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Frazer, Kate
Callinan, Joanne E
McHugh, Jack
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[Intervention Review]

Legislative smoking bans for reducing harms from secondhand smoke exposure, smoking prevalence and tobacco consumption

Kate Frazer[1], Joanne E Callinan[2], Jack McHugh[3], Susan van Baarsel[4], Anna Clarke[5], Kirsten Doherty[6], Cecily Kelleher[3]

[1]School of Nursing, Midwifery & Health Systems, University College Dublin, Dublin 4, Ireland. [2]Library & Information Service, Education, Research & Quality Department, Milford Care Centre, Limerick, Ireland. [3]School of Public Health, Physiotherapy and Sports Science, University College Dublin, Dublin 4, Ireland. [4]School of Medicine and Medical Science, University College Dublin, Dublin, Ireland. [5]National Immunisation Office, Dublin 7, Ireland. [6]Department of Preventive Medicine and Health Promotion, Education and Research Centre, Dublin 4, Ireland

Contact: Kate Frazer, School of Nursing, Midwifery & Health Systems, University College Dublin, Health Sciences Centre, Belfield, Dublin 4, Ireland. kathleen.frazer@ucd.ie.

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ABSTRACT

Background

Smoking bans have been implemented in a variety of settings, as well as being part of policy in many jurisdictions to protect the public and employees from the harmful effects of secondhand smoke (SHS). They also offer the potential to influence social norms and the smoking behaviour of those populations they affect. Since the first version of this review in 2010, more countries have introduced national smoking legislation banning indoor smoking.

Objectives

To assess the effects of legislative smoking bans on (1) morbidity and mortality from exposure to secondhand smoke, and (2) smoking prevalence and tobacco consumption.

Search methods

We searched the Cochrane Tobacco Addiction Group Specialised Register, MEDLINE, EMBASE, PsycINFO, CINAHL and reference lists of included studies. We also checked websites of various organisations. Date of most recent search; February 2015.

Selection criteria

We considered studies that reported legislative smoking bans affecting populations. The minimum standard was having an indoor smoking ban explicitly in the study and a minimum of six months follow-up for measures of smoking behaviour. Our search included a broad range of research designs including: randomized controlled trials, quasi-experimental studies (i.e. non-randomized controlled studies), controlled before-and-after studies, interrupted time series as defined by the Cochrane Effective Practice and Organisation of Care Group, and uncontrolled pre- and post-ban data.

Data collection and analysis

One author extracted characteristics and content of the interventions, participants, outcomes and methods of the included studies and a second author checked the details. We extracted health and smoking behaviour outcomes. We did not attempt a meta-analysis due to the heterogeneity in design and content of the studies included. We evaluated the studies using qualitative narrative synthesis.

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Main results

There are 77 studies included in this updated review. We retained 12 studies from the original review and identified 65 new studies. Evidence from 21 countries is provided in this update, an increase of eight countries from the original review. The nature of the intervention precludes randomized controlled trials. Thirty-six studies used an interrupted time series study design, 23 studies use a controlled before-and-after design and 18 studies are before-and-after studies with no control group; six of these studies use a cohort design. Seventy-two studies reported health outcomes, including cardiovascular (44), respiratory (21), and perinatal outcomes (7). Eleven studies reported national mortality rates for smoking-related diseases. A number of the studies report multiple health outcomes. There is consistent evidence of a positive impact of national smoking bans on improving cardiovascular health outcomes, and reducing mortality for associated smoking-related illnesses. Effects on respiratory and perinatal health were less consistent. We found 24 studies evaluating the impact of national smoke-free legislation on smoking behaviour. Evidence of an impact of legislative bans on smoking prevalence and tobacco consumption is inconsistent, with some studies not detecting additional long-term change in existing trends in prevalence.

Authors' conclusions

Since the first version of this review was published, the current evidence provides more robust support for the previous conclusions that the introduction of a legislative smoking ban does lead to improved health outcomes through reduction in SHS for countries and their populations. The clearest evidence is observed in reduced admissions for acute coronary syndrome. There is evidence of reduced mortality from smoking-related illnesses at a national level. There is inconsistent evidence of an impact on respiratory and perinatal health outcomes, and on smoking prevalence and tobacco consumption.

PLAIN LANGUAGE SUMMARY

Does legislation to ban smoking reduce exposure to secondhand smoke and smoking behaviour?

Since the first national legislation banning indoor smoking in all public places was introduced in 2004, there has been an increase in the number of countries, states and regions adopting similar smoke-free legislation banning smoking in public places and work places since this review was first published. The main reason is to protect nonsmokers from the harmful health effects of exposure to secondhand smoke. Another reason is to provide a supportive environment for people who want to quit smoking.

Study characteristics

We searched for studies that investigated the effect of introducing a ban on any measures of health, or on smoking behaviour (up to February 2015). Since the previous version of this review had shown clear evidence that introducing legislation to ban smoking in public places does reduce exposure to secondhand smoke (SHS) in those places, we did not include studies that only reported exposure to SHS. We included 77 studies from 21 countries in this updated review. Studies of health outcomes typically used data from hospitals to look for changes in rates of admissions, discharges or deaths. Most studies looked at illnesses related to the cardiovascular system (heart or blood vessels), such as heart attacks and strokes. Studies also looked at effects on respiratory health, including chronic obstructive pulmonary disease (e.g. bronchitis), asthma and lung function. Seven studies looked at the health of newborn children. Eleven studies reported death rates. The best-quality studies collected data at multiple time points before and after the introduction of a ban in order to adjust for existing time trends. Some studies could compare events rates in areas with and without bans, or where bans were introduced at different times.

Key results

There is evidence that countries and their populations benefit from improved health after introducing smoking bans, importantly to do with the heart and blood vessels. We found evidence of reduced deaths. The impact of bans on respiratory health, on the health of newborn children, and on reducing the number of smokers and their cigarette use is not as clear, with some studies not detecting any reduction.

Quality of the evidence

Legislative bans have not been evaluated by randomized trials, and the quality of the evidence from the types of studies contributing to this review is lower. Changes in health outcomes could be due to other things, such as change in healthcare practices. However, many of the studies used methods of analysis that could control for underlying trends, and increase our confidence that any changes are caused by the introduction of bans.

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SUMMARY OF FINDINGS

Summary of findings for the main comparison.

Patient or population: Smokers and nonsmokers

Settings: 21 countries including 12 European countries, Turkey, USA, Canada, Australia, New Zealand, Hong Kong, Argentina, Panama, Uruguay.

Intervention: Comprehensive or partial smoking bans in public places implemented by legislation

Comparison: No bans (note: observational data only)

Outcomes[1]	Effects of intervention	Quality of the evidence (GRADE)[2]	Comments
Cardiovascular health	44 studies included. 43 studies evaluated incidence of acute myocardial infarction (AMI) and acute coronary syndrome (ACS), 33 of which detected significant associations between introduction of bans and reductions in events. 6 studies evaluated stroke incidence; 5 detected significant associations between introduction of bans and reductions in events	⊕⊕⊕⊖ **moderate** [3]	
Respiratory health	21 studies included. Data imprecise with conflicting results. 6 of 11 studies reported significant reductions in COPD admissions. 7 of 12 reported significant reductions in asthma admissions	⊕⊖⊖⊖ **very low** [4]	
Perinatal health	7 studies included. Data imprecise with conflicting results; due to study designs unclear if many of observed associations due to confounding factors	⊕⊖⊖⊖ **very low** [4]	
Mortality	11 studies included. 8 detected significant association between introduction of bans and reduced smoking-related mortality	⊕⊕⊖⊖ **low**	

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1]Note, original review also included changes in environmental tobacco smoke (ETS) exposure as an outcome. Evidence was unequivocal that bans were associated with significant reductions in ETS (see Callinan 2010), and hence we did not evaluate this outcome in this update.
[2]As all studies are observational, starting point for GRADE rating is low. Meta-analyses not conducted; data summarized narratively.
[3]Upgraded due to evidence of a dose-response effect.
[4]Downgraded due to imprecision.

