

The 45 and Up Study: reflecting on contributions to global evidence using case studies on cardiovascular disease and smoking

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Key points

- The 45 and Up Study has provided robust, high-quality evidence on a broad range of public health issues
- We identified four attributes of the Study that have enabled success: its establishment as a collaborative resource; its large scale; the high quality, self-reported data; and its linkage to routinely collected administrative data
- We illustrate this value using case studies from our work on socioeconomic inequalities in cardiovascular disease and the harms of smoking

Abstract

Background/objective: To describe the attributes that have underscored the success of the 45 and Up Study (the Study) and demonstrate its value by reflecting on two case studies: our research on socioeconomic inequalities in cardiovascular disease; and the harms of smoking.

Type of program or service: The Study is the largest study of healthy ageing in Australia, and one of the biggest in the world; it recruited 267 357 participants aged 45 years and older from NSW, Australia from 2005 to 2009. For more than 15 years, it has provided high-quality evidence on a broad range of public health related issues. We reflect on its value using two research case studies.

Results: Four key attributes have enabled the success of the Study: its establishment as a collaborative resource, including early and ongoing engagement with researchers and policy and practice partners; its large scale, which makes it ideally suited to quantify associations between risk factors and health outcomes, including for high priority populations; high quality self-reported survey data; and linkage to routinely collected administrative data, including specialised data.

Novel Australian findings on cardiovascular disease (CVD) and smoking illustrate how the Study has contributed to national and international evidence, informing policy and practice. Results on CVD demonstrated individual-level education-related inequalities in CVD incidence and mortality, and greater use of pharmacotherapy for secondary prevention of CVD, in people with low versus high socioeconomic status. In terms of smoking, Study data showed that current smokers have around three times the mortality of never-smokers; that even “light” smoking of <14 cigarettes per day doubles mortality; that quitting is beneficial at any age; that smoking increases the risk of multiple

cancer types; and that smoking causes half of deaths in Aboriginal and Torres Strait Islander adults aged 45 years and over and more than one-third of all deaths in the population. This evidence has been used by more than 50 government and non-government organisations, including contributing to legislation, policy and national and international monitoring and reporting.

Lessons learnt: The Study has fulfilled a vital role in public health research and practice in Australia, providing locally relevant data to enable research on health issues of importance, including health inequity. Through ongoing partnerships, the Study's data has contributed to international scientific evidence and been used to inform public health policy and practice. It has also been used as a focus for collaboration and capacity building.

Background

Since its inception in 2005, the 45 and Up Study (hereafter 'the Study') has provided robust, high-quality evidence on a broad range of public health-related issues. The Study, run by the Sax Institute, has provided longitudinal data on more than 250,000 participants aged 45 years and older for more than 15 years, through surveys covering broad health and social topics, including participant's behaviours, experiences, household and demographic factors, carer responsibilities, quality of life and chronic conditions. Our team has used the Study data extensively since it began and have witnessed its value and seen the impact that it can have on policy and practice. In this article, we describe the attributes we believe have underscored its success and demonstrate the value of the data using two examples from our research. The first example outlines our work examining the relationship between socioeconomic status and cardiovascular disease (CVD). The second describes our work on smoking and its relationship to CVD and cancers.

In writing this paper, we started by thinking about where we would be if we did not have the Study. This counterfactual scenario helped to identify four key attributes that have been integral to its success. First, the Study has been open and collaborative from its inception with researchers, policy and practice partners. These partners were integral to establishing the Study. They continue to engage with projects using the data, ensuring that the Study meets end-users' needs and is used to inform policy and practice. Second, the Study is the largest study of healthy ageing in Australia, and one of the biggest in the world. Thus, it is highly powered to quantify associations between risk factors and health outcomes, and well positioned to quantify these associations within priority populations and for less common exposures and outcomes. Third, the Study collects detailed information from survey responses, including participant sociodemographic, behavioural and health factors. And fourth, a core feature of the Study is linkage to several routinely collected administrative datasets, including hospital data, national medication dispensing and medical services claims data, cancer registry and death data. This linkage allows the long-

term and comprehensive follow-up of participants' health outcomes over time and immediate relevance to the Australian policy context. Thus, the Study has been designed in a way to enable it to address a wide range of predictable and emerging research questions and to serve as a focus for collaboration and capacity building.

The case studies below, and our broader work, illustrate how the Study features enable productive, long-term collaborations, enhanced capacity building and the generation of large-scale, policy-relevant evidence, particularly in relation to health inequity.

