Institution: University of Glasgow

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

Title of case study: Demonstrating and promoting the benefits of smoke-free policy in Scotland and worldwide

1. Summary of the impact

Smoke-free laws are public policies that prohibit tobacco smoking in workplaces and other public spaces. Since the end of March 2006, smoking has been prohibited by law in all enclosed public spaces throughout Scotland, with the specific aim of protecting non-smokers from the effects of second-hand smoke. Studies led by the University of Glasgow have provided the most robust available evidence that smoke-free laws have a significant impact on rates of heart disease, childhood asthma, complications in pregnancy, and stroke. This evidence has been used to support policy debate and decision making in Scotland, the rest of the UK, and around the world, providing guidance for other countries to implement similar legislation. This research has also provided a focal point for an extended and high profile global public debate over smoking legislation, and underpins health advice and campaigns published by the World Health Organization (WHO), World Heart Federation and other international bodies.

2. Underpinning research

Since the end of March 2006, smoking has been prohibited by law in all enclosed public places throughout Scotland, the aim of which is to protect non-smokers from second-hand smoke. The impact of smoke-free laws on public health in Scotland has been evaluated in ongoing research by a combined team of academics and health professionals at the University of Glasgow that is led by Professor Jill Pell and funded by NHS HealthScotland. This research has shown that smoke-free laws are associated with a reduced incidence of key smoking-related disorders, such as coronary heart disease, childhood asthma, complications in pregnancy, and stroke.

Acute coronary syndrome (ACS) is a life-threatening form of heart disease. Although eight previous studies in USA, Canada and Italy had suggested that total admissions for ACS were reduced following the introduction of smoke-free laws, Pell's team was the first to perform a prospective study that linked reductions in admission rates to the smoking status of patients.[1] For 10 months before the enactment of the smoking legislation in Scotland on the 26th March 2006 and the same 10 months in the year following legislation, patients admitted with ACS to nine Scottish hospitals (accounting for 64% of the total ACS admissions in Scotland) were recruited to the study by Pell *et al*.[1] The information collected from participating patients included self-reported smoking status and exposure to second-hand smoke, which was also measured objectively by a well-established biomarker for exposure to tobacco smoke (cotinine – a breakdown product of nicotine). Over the period studied, the number of hospital admissions for ACS in Scotland decreased by 17% (from 3,235 in the 10 months prior to the introduction of the law to 2,684 in the 10 months afterwards), with non-smokers accounting for two-thirds of this reduction. By comparison, a 4% reduction was reported during the same period in England, where no such legislation had been introduced. The significance of this study was reflected by the fact that the publication was voted the Top Paper of 2008 by the American Heart Association.

In 2009, Pell's team used record linkage to conduct a follow-up study of the 1,261 never smokers to establish the effect of exposure to second-hand smoke on early outcomes of ACS. Never smokers who were exposed to second-hand smoke had a higher risk of adverse events (such as death or rehospitalisation) within 30 days of first admission to hospital.[2] This finding further supported the argument for protecting non-smokers from the harmful effects of second-hand smoke.

Pell's team also examined the effects of the smoke-free law on rates of childhood asthma and pregnancy complications in Scotland. Research published by this group showed that childhood asthma admissions had been increasing by about 5% each year prior to the introduction of the smoke-free law, but were reduced by 18% per year following introduction of the legislation.[3]

Faculty of 1000 graded this article as 5* stating it was "an important study for health care providers, legislators and public health care workers". Pell and her team went on to examine data on 717,000 women who conceived between August 1995 and February 2009, and showed that, relative to the underlying trends, there was a significant drop of more than >10% in the overall number of preterm deliveries, and significant drops of 5% and 8% in the number of infants born either small or very small, respectively, for their gestational age.[4] Following the legislation, the number of expectant mothers who smoked fell from 25.4% to 18.8%. This dramatic decline was not observed in the general population but was consistent with other Scottish studies that showed that parents responded to the smoke-free legislation by implementing voluntary home restrictions on smoking to protect their children.

More recently, Pell's team was the first to show a reduction in the incidence of cerebral infarction as a result of the smoke-free law. Cerebral infarction is a form of stroke caused by restriction of blood flow to the brain, due to diseased or damaged cerebral arteries, and accounts for 50% of all strokes. The incidence of cerebral infarction was increasing at around 1% per year but, following introduction of the smoke-free law, reduced by around 9%. This was sustained for 20 months, before partially reverting to pre-legislation levels.[5] This was consistent with another study by Pell's team that showed an initial increase in smoking quit rates, followed by some relapses.

Key researchers at the University of Glasgow: Jill Pell (Henry Mechan Chair of Public Health, 2007–present); Daniel Mackay (Research Associate, 1998–2011; Senior Lecturer of Public Health, 2012-present); Scott Nelson (Muirhead Chair of Reproductive and Maternal Medicine, 2008–present); Peter Langhorne (Professor of Stroke Care, 1994–present); Alex McConnachie (Assistant Director of Biostatistics, 2010–present).
Key collaborator: Sally Haw – (NHS Health Scotland, moved to University of Stirling, Department of Nursing Midwifery and Health in 2011). Professor Haw coordinated the whole portfolio of studies examining the various impacts of the legislation.