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BACKGROUND

Description of the condition

Tobacco is the second major cause of mortality in the world, and currently responsible for the death of about one in ten adults worldwide (WHO 2009; WHO 2013). Measures to control the demand for and supply of tobacco products, as well as to protect public health, have been demanded through Article 8 of the Framework Convention on Tobacco Control (WHO 2003; WHO 2009; WHO 2014).

The epidemic of cigarette smoking is identified as one the greatest public health disasters of the 20th century, with over 20 million attributable deaths (USDHHS 2014). Over the past 50 years of reports by the Surgeon General, international evidence has emerged that smoking affects most organs and that there is no risk-free level of exposure to secondhand smoke (SHS) (USDHHS 2014). The World Health Organization (WHO 2014; WHO 2015) estimates that six million people die annually from tobacco-related diseases; 600,000 from the effects of secondhand smoke exposure.

Secondhand smoke, also known as environmental tobacco smoke (ETS) or passive smoke, is the combination of side-stream smoke, i.e. smoke that is emitted between puffs of burning tobacco (cigarettes, pipes or cigars), and mainstream smoke, i.e. smoke that is exhaled by the smoker (NCI 1999). Secondhand smoke is a complex mixture of thousands of gases and particulate matter emitted by the combustion of tobacco products and from smoke exhaled by those smoking (NRC 1986). Secondhand smoke was declared to be carcinogenic by the International Agency for Research on Cancer (IARC 2004; IARC 2008; IARC 2009).

Negative health effects associated with exposure to SHS have been well documented and include major conditions such as lung cancer, as well as cardiovascular disease, respiratory disease and asthma, and other significant health outcomes such as eye and nasal irritation and low birth weight in babies of nonsmokers (Allwright 2002; Hackshaw 1997; NCI 1999; ANHMRC 1997; SCOTH 2004; IARC 2009; USDHHS 2014).

There has been an increase in the number of countries introducing comprehensive national indoor smoking policies banning smoking in indoor public places and work places since 2005 and the number of research papers has risen exponentially since this review was first published (Callinan 2010). The primary outcome is to protect nonsmokers from the harmful health effects of exposure to secondhand smoke and additionally to provide a supportive environment for people who want to quit smoking.

Description of the intervention

The efforts of the Framework Convention on Tobacco Control to reduce tobacco consumption worldwide (WHO 2003; WHO 2009; WHO 2013) include a demand for smoke-free legislation, and the MPOWER provisions include protecting people from tobacco use (WHO 2008; WHO 2009; WHO 2015). Legislating for smoke-free environments is a fundamental component of these actions.

Introducing national smoking legislation is a public policy issue. The underpinning decision-making process is multifactorial, including epidemiological evidence of the toxicity of smoke and the associated link to a pathological endpoint, international policy evidence of acceptability and compliance and evidence of improved health outcomes. Legislative smoking bans vary in their comprehensiveness in different settings, i.e. the extent to which they allow smoking or restrict it to designated areas and where those smoking restrictions occur. Legislation prohibiting smoking indoors, including in bars and restaurants, we classify in this review as a comprehensive smoking ban, even though exemptions may occur in different settings, e.g. psychiatric units, prisons, and residential homes, including nursing homes. Less comprehensive smoking bans, such as those which allow smoking in designated rooms or areas, we classify in this review as partial bans. The primary outcome is to protect nonsmokers from the harmful health effects of exposure to secondhand smoke, and additionally to provide a supportive environment for people who want to quit smoking. Evidence from the previous review identified the impact of national smoking bans on improved respiratory and sensory symptoms, improved lung function, reduced tobacco consumption and reduced SHS exposure (Callinan 2010).

How the intervention might work

One potential outcome of smoking bans and restrictions is to reduce or eliminate the exposure of nonsmokers to the dangers of SHS. Another is to reduce tobacco consumption among smokers in specified areas including work places or general public places. While SHS in the work place increases the risk of lung cancer among nonsmokers, the elevation in risk is modest in comparison with the risk of active smoking. International evidence is emphatic, that smoking is responsible for increased mortality for smokers, and for nonsmokers through SHS exposure (WHO 2015). Ethical questions also arise in relation to individual civil liberty, and policy makers prefer not to interfere with such rights for those who smoke, except for minors. It is the harmful effect of passive smoking in nonsmokers that justifies the policy action, especially for workers. This means that the endpoint is often more likely to be an exposure measure to passive smoke than either active smoking rates or a health gain of reduced smoking-related morbidity or mortality. Evidence from this review previously demonstrated that a smoking ban does lead to a reduction in exposure to passive smoking, specifically for the population employed in the hospitality sector. It also reported evidence of improved health outcomes (Callinan 2010).

Why it is important to do this review

This is a major public health issue affecting an estimated billion active smokers worldwide and the larger population of nonsmokers. The impact of introducing smoking legislation is to cut exposure to passive smoke. For every person who dies as a result of smoking, it is estimated that 30 or more people will live with smoking-related illnesses (USDHHS 2014). Banning smoking is a public policy issue. The decision-making process underpinning it is ultimately a political action which rests on a combination of evidence sources, including:

1. Mechanistic evidence of toxicity of smoke
2. Epidemiological evidence that either smoking or SHS is linked to a pathological endpoint
3. Policy evidence that imposing a restriction will be socially acceptable and achieve high compliance
4. Action research evidence that it can be successfully implemented.

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Bans and policies can be implemented through public health policies or legislation affecting populations at a national, state or community level.

In setting the parameters for the original review, we adopted a strict methodological approach in keeping with the Cochrane process but with consideration for the nature of health promotion interventions in setting those parameters. Evaluation of health promotion interventions continues to generate debate in the scientific literature. Davey Smith 2000 argues that the randomized control trial is the standard for assessing health promotion interventions. Opponents of this view (Britton 2010; Green 2015) acknowledge that rigorous evaluation of studies is important, but that randomized controlled trials may not be the best approach given the complexities, processes and scope of health promotion programmes.

During the intervening period since this review was first published, there have been sustained developments to reduce exposure to tobacco and reduce consumption, with more countries signing up to the Framework Convention on Tobacco Control and enacting national smoke-free legislation. There have been extensions of smoking bans to reduce exempted population groups. This has resulted in fewer partial smoking bans and more inclusive comprehensive bans in a wider range of settings. The evidence of health outcomes on reduced exposure, morbidity and mortality arising from the enactment of smoking bans can take time to emerge. In this review we include robust studies strengthening this evidence base and its impact at a population level.

OBJECTIVES

To assess the effects of legislative smoking bans on (1) morbidity and mortality from exposure to secondhand smoke, and (2) smoking prevalence and tobacco consumption.

METHODS

Criteria for considering studies for this review

Types of studies

We include randomized controlled trials, non-randomized controlled studies, controlled before-and-after studies, and interrupted time series, as defined by the Cochrane Effective Practice and Organisation of Care Group (EPOC 2013), and uncontrolled before-and-after studies, with a minimum follow-up of six months for measures of smoking.

Types of participants

Smokers and nonsmokers exposed to comprehensive or partial smoking bans. The bans must be implemented by legislation, and may affect populations at a local, regional, or national level.

Types of interventions

Legislative bans which either ban smoking completely in all settings including the hospitality sector (comprehensive) or restrict it to designated areas (partial). The ban may be implemented at national, state or local level. For controlled studies, the intervention setting may be compared to settings without smoking bans or with less restrictive policies.

Types of outcome measures

Primary objective:

Measures of health outcomes including any measure of morbidity or mortality, e.g. cardiac admissions, respiratory health, and pulmonary function. In studies with longer follow-up, measures of the incidence of lung cancer and cardiovascular disease may also be available. If health outcomes were reported for population subgroups defined by smoking status or by levels of or changes in SHS exposure, we extracted data for these subgroups.