Case study: socioeconomic status and CVD

In 2015, working partners including the Heart Foundation, The Consumers Health Forum of Australia, and the NSW Agency for Clinical Innovation, a team of researchers from the Australian National University, Concord Repatriation General Hospital, The George Institute for Global Health, Baker IDI, the University of Newcastle, and Sydney University were awarded a National Health and Medical Research Council (NHMRC) Partnership Grant, to investigate inequalities in CVD, including potential opportunities for intervention.

The Study, with detailed information on socioeconomic factors and follow-up of CVD hospitalisations and deaths, was a key dataset used for this program of work. The Study provided questionnaire data on individual-level socioeconomic status, including education, linked to NSW Admitted Patient Data Collection and death data. This allowed quantification of rates of primary and secondary CVD incidence and showed, for the first time in Australia, that CVD incidence for both primary and secondary events increased with decreasing education.¹ For those aged 45–64 years, those with the lowest versus highest levels of education were 62% more likely to have a first-time major CVD event and 49% more likely to have a secondary event.¹ Gradients using the individual-level measure of socioeconomic status were larger than previously documented using an area-level measure of

disadvantage. This shows the importance of individual-level data to quantify inequalities in CVD. This research, which contributed significantly to the international evidence base, was feasible due to the availability of large-scale linked data, providing a cohort with a large sample size and with detailed individual-level follow-up. The research highlighted the importance of primary and secondary prevention and treatment in reducing socioeconomic variation in CVD and the overall burden of CVD in Australia.

Data from the Study was then used to replicate and expand on findings first shown in cross-sectional self-reported data from the Australian Bureau of Statistics National Health Survey. The survey suggested that, among those with prior CVD, those with low versus high socioeconomic status were more likely to be using preventive lipid- and blood pressure-lowering medications.² This finding contrasted with international studies, which showed that more advantaged individuals were more likely to receive preventive medications than those who were more disadvantaged. Using Study survey data linked with hospital and medication dispensing data from the national Pharmaceutical Benefits Scheme (PBS), we were able to provide more robust large-scale evidence that among people with existing CVD, those with lower levels of educational qualifications were more likely to be using lipid- and blood pressure-lowering medication than those with more education. We further showed that medication subsidisation almost entirely explained this inverse relationship between education and medicine use.³ People receiving the highest level of medication subsidies through the PBS were more likely to be using CVD preventive medications than those on the lowest level of Government subsidisation. These findings show that Government subsidisation of CVD medications is working in the intended direction – a success story for Australia's health system – providing an example to other countries and highlighting the potential risks associated with increasing out-of-pocket medication costs. This example highlights the contribution of large-scale cohort studies to policy-relevant research and the power to provide more robust data on issues raised in routine survey data.

Case study: the association of tobacco smoking with all-cause mortality and CVD

Australia is an acknowledged world leader in tobacco control. While the harms caused by tobacco smoking are well established internationally, prior to the establishment of the Study, estimates of the impact of smoking on death and disease in Australia were based on data from other countries. Working with national and international collaborators, our team has used the Study to provide the first large-scale, contemporary Australian evidence on the

damage caused by smoking and the ongoing benefits of quitting.

Using data from the Study questionnaire linked to hospitalisation and death data, the first major results on the harms of smoking showed that death rates in participants who reported current smoking at baseline of the Study were around three-fold those of people who had never smoked.⁴ The large-scale nature of the data enabled the research team to demonstrate that even so-called “light” smoking of an average of <14 cigarettes per day was associated with a two-fold increase in mortality compared to never having smoked. The findings also showed that, on average, participants who smoked died 10 years earlier than non-smokers and that up to two-thirds of people who smoke will die from their habit – substantially greater than previously thought. The richness of information collected on the Study baseline survey also allowed analyses highlighting the benefits of quitting smoking; quitting at any age was beneficial and those who quit before the age of 45 had mortality rates similar to never-smokers.

This work was then extended to generate the most systematic and comprehensive evidence on the risks of CVD subtypes associated with smoking worldwide. Using data from the Study baseline questionnaire linked to hospitalisation and death records, the team identified that risks of 29 CVD subtypes were elevated in people who smoked at baseline compared to those who never smoked, including two CVD subtypes for which there was no prior epidemiological evidence. Compared to never-smokers, people who smoked had at least twice the risk of acute myocardial infarction, cerebrovascular disease and heart failure and more than five times the risk of peripheral arterial disease. The research team estimated that any CVD event among smokers was more likely than not caused by smoking, on the balance of probability. Again, the benefits of quitting smoking were clear: for most CVD outcomes studied, people who had quit before the age of 35 had CVD risks similar to those who never smoked.