3. References to the research

1. Pell, J. P. *et al*. Smoke-free legislation and hospitalizations for acute coronary syndrome. *NEJM* 2008; 359(5): 482–491; doi: 10.1056/NEJMsa0706740.
2. Pell, J. P. *et al*. Secondhand smoke exposure and survival following acute coronary syndrome: prospective cohort study of 1261 consecutive admissions among never-smokers. *Heart* 2009; 95(17): 1415–1418; doi: 10.1136/hrt.2009.171702.
3. Mackay, D. F. *et al*. Smoke-free legislation and hospitalizations for childhood asthma. *NEJM* 2010; 363: 1139–1145; doi: 10.1056/NEJMoa1002861.
4. Mackay, D. F. *et al*. Impact of Scotland's smoke-free legislation on pregnancy complications: retrospective cohort study. *PLOS Med.* 2012; 9(3): e1001175; doi: 10.1371/journal.pmed.1001175.
5. Mackay, D. F. *et al*. Impact of Scotland's comprehensive, smoke-free legislation on stroke. *PLOS One* 2013; 8(5): e62597; doi: 10.1371/journal.pone.0062597.

4. Details of the impact

In 2006, Scotland became the first country in the UK to introduce a ban on smoking in public places. Prior to this, there was credible doubt that a ban would be effective despite research to show that more than 13,000 people in Scotland were dying each year from the effects of smoking, with an estimated 1,000 of those deaths caused by passive smoking. Researchers from the University of Glasgow have presented the most robust evidence to show that smoke-free laws have significant and wide-reaching health benefits for smokers and non-smokers alike. The research has been widely cited to further strengthen the public health case for smoking bans both nationally and internationally, supporting the argument that smoke-free laws protect non-smokers, including unborn children, from the effects of second-hand smoke.

Informing advocacy and policy

In 2009, the European Union (EU) cited these findings in its 'Q&A briefing memo' (published on 30 June 2009), which prepared ministers for parliamentary questions on a European Commission

proposal on smoke-free environments.[a] In response to the question "is there evidence that smoke-free policies work?", the author of the memo stated that "better air quality has been mirrored by substantial reductions in the incidence of heart attacks, including… a 17% drop in Scotland " citing the Pell 2008, *NEJM* paper as the supporting reference. On 12 October 2010, the EU Health Commissioner John Dalli stated that "a number of studies indicate important health effects of smoke-free policies" when answering a question raised in the European Parliament regarding the Commission's proposal, before referring to another memo that also references the Pell findings.[b]

In 2011, the WHO released the document 'Making Cities Smoke-free' to support compliance with the WHO Framework Convention on Tobacco Control, an international treaty signed by 174 countries.[c] Addressed to mayors of cities across the world, this document drew on the experience of many different jurisdictions and provided a practical framework for implementing smoke-free laws in cities (effectively defining the legislation, anticipating and countering opposition, ensuring civil society involvement, and managing public communications). In the section entitled 'Key Resources', the 2008 study by Pell and colleagues (2008, *NEJM* in section 3) was the sole reference provided for the UK to demonstrate the benefit of measuring indicators of worker health pre- and post-ban, specifically 'the number of emergency admissions to hospital for acute cardiovascular problems such as heart attacks'. Professor Pell was also invited by the WHO to present at the 14th World Conference on Tobacco and Health in 2009 in Mumbai, India. The World Heart Federation, which supports "reduction of the prevalence of risk factors associated with cardiovascular deaths" and includes tobacco control as one of its advocacy strands has selected Pell's research as one of four international case studies that exemplify "the work of women who have played key roles ensuring that women's needs are taken into account in the formation of tobacco control policy and the provision of cessation services around the world".[d]

In the USA, the University of Glasgow findings have been covered widely by the press. A White Paper produced in 2011 by the Health Care Foundation for Greater Kansas City included a section entitled '*Clean Indoor Air Laws*,[e] which cited Pell's research (2008, *NEJM* in section 3), stating that "after just one year in effect, Scotland's comprehensive clean indoor air law resulted in a 17% reduction in hospital admissions for heart attacks and other coronary problems." These data were also referenced in a section of the Global Voices Status Report (2009) that referred to the UK and Ireland as 'Regional Leaders' for their smoking legislation.[f] This report provides guidance for clinicians and policy-makers on how to protect people from second-hand smoke and was produced by the Global Smoke-free Partnership (GSP) – an international umbrella organisation coordinated by the American Cancer Society – which promotes effective smoke-free air policies worldwide. The GSP has also disseminated the research of Pell's team in a number of the smoking-related factsheets that are available on its website.