Secondary objective:

Measures of smoking behaviour including prevalence of tobacco use, tobacco consumption, cessation rates. For these outcomes we required data from large population-based studies. We also required baseline data (pre-legislation) and a follow-up period of a minimum of six months after introduction of a ban, to assess a sustained impact.

For this update, we have not included studies only reporting the impact of smoking bans on passive smoke exposure using self-reported data or only measuring cotinine. An impact of bans on passive smoke exposure and a reduction in cotinine measures following reduced exposure was unequivocal from the first version of the review (Callinan 2010). We now require measured health outcomes data for studies reporting passive smoke exposure.

We required biochemical verification of exposure to environmental tobacco smoke over self-reported perceptions. In order to assess sustained impact, we included studies which reported outcomes such as smoking behaviour at least six months after the start of the smoking ban. In the first version of the review, we excluded studies which reported environmental measures of air quality (e.g. particulate matter ($PM_{2.5}$), respirable particles (RSP), vapour phase nicotine) as their sole measure of exposure to SHS, and we do not include these studies in this update.

Where possible, we stratified smoking behavioural outcomes by age, gender and socioeconomic status.

Search methods for identification of studies

For the original version, we searched all databases from inception to June 2009. One author subsequently conducted searches from 2009 to March 2013. For this update, the Trials Search Co-ordinator of the Tobacco Addiction Group completed all searches from February 2009 to 26th February 2015.

The searches conducted were:

- Cochrane Tobacco Addiction Group Specialised Register (up to end of February 2015); see Appendix 1 for search strategy.
- MEDLINE & PubMed (via OVID, up to 26th February 2015); see Appendix 2 & Appendix 3 for search strategies.
- EMBASE (via OVID, up to 26th February 2015); see for Appendix 4 for search strategy.
- PsycINFO (via OVID, up to 26th February 2015); see Appendix 5 for search strategy.
- Cumulative Index to Nursing and Allied Health Literature (CINAHL) (via Ebscoup to March 2013); see Appendix 6 for search strategy.

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We did not update the searches of CINAHL beyond 2013 as they were not identifying additional studies. We also checked the reference lists and bibliographies of included studies for further articles, and we contacted other experts for published and unpublished trials. We did not exclude any publications on the basis of language or publication date.

We checked websites for relevant studies and contacted authors for details of unpublished research papers and for additional information

Data collection and analysis

For this update, JC prescreened titles and abstracts between 2009 and 2012. One author (KF) prescreened titles and abstracts (2009 to 2015) to identify studies that may be relevant or useful. Three authors (JC, AC, KD) independently screened the reduced number of titles and abstracts to assess relevance for inclusion. KF obtained the full text of potentially relevant studies. Two authors (KF, CK) independently assessed the papers to see if they met the inclusion criteria. No discrepancies emerged. At this time, we limited studies reporting passive exposure to include those also reporting specific health outcome measures. We noted all decisions. One author (KF) independently extracted the data for the individual studies, and a second author (SvB) checked the results.

Two authors (KF, JMcH) independently reviewed studies reporting active smoking measures. We held discussions with a third independent author (CK) and made a decision to limit active smoking studies to those reporting outcomes from a population level.

One author (KF) completed a 'Risk of bias' assessment using the assessment tool (Higgins 2011) for the included studies, and a second author (SvB) checked the results. The domains assessed were:

- Adequate sequence generation.
- Adequate allocation concealments.
- Blinding of personnel/all outcomes.
- Addressing incomplete outcome data.
- Selective outcome reporting.
- Other bias.

We assessed each domain as being at high, low or unclear risk of bias.

We completed data extraction on a specific pro forma, and extracted data on the following information, where it was available:

1. Country and study setting
2. Category of study (population- or institution-based)
3. Size of eligible population
4. Number of participants or number of clusters and participants
5. Demographic characteristics (if relevant) of participants
6. Description and target of the intervention
7. Definition of smoking status used
8. Definition of exposure to secondhand smoke
9. Outcomes and how they were measured
10. Biochemical validation
11. Length of follow-up
12. Handling of dropouts and losses to follow-up
13. Adverse effects of intervention

Meta-analysis was not possible due to the heterogeneity in study design, participants, outcomes and nature of the intervention, so we have presented summary and descriptive statistics. We report any threats to validity or other limitations described by the studies.

RESULTS

Description of studies

See: Characteristics of included studies, Characteristics of excluded studies, Figure 1.

Figure 1.

