

<p>Institution: St George's, University of London</p> <hr/> <p>Unit of Assessment: A2 Public Health, Health services and Primary Care</p> <hr/> <p>a. Context</p> <p>The REF2014 submission in this Unit of Assessment is entirely from the Population Health Research Centre (PHRC), one of six research centres formed at St George's, University of London at the beginning of 2010. The aspiration (mission statement) of PHRC is <i>"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 or health care practice"</i>.</p> <hr/> <p>b. Approach to impact</p> <p>Epidemiological research is inherently orientated towards prevention of illness and therefore its impact (as defined in the REF2014 guidance documents) may be evaluated in terms of <i>changes in policies</i> which aim to reduce the burden of disease at the <i>community</i> level.</p> <p>The two impact studies included in this submission illustrate how our research programme has informed public policy <i>nationally and internationally</i> by:</p> <ol style="list-style-type: none"> Systematic collation and review of observational studies of the adverse health effects of indoor and outdoor air pollutants (<i>evidence synthesis</i>) Evaluation of the strength of evidence in favour of causal relationships between environmental exposures and health consequences (<i>hazard assessment</i>) Quantitative meta-analysis to establish the strength of exposure-response relationships (<i>risk assessment</i>) Use of these quantitative estimates to model the likely health benefits from policy-related changes in pollutant exposures (<i>health impact assessment</i>) Updating these assessments periodically in response to national or international policy reviews (<i>policy development</i>). <p>Our approach to defining impact (for REF2014) focuses on the link between the evidence base (and particularly those elements related directly or indirectly to work at St George's) and the policy development process. We have not, in general, evaluated impact in terms of changes in the <i>environment</i> or <i>health</i> of the population, because:</p> <ol style="list-style-type: none"> Rarely is there a simple link between such changes and specific elements of public policy There may be a prolonged time interval between introduction of a policy initiative and the occurrence of changes in exposure There is often further latency in effects upon disease incidence or outcome Due to all these factors, the link between the original aetiological research and changes in the health of the population is usually tenuous. <hr/> <p>c. Strategy and plans</p> <p>Over the past 20 years, the epidemiological research group at St George's developed a strategic alignment with Department of Health (DH) and Department of Environment (now DEFRA) initiatives in air pollution control. When DH interest in this area was revitalised in the early 1990s, Anderson was a member of the DH advisory panel on medical effects of air pollution episodes and Strachan was a medical advisor to the Building Research Establishment in relation to health consequences of indoor environmental exposures. Over the subsequent two decades, Anderson, Atkinson and Strachan have all served or still serve on the DH Committee on the Medical Effects of Air Pollutants (COMEAP) and various COMEAP sub-groups. Anderson has also been a member of DEFRA committees advising on air quality standards (EPAQS and CSAS) and advises the US Health Effects Institute (HEI). Both Atkinson and Anderson advise the World Health Organisation.</p> <p>Participation in these advisory committees provided useful insights into deficiencies in collation, analysis and interpretation of the evidence needed by government departments and policy-makers.</p>
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As a result, a strategic decision was taken to re-orientate part of our research portfolio away from “causes of disease” towards “consequences of exposure”. Aware of the need for evidence synthesis, and the rapidly growing literature, systematic quantitative reviews were encouraged, alongside primary studies.

From 2000 onwards, recognising the strategic value of international collaboration, productive links were built with European investigators, through active engagement (Atkinson, Anderson) with the EU-funded APHEA1 and APHEA2 projects, later expanded to a trans-Atlantic collaboration with US investigators (APHENA). Atkinson also collaborated with the APHEIS and APHEKOM projects to estimate the health impact of air pollution exposures in European cities. Cook and Strachan contributed to the Surgeon-General’s Report on Second-hand Smoking (published in 2006) and Anderson co-chaired the Global Burden of Disease expert group on outdoor air pollution (report published in 2012).

As a result, during the REF 2014 impact period (2008-2013), there was already a substantial commitment to both national and international policy development and standard setting in relation to air pollution, drawing particularly on quantitative systematic reviews of observational evidence. The selected case studies illustrate two major portions of this work: studies of environmental tobacco smoke (based on measurements of individual exposure) and studies of short-term effects of outdoor air pollution (based on time-series analyses of exposures and health events at the population level).