Evidence produced by the University of Glasgow has also been cited in the Scottish Government's evaluation of the success of the smoking ban and continues to support its tobacco control policies. ASH Scotland's Information Service is funded by the British Heart Foundation and the Scottish Government to provide reliable evidence-based information on tobacco and its harmful effects on health, society, and the economy in Scotland. In ASH's 'National evaluation of Scotland's smoke-free legislation' (2013), key findings of the University of Glasgow research (2008, *NEJM* and 2010, *NEJM* in section 3) are presented as headline items, including the positive impacts on childhood asthma and on heart attack admissions to hospital.[g] The Scottish Government's 2013 strategy on tobacco control, entitled 'Creating a tobacco-free generation: A tobacco control strategy for Scotland', cites the "clear evidence that … the smoking ban, has lead [sic] to a range of health benefits including: reduced heart attack admissions to hospital; reduced childhood asthma admissions to hospital; and fewer premature births", referencing the 2008 and 2010 *NEJM* papers (section 3), demonstrating the continued influence of Glasgow research on the government's current smoke-free policy.[h]

Leading public debate

Extensive coverage in UK and international newspapers, on the radio, and on the internet mean that the findings of Pell and her team have played an important role in the continuing and often vociferous public debate for and against smoking legislation.[i-p] As an example, the *Wall Street*

Journal, with a daily circulation of 2.1 million readers, cited the team's findings in its coverage of the smoking ban debate in the USA in 2008, stating that "a new study from Scotland provides what public-health experts in the US say is the strongest evidence yet that public bans on smoking being debated in several locales – improve health by reducing exposure to secondhand smoke".[i]

Despite research from the Scottish Government showing that 80% of people supported the idea of a smoking ban, there were concerns expressed about the potentially damaging effect it would have on businesses and vocal opposition from pro-smoking groups is ongoing. The significance of the Glasgow findings in supporting a smoking ban policy is evidenced by the regularity with which they are targeted by ban opponents, e.g. Freedom2Choose (F2C), a lobbying initiative seeking to 'alleviate the negative social and economic impacts of the ban' and to challenge supposedly misleading claims over smoking issues, particularly in relation to passive smoking.[j] Pell's research findings also feature regularly in a blog entitled 'Taking Liberties' written by Simon Clark, the director of an anti-tobacco-legislation lobbying group called Forest that is funded, in part, by British American Tobacco.[k]

On the other side of the debate, the Chief Executive of Action on Smoking and Health (ASH) Scotland has contributed to a number of blogs in her 'Smoked out' series using the research by Pell's team to support the argument in favour of smoking bans[l]. In 2011, on the 5-year anniversary of the Scottish smoking ban, the *Scotsman* newspaper published a feature covering the wide range of views on smoke-free legislation. In addition to soliciting opinions from Simon Clark and representatives from the ASH and the Scottish Licensed Trade Association, they invited Jill Pell and Phil Hanlon to present the evidence base in support of such laws.[m] In the BBC coverage of the 5th anniversary of the ban, the legislation was described as one of the country's "big public health success stories" – research by Pell and colleagues (showing lower hospitalisation rates for children with asthma) was used to support this statement.[n]

5. Sources to corroborate the impact

Contribution to advocacy and policy documents

a. European Commission. *Questions and answers on the Commission proposal on smoke-free environments*; a briefing memo on smoke-free laws released on 30 June 2009.
b. European Parliament. *Parliamentary questions*; answers to a written question on smoke-free environments published on the 12 October 2010.
c. Tobacco Free Initiative (TFI) and WHO Centre for Health Development. *Making Cities Smoke-free* (2011); pg31.
d. World Heart Federation. *Cardiovascular harms from tobacco use and second-hand smoke* (2012) pg4. *World No Tobacco Day: Case studies / women taking action* (2011).
e. White Paper on Tobacco Policy for Kansas and Missouri. *Clean Indoor Air Laws* (2011); pg3
f. Global Voices Status Report 2009. *Rebutting the tobacco industry winning smoke free air*; pg33
g. Action on Smoking and Health (ASH). *National evaluation of Scotland's smoke-free legislation* (2013).
h. Scottish Government. *Creating a tobacco-free generation: A tobacco control strategy for Scotland* (2013), pg6.

Contribution to public awareness and debate

i. The Wall Street Journal. *Study supports health benefits of smoking ban* (2008).
j. Freedom2Choose. *Lodging motions on Pell in the Scottish Parliament* (blog 2010)
k. Simon Clark, Taking Liberties (blog 2011-13)
l. Chief Executive of ASH Scotland. *Smoked out: monthly musings on tackling tobacco* (blog 2013).
m. The Scotsman. *Five years of the smoking ban* (2011).
n. BBC News online: Scotland. *Scotland's smoking ban hailed as anniversary approaches* (2011).
o. The Guardian. *Smoking ban 'has reduced asthma and heart attacks'* (2012).
p. Netdoctor news. *Large fall in premature births following Scots smoking ban* (2012).