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- **Study flow diagram.**

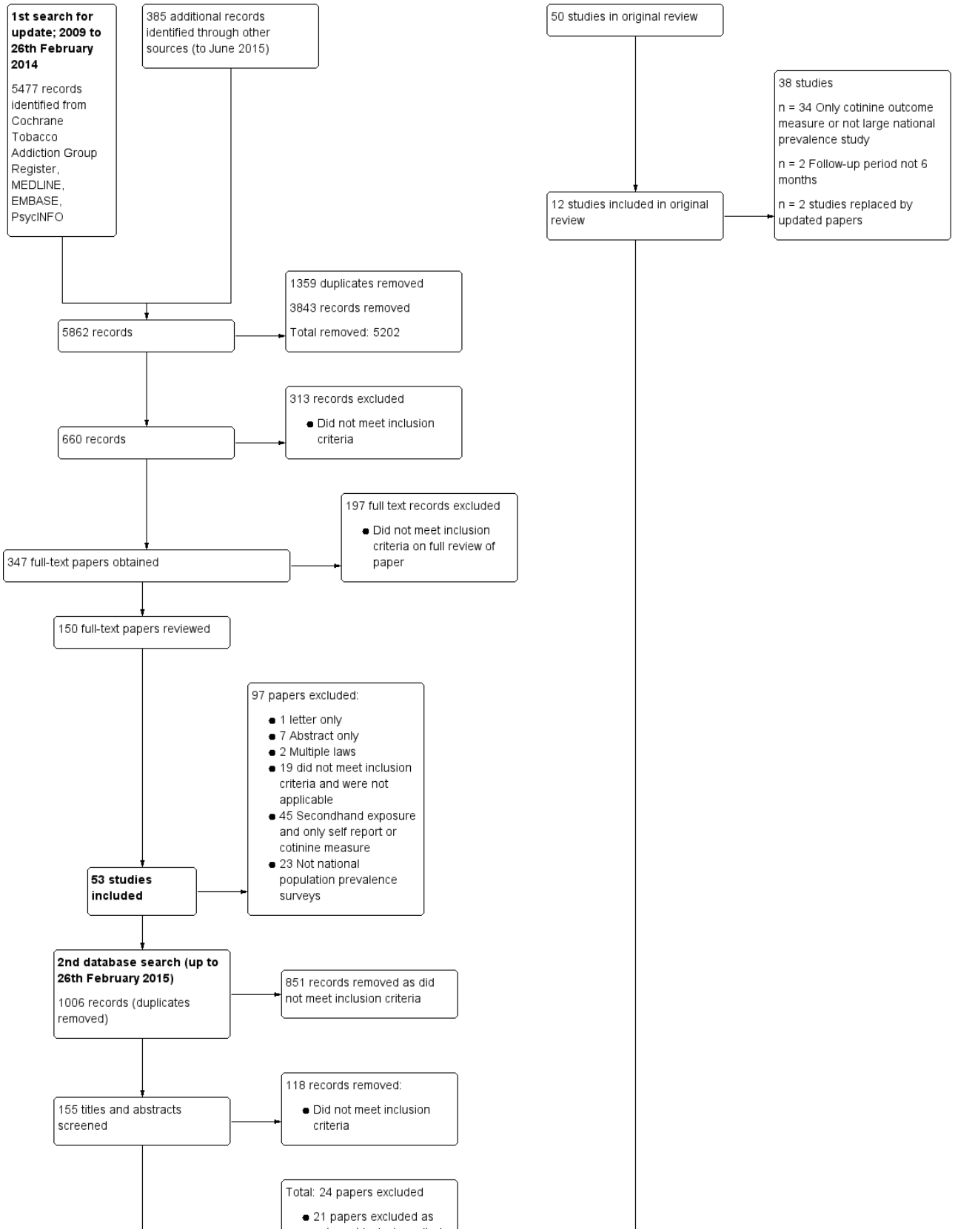

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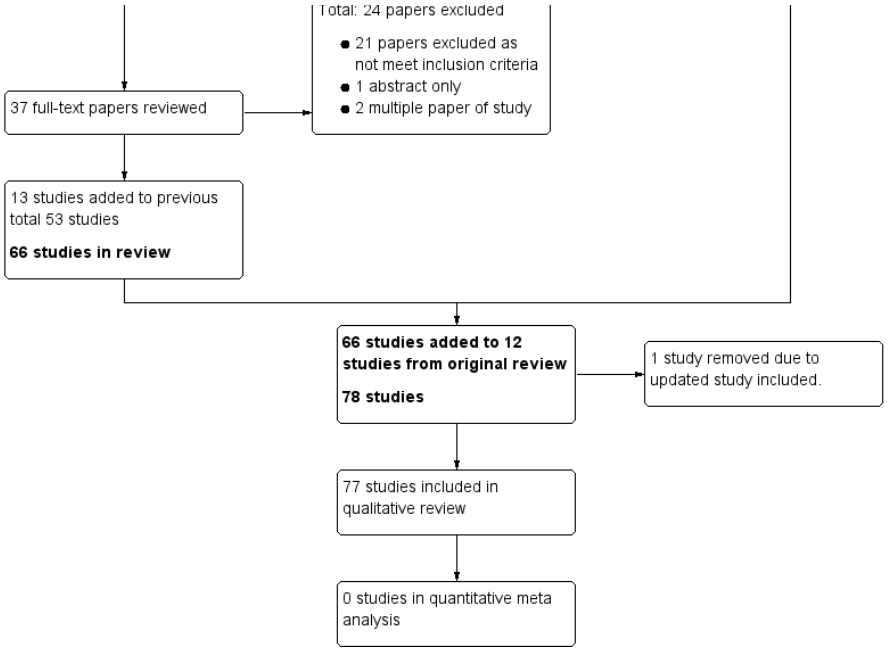
Figure 1. (Continued)



We include 77 studies which met the eligibility criteria for this updated review. We retain 12 studies with unchanged data from the first version of the review (Cesaroni 2008; Gallus 2007; Goodman 2007; Hahn 2008; Juster 2007; Khuder 2007; Larsson 2008; Lemstra 2008; Pell 2008; Pell 2009; Sargent 2012; Seo 2007). Additional results have been reported for two previously included studies, and we have renamed them to reflect this, with original reports now listed as secondary references: Alsever 2009 (previously Bartecchi 2006), and Barone-Adesi 2011 (previously Barone-Adesi 2006). We have now excluded other studies previously included that reported passive smoke exposure with either self-reported outcomes or cotinine measures. Other excluded studies are those without a six-month follow-up period following the ban and those that did not report smoking prevalence from national population data.

The included studies examine the effects of comprehensive or partial indoor smoke-free legislation implemented in countries, states (regions) or at local level. We identified the effect of the implementation of national smoking bans in studies representing 21 countries. Studies with national smoking bans in countries included in this update are: Argentina (Ferrante 2012), Belgium (Cox 2013; Cox 2014), Denmark (Christensen 2014), Germany (Sargent 2012; Schmucker 2014), Hong Kong (McGhee 2014), Panama (Jan 2014), Switzerland (Bonetti 2011; Di Valentino 2015; Durham 2011; Dusemund 2015; Humair 2014; Rajkumar 2014), Turkey (Yildiz 2015) and Uruguay (Sebrié 2014).

Countries included in the earlier review are retained in the update: Canada (Gaudreau 2013; Lemstra 2008; Naiman 2010), England (Lee 2011; Liu 2013; Millett 2013; Sims 2013), France (Séguret 2014), Ireland (Cronin 2012; Goodman 2007; Kabir 2009; Kabir 2013; Kent 2012; Stallings-Smith 2013), Italy (Barone-Adesi 2011; Cesaroni 2008; Federico 2012; Gallus 2007; Gasparrini 2009; Gualano 2014), Netherlands (De Korte-De Boer 2012), New Zealand (Barnett 2009), Norway (Bharadwaj 2012), Scotland (Jones 2015; Mackay 2010; Mackay 2011; Mackay 2012; Mackay 2013; Pell 2008; Pell 2009), Spain (Aguero 2013; Villalbi 2011), Sweden (Larsson 2008) and USA (Alsever 2009; Amaral 2009; Barr 2012; Basel 2014; Bruckman 2011; Bruintjes 2011; Croghan 2015; Dove 2010; Hahn 2008; Hahn 2011; Hahn 2014; Head 2012; Herman 2011; Hurt 2012; Juster 2007; Khuder 2007; Klein 2014; Landers 2014; Lippert 2012; Loomis 2012; North Carolina 2011; Page 2012; Roberts 2012; Rodu 2012; Sargent 2004; Seo 2007; Vander Weg 2012).

One study reports on the impact of national smoking bans from a number of countries including the USA, Canada, New Zealand, Scotland, Republic of Ireland, and Northern Ireland (Bajoga 2011). The majority of studies (27) are located in the USA. Other countries with multiple studies are: Scotland (7), Ireland (6), Switzerland (6), Italy (6) and England (4).

The definition used in this review for comprehensive smoking bans is prohibited smoking in work places, including restaurants and bars. We categorise legislation which permits smoking in bars and restaurants as a partial smoking ban, whether at local, state or national level. The implementation of smoking bans has varied across national jurisdictions, and exceptions for smoking rooms may be allowed within comprehensive bans. Using these definitions, we identified 18 studies reporting evidence for partial smoking bans (Aguero 2013; Amaral 2009; Bonetti 2011; Christensen 2014; Cox 2014; Di Valentino 2015; Dusemund 2015; Durham 2011; Humair 2014; Khuder 2007; Lippert 2012; Loomis 2012; McGhee 2014; Rajkumar 2014; Sargent 2004; Sargent 2012; Schmucker 2014; Villalbi 2011). We define the majority of smoking bans in place as comprehensive within this review.

The settings in this update vary considerably from the original review. For this update we identified studies reporting the impact of national smoking bans in the following settings:

- 42 studies used hospital registers for admissions or discharge data on specific population cohorts
- 20 studies used registries for national health outcomes, death rates, pregnancy and perinatal health

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- 11 studies used population-level country-specific prevalence surveys reporting active exposure to smoking
- 4 studies are work place-based, reporting primarily passive exposure and measured health outcomes.

We found 43 studies which reported smoking data either as a primary outcome, a descriptive variable reporting national prevalence without comparing rates before or after smoking legislation, or used as a covariate in analysis. Eleven studies (Cesaroni 2008; Christensen 2014; Cox 2014; Ferrante 2012; Head 2012; Hurt 2012; Jan 2014; Kabir 2013; Mackay 2010; Naiman 2010; Stallings-Smith 2013) report smoking prevalence data from another data source, rather than data from their own studies. Twenty-four studies report an impact of smoking bans on active or passive smoking (Analysis 1.1). Active smoking outcomes including prevalence, quit rate and tobacco consumption are specifically reported in 19 studies (Bajoga 2011; Bharadwaj 2012; Cesaroni 2008; Cox 2014; Federico 2012; Ferrante 2012; Gallus 2007; Gualano 2014; Hahn 2008; Hurt 2012; Jones 2015; Kabir 2009; Klein 2014; Lee 2011; Lemstra 2008; Lippert 2012; Mackay 2011; Mackay 2012; Page 2012). Combined active and passive smoking outcomes are reported in Larsson 2008. Passive smoke exposures are reported in a further four studies (Durham 2011; Goodman 2007; Pell 2008; Rajkumar 2014) with the evidence of health outcomes reported in 72 studies, including: cardiovascular outcomes (Analysis 1.1), respiratory outcomes (Analysis 2.1) and perinatal health outcomes (Analysis 3.1). Associations between indoor smoking legislation and mortality rates are reported in 11 studies included in this update (Analysis 4.1). A number of studies report multiple health outcomes or a combination of health-related outcomes and mortality outcome data.