The Study is also a valuable resource for investigating Aboriginal and Torres Strait Islander health and was, until recently, the largest cohort study of Aboriginal and Torres Strait Islander adults. The Study was used to produce the first estimates of smoking-related mortality for an Indigenous population in Australia and worldwide. It was estimated that smoking causes half of the deaths in Aboriginal and Torres Strait Islander adults aged 45 and older and more than one-third of all deaths in the population, equivalent to more than 10,000 premature deaths⁵ over 10 years. As efforts continue to improve the health and wellbeing of Indigenous Australians, the Study demonstrated that reducing tobacco use would result in enormous benefits to the health of Aboriginal and Torres Strait Islander people.

The Study research on smoking provided compelling, local, and contemporary evidence on the harms of smoking and the benefits of quitting, using five simple,

well-validated questions on the baseline questionnaire about smoking behaviour. This evidence is regularly used in contemporary tobacco control policy to underscore the importance of continued investment in comprehensive tobacco control measures. To date, this research has been used by more than 50 organisations, including Study partners, Cancer Council NSW and the National Heart Foundation, leading to improvements in policy, practice and care. For example, this research has been used to support recently legislated tobacco excise increases, tobacco control policy and advocacy (e.g. Figure 1) and front-line smoking cessation services and clinical practice. The findings have also been applied in the most recent tobacco-related burden of disease report for Australia⁶ and used to underpin a simulation model of Australian smoking behaviour that can be used to predict future smoking rates based on scenario modelling of new and existing tobacco control strategies.⁷

Figure 1. A 2015 Cancer Council Western Australia 'Make Smoking History' campaign advertisement which cites findings from research using the 45 and Up Study



Quit and the news gets a whole lot better.
New research from the 45 and Up Study has found that men who quit smoking are likely to live longer than those who don't.
This is a much bigger benefit than you might expect.
Researchers used the statistical strength of the 45 and Up Study to find out.
Over 100,000 people smoking an average of 20 cigarettes a day, the risk of premature death is more than halved.
The 45 and Up Study is a national study of more than 400,000 people.
The campaign will influence how the public understands tobacco and if you really are quit smoking, it'll be a pleasure to meet.

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Building research capacity

A highly skilled workforce capable of analysing, interpreting and translating the findings from research such as this is essential. The Study has been the training ground for many early-career researchers, providing a new generation of researchers with the experience of working with large-scale linked data. Skills in analysing large-scale linked data are crucial in the world of big data, international research consortia and real-time health tracking. Given that whole-of-population, multi-sector, linked datasets are increasingly becoming available to researchers in Australia, a highly trained workforce with the ability to use these to understand and address multiple complex health problems is crucial.

Conclusions

Nationally and locally relevant data are critical for public health policy and practice. The 45 and Up Study is a vitally important element of burgeoning, large-scale linked data. Much of the success of the Study to date has stemmed from its design, including its foundation as a collaborative resource, and prioritising partner engagement to ensure it meets end-users' needs. Ongoing engagement with policy and practice partners has ensured that Study research is fit-for-purpose and designed to address policy-relevant questions. However, retaining relevance in contemporary Australia will require continuous innovation, which includes data collection on new and emerging health threats (for example, coronavirus 2019 (COVID-19)), evidence to support a reduction in health inequities, and data that capitalises on advances in health technologies, for example, biobanking.

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The 45 and Up Study is managed by the Sax Institute in collaboration with partners Cancer Council NSW, the Heart Foundation and NSW Ministry of Health.

Peer review and provenance

Externally peer reviewed, invited.

Competing interests

EB holds a NHMRC Principal Research Fellowship. She was Scientific Director of the 45 and Up Study from 2003–2018 and wrote the original protocol for the Study. She

was also a Senior Advisor to the Sax Institute, focusing on advice relating to the Study. MW reports contract funding from Cancer Australia and from the Australian Government Department of Health, outside the submitted work.

Author contributions

EB, EP, JW and GJ conceived the idea for the paper. EP and JW wrote the first draft of the manuscript, with input from GJ, MW, and EB. All authors critically reviewed the paper and approved the final manuscript.

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