and Community Preventive Interventions Panel (**Harris**, 2015-2019) and NIHR RfPB panel (**Oakeshott**, 2015-2017). PHRI investigators have been members of >20 Trial and Programme grant Steering Committees for trials addressing food allergy prevention (**Strachan**), food provision in secondary schools (**Owen**), obesity prevention (**Harris**, **Whincup**), smoking cessation interventions (**Ussher**), safe sex among teenagers (**Oakeshott**) health behaviours (**White**), physical activity promotion (**Harris**) and several trials of eczema prevention and treatment (**Perkin**). **Strachan** is a Fellow of the Academy of Medical Sciences and was a highly cited researcher (top 1%) in the Clarivate Analytics ranking for 2014-2018. **Rudnicka** was awarded the Arthur Bennett Prize of the College of Optometrists for eye disease research (2017) and is the most highly cited UK optometric researcher (2020). **Oakeshott** was awarded the British Medical Association TP Gunton Prize (2017). The UK Faculty of Public Health Sam Ramaiah Prize (for research into the health of ethnic minority populations) was awarded to Hudda (PhD student supervised by **Nightingale** and **Whincup**). PHRI investigators have organized and chaired conference sessions at the Society for Academic Primary Care (**Harris**, **Oakeshott**), the European network for congenital anomaly surveillance (EUROCAT) (**Morris**) and NIH/NIAID meetings on 'Tuberculosis and Diabetes' (Rockville, Maryland 2016) (**Critchley**). Invited keynote lectures have been delivered at the SAPC 2017 (**Harris**), the European Society for Research on Nicotine and Tobacco 2016 (**Ussher**) and the International Congress on Endocrinology 2018 (**Critchley**). **Perkin** gave keynote lectures at scientific conferences of the Australian Society of Clinical Immunology and Allergy (2016), the Japanese Society of Pediatric Allergy and Clinical Immunology (2019), the European Academy of Allergy and Clinical Immunology (2019) and the British Society for Allergy & Clinical Immunology (Harry Morrow Brown Lecture 2020). Many PHRI investigators have reviewed grant applications for a wide range of funding organizations (e.g. UK-MRC, NIHR, Wellcome Trust, BHF, Diabetes UK) and reports for medical journals, including *NEJM*, *Lancet*, *BMJ* and *PLoS Medicine*.