Study Design

We did not identify any randomized controlled trials, due to a lack of feasibility in using this methodology in population-level studies measuring the effect of national legislative smoking bans. Of the 77 studies included in this update, 36 used an interrupted time series design measuring the impact of smoking bans using data from national registries, episodes of monthly hospital admissions or discharges, or reporting multiple prevalence surveys from population health surveys (Aguero 2013; Amaral 2009; Bajoga 2011; Barnett 2009; Barr 2012; Barone-Adesi 2011; Basel 2014; Bruckman 2011; Christensen 2014; Cox 2013; Cox 2014; Croghan 2015; Cronin 2012; De Korte-De Boer 2012; Federico 2012; Gasparrini 2009; Gualano 2014; Hahn 2011; Humair 2014; Jan 2014; Kabir 2013; Kent 2012; Klein 2014; Liu 2013; Mackay 2010; Mackay 2011; Mackay 2012; Mackay 2013; Millett 2013; Roberts 2012; Sargent 2012; Schmucker 2014; Sebrié 2014; Séguret 2014; Sims 2013; Stallings-Smith 2013).

Twenty-three studies use a quasi-experimental (controlled before-and-after) study EPOC 2013 design (Alsever 2009; Bharadwaj 2012; Bonetti 2011; Bruintjes 2011; Di Valentino 2015; Dove 2010; Dusemund 2015; Ferrante 2012; Gaudreau 2013; Hahn 2008; Hahn 2014; Head 2012; Herman 2011; Jones 2015; Khuder 2007; Landers 2014; Loomis 2012; Naiman 2010; Page 2012; Rodu 2012; Sargent 2004; Seo 2007; Vander Weg 2012). Three of these studies reported using a matched control area for comparison (Hahn 2014; Khuder 2007; Seo 2007). The remaining 18 studies used before-and-after methods with no control group (Cesaroni 2008; Durham 2011; Gallus 2007; Goodman 2007; Hurt 2012; Juster 2007; Kabir 2009; Larsson 2008; Lee 2011; Lemstra 2008; Lippert 2012; McGhee 2014; North Carolina 2011; Pell 2008; Pell 2009; Rajkumar 2014; Villalbi 2011; Yildiz 2015). Six of these studies used a cohort design (Durham 2011; Goodman 2007; Larsson 2008; Pell 2008; Pell 2009; Rajkumar 2014).

Excluded studies

For this update, we exclude 36 studies included in the first version, as they did not meet the revised inclusion criteria for this update (Abrams 2006; Akhtar 2007; Alcouffe 1997; Allwright 2005; Biener 2007; Bondy 2009; Braverman 2008; Brownson 1995; CDC 2007; Eagan 2006; Eisner 1998; Ellingsen 2006; Farrelly 2005; Fernandez 2009; Fernando 2007; Fichtenberg 2000; Fong 2006; Fowkes 2008; Galán 2007; Gilpin 2002; Gotz 2008; Hahn 2006; Haw 2007; Helakorpi 2008; Heloma 2003; Hyland 2009; Jiménez-Ruiz 2008; Menzies 2006; Mulcahy 2005; Mullally 2009; Palmersheim 2006; Pearson 2009; Semple 2007; Vasselli 2008; Verdonk-Kleinjan 2009; Waa 2006). We now included two further studies as secondary references in this update (Barone-Adesi 2006; Bartecchi 2006).

In this update, we exclude uncontrolled before-and-after studies reporting unverified health outcomes or those which only reported cotinine biomarkers and no other additional health outcome data, as the focus for this update is on including studies reporting reduced passive exposure that also measured health outcomes. The evidence from the first version clearly established that reduced passive smoke exposure results in reduced cotinine measures. We exclude from this update studies reporting the impact of smoking bans on smoking prevalence, tobacco cessation or quit rates which are not representative population-level measures. See Characteristics of excluded studies for specific details.

Risk of bias in included studies

We made explicit judgements of bias according to the criteria in the *Cochrane Handbook for Systematic Reviews of Interventions* (Cochrane Handbook, Higgins 2011). We provide a summary of the assessments in Figure 2. The study designs used in this review for evaluating a policy-level health promotion outcome do not fulfil the criteria used to confirm a low risk of bias, and as such we consider the evidence to be at high risk of bias for many of the studies included. However, we acknowledge that the majority of study designs included in this update used data from large hospital and national data registries, and for 23 studies include a control reference area.

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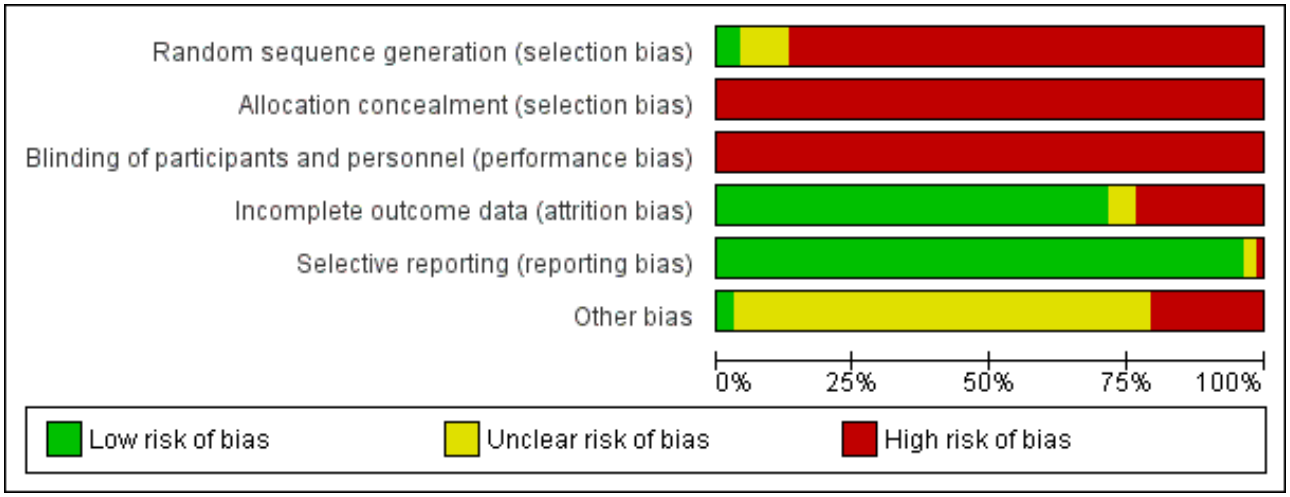
Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.



Sequence generation and allocation concealment

The non-randomized studies used in this review did not facilitate random sequence generation, allocation concealment or blinding of participants, as smoking is a visible and active process. A number of studies used large representative population surveys which employed stratified or random sampling nationally (Bajoga 2011; Federico 2012; Gualano 2014; Jones 2015; Lee 2011; Lippert 2012; Liu 2013; Mackay 2011). Volunteer samples were reported in four studies (Durham 2011; Goodman 2007; Larsson 2008; Rajkumar 2014).

Blinding

It was not possible to blind participants in the studies included in this review, as the intervention was a national public policy and smoking is visible. The use of large data sets also negated blinding. However the large data sets obtained from hospitals used the Internation Classification of Diseases (ICD) coding to confirm principal diagnoses. Studies reporting mortality data similarly used data sets from large national registries.