This work resonates with a broader portfolio of policy-related research, funded by current grants:

- a) Systematic reviews of the chronic health effects of long-term exposure to outdoor pollutants, particularly in relation to asthma (Anderson, Atkinson)
- b) Evaluation of health and environmental impacts from the London Congestion Charging Scheme and Low Emission Zone implementation (Anderson, Atkinson, Cook)
- c) Use of primary care electronic databases to investigate spatial correlations between air pollution exposures and adverse health outcomes across mainland Britain (Atkinson, Cook)
- d) Systematic reviews of experimental evidence through the Cochrane Airways Group, hosted within the Population Health Research Centre (co-ordinating editor: Cates)
- e) Evaluation of the evidence base for WHO guidelines for treatment of asthma in low-income countries, published in 2013 (Cates).

Outside the air pollution field, several themes of currently funded research within PHRC are closely related to major issues of concern in public health or social policy, including:

- a) Obesity, nutrition and activity patterns in children (Whincup, Cook, Owen, Rudnicka)
- b) Promotion of physical activity in middle-aged and older adults (Harris, Cook)
- c) Effects of the built environment (Olympic village rehousing in East London) on health-related behaviour and health outcomes (Owen)
- d) Evaluation of screening programmes for sexually transmissible infections (Oakeshott)
- e) Quality assurance of medical care and prescribing in care homes for the elderly (Shah).

Many of these projects have been funded by national calls in specific policy-related areas (from NIHR, NPRI and CQC). Looking to the future, such commissioned calls will continue to form an important opportunity to develop our research portfolio and can be expected to lead directly to impact on public health policy or clinical practice.

d. Relationship to case studies

The two submitted impact case-studies each relate, in part, to commissioned projects which were developed in response to the perceived need to conduct systematic quantitative review of observational studies (at a time, in the mid-1990s, when available reviews and policy documents, mainly from overseas, were non-systematic and narrative in style).

Case study 1 (*Effects of parental smoking on respiratory health among children*) is based upon reviews commissioned by the UK Department of Health (1996-7, published 1997-9) and the US

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Surgeon General (2000-1, published in 2006). The former was the first systematic quantitative review of the epidemiological evidence in this area.

Case study 2 (*Effects of outdoor air pollution on human health*) relates original underpinning research to recent policy developments, including the European REVIHAAP and HRAPIE reviews, described in more detail in REF3b.

As the link from research to impact in case study 2 is mainly through the Air Pollution Epidemiology Database (APED), we take this opportunity to provide background information on APED, which is based within the Population Health Research Centre at St George's and funded by the Department of Health (latterly through the Health Protection Agency and now through Public Health England).

APED was developed within PHRC from 2005 onwards as the first comprehensive compilation and cumulative meta-analysis of the rapidly expanding literature from time-series studies of outdoor air pollutants and health outcomes. It builds upon, and includes, our earlier primary research and the results of international collaborations including APHEA and APHENA.

The rationale and methods for APED are described in detail on pages 9-18 in: Anderson HR, Atkinson RW, Bremner S, Carrington J, Peacock J *et al.* Quantitative systematic review of short term associations between ambient air pollution (particulate matter, ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide), and mortality and morbidity. London, Department of Health, 2007. <https://www.gov.uk/government/publications/quantitative-systematic-review-of-short-term-associations-between-ambient-air-pollution-particulate-matter-ozone-nitrogen-dioxide-sulphur-dioxide-and-carbon-monoxide-and-mortality-and-morbidity>

Although this publication predates the REF 2014 impact period, the APED database is continuously updated and the specific contributions to the European 2013 review of evidence on health aspects of air pollution (REVIHAAP), which we submit as evidence of impact in case study 2, are based on commissioned analyses of the April 2011 version of APED.

APED remains active in 2013 and provides regular input to DH COMEAP discussions and working papers. It has also been commissioned to contribute meta-analyses for the HEI review of air pollution and health in Asia, the WHO report on health effects of black carbon, and the CAFÉ report on health impacts of air pollution exposures in Europe.

Recently, the systematic review work within APED has extended to studies of chronic effects of long-term air pollution exposure, informing COMEAP discussions on the relationship between air pollution and asthma, and leading to two comprehensive reviews in the published literature:

Anderson HR, Favarato G, Atkinson RW. Long-term exposure to outdoor air pollution and the prevalence of asthma: meta-analysis of multi-community prevalence studies.. *Air Quality Atmosphere and Health* 2013;6(1):57-68. doi:10.1007/s11869-011-0145-4.

Anderson HR, Favarato G, Atkinson RW. Long-term exposure to air pollution and the incidence of asthma: meta-analysis of cohort studies.. *Air Quality Atmosphere and Health* 2013;6(2):541-542. doi:10.1007/s11869-011-0144-5.