Incomplete outcome data

A number of studies did not report total sample sizes. Durham 2011 and Larsson 2008 reported high attrition rates, with consequent reporting bias for outcomes. Two studies reported the use of imputed scores (Aguero 2013; Hurt 2012). Klein 2014 reported that records were excluded from the data set when smoking status or other key descriptive variables including gestational age or data on duration of pregnancy were missing. This led to the exclusion of 6.3% of cases, amounting to over 30,000 records.

Selective reporting

Within this review a large number of studies used existing data sets, and individual-level data were not available. Whilst the outcomes associated were reported, the data sets were pre-existing and may have given rise to bias associated with misclassification of data, i.e. residual confounding. Prevalence studies used different data sets for each survey and this can introduce bias when combining data (Bajoga 2011; Federico 2012; Gallus 2007; Gualano 2014; Jones 2015; Lee 2011; Lippert 2012; Mackay 2011). There is a reliance on self-reported, unverified smoking status in studies included in this update. Verified smoking status (confirming either smoker or nonsmoker status) was reported by Goodman 2007; Larsson 2008; Pell 2008; Pell 2009. Pell 2009 primarily analysed data for nonsmoker outcomes, but provided a comparison for current smokers, with limited data reported.

Other bias

Other bias identified in the included studies is the lack of adjusting for confounders, as data were not available within the accessed data sets. Smoking status was self-reported for the majority of studies covering active and passive smoke exposure. Cesaroni 2008; Christensen 2014; Cox 2014; Ferrante 2012; Head 2012; Hurt 2012; Jan 2014; Kabir 2013; Mackay 2010; Naiman 2010; Stallings-Smith 2013 report smoking prevalence data from other data or from national surveys, and not from their main data sources. A number of these studies only provided a single smoking prevalence result, and we have not included this information in further statistical analyses (Christensen 2014; Head 2012; Kabir 2013; Mackay 2010; Naiman 2010; Stallings-Smith 2013). Kabir 2013 included maternal smoking prevalence data for analyses reported from an earlier paper (Kabir 2009). Verified smoking status was measured in four studies (Goodman 2007; Larsson 2008; Pell 2008; Pell 2009).

A number of the studies using data from large hospital or population registries did not provide information on individual smoking status or other individual confounders. However, these data sets used statistical modelling (both linear and non-linear) and adjustments to account for confounding of included variables. A number of studies adjusted for air quality, pollution, influenza rates and seasonality, using national data sets in an effort to reduce confounding and influence on health outcomes.

Other factors that could have led to bias include: changed prescribing practices for statins during the period of data collection (Cesaroni 2008; Christensen 2014); legislation banning trans-fatty acids in foods, resulting in dietary changes which could influence cardiovascular outcomes (Christensen 2014). Legislative changes during the period of data collection, including an increase in the price of cigarettes, was reported by Federico 2012, Jan 2014 and Klein 2014. This may have influenced their study

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outcomes. Bharadwaj 2012 reported changed occupational status for pregnant women during the period of the study, and this was identified as a factor which reduced the power of the study. Page 2012 reported significant differences in demographic data between the control area and the intervention area at baseline, and the influence of this on their outcomes. Larsson 2008 reported that the study was predominantly in women, as only 30% of the study participants were men. Schmucker 2014 included ex-smokers in the group of nonsmokers, due to a small sample size of less than 6%, and inconsistent documentation. Di Valentino 2015 detected a significant reduction in the control area which did not have a ban in place. Other new legislation, including laws banning advertising and sales of cigarettes to minors, may have influenced these outcomes.

Sample size

Two studies reported power calculations (Bajoga 2011; Lee 2011). Aguero 2013 did not analyse the impact of legislative changes on mortality, due to the small sample size reported. Fifteen studies did not report a sample size (Alsever 2009; Bajoga 2011; Bharadwaj 2012; Bruckman 2011; Gaudreau 2013; Gualano 2014; Head 2012; Herman 2011; Khuder 2007; Landers 2014; Loomis 2012; McGhee 2014; Mackay 2011; Naiman 2010; Seo 2007), although a number of these studies reported that large data sets were used with samples in excess of 1000 and up to 26,000 participants during annual data collections. Seo 2007 does not include an overall sample size, although the totals included in tables reported in the paper are suggestive of small numbers. Naiman 2010 reported population statistics and analyses based on rates per 10,000 population.

Follow-up

The minimum period required for follow-up was six months. The period for follow-up extended from nine months post-legislative bans (Kabir 2009) up to 81 months (Stallings-Smith 2013; secondary reference Stallings-Smith 2014). Gualano 2014 reported an eight-year follow-up period post-legislation. A number of studies reported phased implementation of national smoking bans in a variety of settings. Cox 2013, De Korte-De Boer 2012, Gaudreau 2013, ,Hahn 2014, Naiman 2010, Roberts 2012, Sebrié 2014 and Séguret 2014 report phased implementation of smoking bans in Belgium, Netherland, France, USA, Canada and Uruguay. Landers 2014 detected the impact of county-level and state-level bans on child and adult asthma discharge rates across multiple US states; Amaral 2009 compared the impact of local and statewide ordinances on perinatal health outcomes in California over a period of six years.

Biochemical verification

Smoking status was not reported in the majority of studies included in this update. Biochemical verification of smoking status was measured through analysis of cotinine in saliva or urine for four studies (Goodman 2007; Larsson 2008; Pell 2008; Pell 2009). Health outcomes data were verified by primary diagnosis using International Classification of Diseases (ICD) codes. Definitions of current, ex- or nonsmoker status in prevalence surveys were reported using WHO guidelines; cotinine measures (when present) for nonsmoking status were confirmed as those less than 15 ng/ml (See Characteristics of included studies).

Adverse events

Four included studies identified adverse events which may have influenced their study populations and reported outcomes. Humair 2014 and Sargent 2004 reported suspension of smoking bans in each of their studies during the periods of data collection. Gualano 2014 reported that 2007 was the peak year in the Italian recession and that this may have influenced smoking rates. Head 2012 reported the influence of hurricanes Katrina and Rita, which may have affected population levels during their study period.

Assessment of heterogeneity

As in the original version of the review, due to the heterogeneity in clinical variation and study designs reporting primary and secondary outcomes, we did not attempt a meta-analysis. We offer a qualitative narrative analysis to report the outcomes in this updated review.

Effects of interventions

See: **Summary of findings for the main comparison**

Primary objective: Effect on health outcomes

We found evidence for health outcomes in 72 studies. A number of the studies included evidence for multiple health outcomes. We divided outcomes into cardiovascular (Analysis 1.1), respiratory (Analysis 2.1), perinatal (Analysis 3.1), and mortality (Analysis 4.1) and report trends and associations using Bradford-Hill 1965 criteria. (Where results are described as significant they were statistically significant at the P=0.05 level unless otherwise stated).

Cardiovascular outcomes (Analysis 1.1)

We found 44 studies assessing associations between bans and cardiovascular health outcomes. Thirty-eight studies collected data on specific cardiac outcomes (acute coronary syndrome (ACS), acute myocardial infarction (AMI)); 19 interrupted time series studies (Aguero 2013; Barnett 2009; Barone-Adesi 2011; Barr 2012; Basel 2014; Bruckman 2011; Christensen 2014; Cronin 2012; Gasparrini 2009; Hahn 2011; Humair 2014; Jan 2014; Kent 2012; Liu 2013; Roberts 2012; Sargent 2012; Schmucker 2014; Sebrié 2014; Séguret 2014), 10 quasi-experimental controlled before-and-after studies (Alsever 2009; Bonetti 2011; Bruintjes 2011; Di Valentino 2015; Ferrante 2012; Gaudreau 2013; Khuder 2007; Sargent 2004; Seo 2007; Vander Weg 2012), and nine uncontrolled before-and-after studies (Cesaroni 2008; Hurt 2012; Lemstra 2008; Lippert 2012; McGhee 2014; North Carolina 2011; Pell 2008; Rajkumar 2014; Yildiz 2015; see Analysis 1.1). Evidence from four quasi-experimental controlled before-and-after studies (Head 2012; Herman 2011; Loomis 2012; Naiman 2010) and one uncontrolled before-and-after study (Juster 2007) provide evidence for both cardiac and stroke outcomes. Mackay 2013 provides evidence of the Scottish ban specifically for stroke outcomes.

Cardiac outcomes

We found consistent temporal trends with evidence of significant reductions in AMI/ACS admissions following the introduction of national smoking bans. Significant reductions in rates of admissions and discharges were evident in 12 studies (Alsever 2009; Bonetti 2011; Di Valentino 2015; Ferrante 2012; Gaudreau 2013; Head 2012; Herman 2011; Loomis 2012; Naiman 2010; Sargent 2004; Seo 2007; Vander Weg 2012), compared to their reference areas. Seven studies found similar associations (Cesaroni 2008; Hurt 2012;

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Juster 2007; Lemstra 2008; McGhee 2014; North Carolina 2011; Pell 2008). Studies using interrupted time series data also identified a consistent association with reduced admissions (Aguero 2013; Barnett 2009; Barone-Adesi 2011; Bruckman 2011; Christensen 2014; Cronin 2012; Hahn 2011; Jan 2014; Kent 2012; Liu 2013; Roberts 2012; Sargent 2012; Schmucker 2014; Sebrié 2014).

Bruintjes 2011 and Khuder 2007 detected declining trends in AMI admissions, but the reductions were not statistically different to comparison areas in either study. Barr 2012 and Gasparrini 2009 observed declining trends in AMI admissions post-ban, but no statistically significant association after adjusting for linear trends and non-linear adjustment for secular trends. Whilst Basel 2014 reported a steep decline in AMI rates in the five years prior to the smoking ban, they found no significant results after statistical adjustment for previous ordinances. Two smaller communities in Colorado previously enacted smoke-free legislation and identified a 27% reduction in AMI hospitalizations (Bruintjes 2011). The effect of the existing ordinances may have influenced the current results (Basel 2014).

Séguret 2014 detected a downward trend in ACS admissions over a seven-year phased implementation of smoking bans in France. However, after adjusting for linear trends, age and gender, the results were not statistically significant. Lippert 2012 detected mixed results, predominantly reduced prevalence of heart disease, angina and AMI rates; however, increased rates were also detected in states with partial bans. Whilst Humair 2014 observed significant reductions in ACS hospital admissions post bans, the results were not significant after statistical adjustment for confounders including age, gender and secular trend. Yildiz 2015 did not observe any change in cardiac admissions.

We found a clear dose-response effect in a number of studies included in this update. Alsever 2009 reported sustained reductions three years after a smoking ban was introduced, (statistically adjusting for secular trends) in comparison with the control area. Similar results were reported in Vander Weg 2012, who observed reducing admission trends during the phased implementation of smoking bans in settings, compared to states without bans.

Bonetti 2011 found evidence of sustained reductions in AMI rates in the second year of the ban for nonsmokers, with no change observed in the control area. Cronin 2012, Jan 2014 and Sebrié 2014 reported consistent reductions in AMI admissions at least two years after the introduction of national smoking bans. Naiman 2010 detected reduced admissions for angina after a work place ban was introduced, and further reductions in admissions for cardiovascular conditions following subsequent enactment of a ban in restaurants. Statistically significant reductions in AMI admissions were observed following the implementation of a ban in bars and the hospitality sector. The authors suggest that the statistically significant reductions in hospital admissions were unlikely to be attributable to decreased active smoking rates.

Biological coherence was observed in Schmucker 2014, with diverging trends in ST-elevation myocardial infarction (STEMI) incidence between smokers and nonsmokers. Schmucker 2014 detected less coronary vessel disease in smokers compared to nonsmokers in those admitted for STEMI; however, statistically significant post-ban reductions in admissions were only observed in nonsmokers, irrespective of gender and age. Greater reductions were observed in both younger nonsmokers (aged less than 65 years) and in older nonsmokers (65 years and over) in both the first and second years after the ban was introduced. Nonsmokers in the study also included a small number of ex-smokers. Overall, current smokers in the study presented with STEMI at an earlier age (13 years younger) and were otherwise young and healthy people, their only risk factor being smoking. Di Valentino 2015 identified statistically significant reduced STEMI admissions in each of the three years after a ban was introduced, for older patients (up to 65 years), irrespective of gender. Reductions in those aged under 65 years were detected in the first year after the ban. While they noted a dose effect, the authors suggest a biological plausibility, as the results were not transient and the reduction in STEMI admissions in the older age group may include more nonsmokers. Smoking status was not recorded in this study. While the authors observed reductions in men aged 65 years or older in the control canton area (no ban), they did not observe reductions in older women. The observed reductions may have been influenced in the control area by other anti-smoking activities and legislation (Di Valentino 2015).

Outcomes in subgroups

The majority of studies made statistical adjustments for either age, gender, smoking status (where available, Analysis 5.1) or socioeconomic status, and conducted specific sub group analyses.

Head 2012 observed statistically significant reductions in AMI admissions, irrespective of ethnic class. Overall, the greatest reductions in admissions for heart disease following smoking legislation were identified in nonsmokers (Aguero 2013; Barnett 2009; Bonetti 2011; Cronin 2012; Pell 2008; Schmucker 2014; Seo 2007), with Rajkumar 2014 reporting decreased heart rate variability in nonsmokers. Greater reductions in admission were observed among younger age groups (Barone-Adesi 2011; Cesaroni 2008; Di Valentino 2015; Sargent 2012), irrespective of gender (Aguero 2013; Barone-Adesi 2011; Gaudreau 2013; Hurt 2012). Schmucker 2014 observed reductions in nonsmokers, irrespective of age (Analysis 1.1).

Cesaroni 2008 identified a reduction in acute coronary events in 35- to 64-year-olds; the association was significant for men and greater for those living in lower socioeconomic areas compared to higher socioeconomic groups. Liu 2013 observed similar results. Barnett 2009 identified significant reductions in men, and those aged 55 to 74 years, but living in more affluent areas (quintile 2), with increases in admissions for younger women. The greatest decrease in admissions was seen in never-smokers. Among younger never-smokers (30 to 54 years) there was a statistically significant increase in AMI admissions (Barnett 2009). While Kent 2012, Roberts 2012 and McGhee 2014 detected statistically significant reductions in admissions after adjusting for age, Aguero 2013 detected significant reductions particularly in women and in people aged 65 to 74 years, with former and nonsmokers showing significantly reduced AMI rates. North Carolina 2011 observed reduced admissions, irrespective of gender and in both age groups. Further statistical modelling, using dummy false start dates, found one false date did improve results. Sargent 2012 reported a reduction in AMI rates amongst older age groups and those aged 30 to 68 years, with reduced hospitalization costs observed at one year following the smoking ban. The upper age limit in this study was 105 years and 43.5% of the cohort were retired. Di Valentino 2015 also observed reduced admissions in those aged 65 years and older, irrespective of gender for each year after the ban. A reduction in admissions in younger age groups (under 65 years) was observed in the first

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year after the ban. Barone-Adesi 2011 also observed significant reductions in younger participants.

Hahn 2011 identified a reduction in AMI rates, significantly for women but not for men. The gender differences may be explained by the settings and work place bans in place. Jan 2014 also identified a reduction in AMI rates among women. The impact of a subsequent tax increase on cigarette pricing was associated with a significant reduction in AMI admissions. Liu 2013 identified significant reductions in MI admissions in both genders, after adjusting for deprivation. Significant absolute risk reductions were associated with men living in the most deprived areas compared to those living in either middle-ranked or higher-ranked areas.

Cronin 2012 observed significantly reduced ACS admission rates in men, in smokers and in nonsmokers after the introduction a smoking ban in Ireland. Pell 2008 observed a 14% reduction in admissions in smokers, a 19% reduction in ex-smokers and a 21% reduction in admissions for nonsmokers. They note that of the total reduction in admissions, 67% was attributable to nonsmokers. Greater reductions were observed in men under 55 years and women under 65 years. Christensen 2014 observed significant reductions in AMI admissions; however, they could not explain the difference detected post-ban after adjusting for age and gender and in the absence of diabetes. The authors suggest that a separate national ban on trans-fatty acids may have influenced their study results. Bruintjes 2011 did not detect any significant difference in admissions in Greeley (Colorado, USA) when compared to the control area. However, they observed a significant reduction in AMI admissions amongst smokers when compared to nonsmokers after the introduction of the smoking ban in Greeley.

Stroke outcomes

Six studies detected an association with stroke admissions (Analysis 1.1.2), four studies using a control for comparison (Head 2012; Herman 2011; Loomis 2012; Naiman 2010), and one study using interrupted time series data (Mackay 2013). Juster 2007 used a before-and-after method, reporting significant reductions in AMI admission rates in New York, but not for stroke admissions.

Five studies did provide evidence of significant reductions in stroke admissions following smoking bans. Head 2012, Herman 2011, Loomis 2012 and Naiman 2010 detected significant declines in admissions compared to their control areas.

Mackay 2013 identified increasing admission rates for cerebral infarction in Scotland, prior to the introduction of a smoking ban. Following the ban, and after statistically adjusting for confounders, there was a significant reduction in admissions for cerebral infarction (8.9%), persisting for 20 months following the legislation. No interactions between subgroups were significant after adjustment for confounders (e.g. gender, age, residence or deprivation index).

Respiratory outcomes

We found 21 studies assessing the association between smoking bans and respiratory outcomes, including chronic obstructive pulmonary disease (COPD), asthma and lung function. Eleven studies reported COPD health outcomes: three studies used interrupted time series data (Croghan 2015; Humair 2014; Kent 2012). Six studies used quasi-experimental controlled before-and-after methods (Dusemund 2015; Gaudreau 2013; Hahn 2014; Head 2012; Naiman 2010; Vander Weg 2012); the remaining two studies used an uncontrolled before-and-after design (McGhee 2014; Yildiz 2015). Six of these studies additionally reported asthma health outcomes (Croghan 2015; Gaudreau 2013; Head 2012; Humair 2014; Kent 2012; Yildiz 2015).

Six studies only reported asthma outcomes: Herman 2011; Landers 2014 (controlled before-and-after studies); Mackay 2010; Millett 2013; Roberts 2012 and Sims 2013 (interrupted time series data). Four uncontrolled before-and-after studies identified the impact of smoking bans on specific lung function outcomes (Durham 2011; Goodman 2007; Larsson 2008; Rajkumar 2014).

COPD (Analysis 2.1)

Six studies reported consistent reductions in COPD admissions associated with smoking bans. Dusemund 2015 identified a 22.4% reduction in admissions compared to the control area. Naiman 2010 reported reductions in admissions for COPD post-ban compared to the control areas. Hahn 2014 reported, after adjusting for trends and confounders, that those living in counties with comprehensive smoke-free bans were 22% less likely to be admitted for COPD than those living in counties with weak or no bans. A dose response was associated with smoking bans in place for more than 12 months, resulting in a 21% reduction in admissions. Protective factors identified in the study were being male, aged 45 years to 65 years, and educated at least to secondary level (Hahn 2014).

Head 2012 identified significant differences in non-Hispanic black and white residents in Beaumont compared to the control areas, and identified ethnic differences between both groups of residents. They found significant reductions in admissions for COPD and asthma in non-Hispanic white residents only. Vander Weg 2012 and Humair 2014 observed dose-response associations with lower COPD admissions; at 36 months after smoking legislation when compared to controls, Humair 2014 observed reductions in COPD admissions over the four time periods of the study.

Five studies reported no significant reductions in COPD admissions. Gaudreau 2013 and Yildiz 2015 observed no significant association; Croghan 2015 identified a downward trend in COPD admissions, but this was not significant after adjusting for age and gender. Kent 2012 detected increased admissions for pulmonary diseases in general, with a significant different post-ban for pneumonia rates, but not for COPD. McGhee 2014 also reported increased admissions for bronchitis and respiratory tract infections post-ban, but no associations with COPD admissions.

Asthma (Analysis 2.2)

Seven of the 12 studies reported a significant association between smoking bans and reduced asthma hospitalizations. Sims 2013 observed that a significant reduction for nonsmokers was equivalent to 1900 fewer admissions for each of the first three years of the ban. Consistent reductions in asthma admissions amongst children post-legislation ranged from 12.3% (Millett 2013), through 18.2% (Mackay 2010), up to 22% Herman 2011, whilst Gaudreau 2013 observed no association between the ban and reduced admissions for children or adults. Kent 2012 observed reduced asthma admissions in younger age groups, whilst Mackay 2010 identified increased asthma admissions among children prior to the introduction of smoke-free legislation; admission rates reduced

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in children post ban and these were not significantly different in either the preschool age group or the 5- to 14-year age group.

Croghan 2015 reported a step-change reduction in visits to emergency departments for asthma. After statistical adjustment for potential underlying temporal trends in hospital visits, they observed significant reductions in hospitalization rates both for adults and for children. Millett 2013 also observed increasing admissions amongst children in the year before the ban. Post-ban decreases were significant, even after adjusting for confounders. The authors suggest a reduction of 6802 admissions could be identified in the first three years of the ban.

Head 2012 observed significant reductions in discharge rates among white non-Hispanic residents, but there was no significant difference in discharges for black non-Hispanic residents. Landers 2014 identified significant reductions in admissions for adults of working age and for children after the introduction of county smoking laws. No significant associations were observed following implementation of state laws.

Gaudreau 2013, Humair 2014, Roberts 2012 and Yildiz 2015 did not detect any significant reductions in asthma admissions in adults following smoke-free bans; Roberts 2012 observed an increase in hospitalization rates.

Lung function (Analysis 2.3)

There was evidence of improved lung function with significant reductions in passive smoke exposure reported in hospitality workers following smoking legislation (Durham 2011; Goodman 2007) (Analysis 2.3). These findings are consistent with the evidence in the earlier version of the review. Lung function improved for smokers and nonsmokers (Goodman 2007), with improvements observed in women and older participants (Durham 2011). Larsson 2008 did not observe improvements in lung function post-bans; Rajkumar 2014 reported reduced episodes of coughing.

Inconsistent evidence emerged for COPD outcomes post-ban, but there was more consistent evidence for reduced asthma admissions and reduced passive smoke exposure.

Perinatal outcomes (Analysis 3.1)

Seven studies identified specific perinatal health outcomes (Amaral 2009; Cox 2013; Kabir 2013; Mackay 2012 (using interrupted time series data); Bharadwaj 2012; Page 2012 (controlled before-and-after); Kabir 2009 (uncontrolled before-and-after)). The emerging evidence identifies an association between smoking bans and reductions in active smoking in pregnant women, and consequent reductions in foetal passive smoke exposure. Bharadwaj 2012 and Page 2012 detected significant reductions in maternal smoking compared to their controls.

Cox 2013 and Kabir 2009 identified a reduction in the risk of preterm deliveries after adjusting for confounders. Kabir 2009 observed an increase in the risk of low birth weight, which the authors suggest may reflect secular trends. Bharadwaj 2012 and Kabir 2013 observed a reduction in the risk of low and very low birth weights, while Mackay 2012 detected significant reductions in small-for-gestational-age babies and in rates of preterm delivery among both current and nonsmokers, using a ban date three months prior to implementation. Analyses using the later start date identified an increase in preterm delivery rates following adjustment for pre-eclampsia data.

Amaral 2009 noted that local ordinances were associated with a decrease in very low and low birth weights and an increased gestation period of 0.03 days. A dose-response effect for a more restrictive statewide smoking ban resulted in an increased gestation period for white and higher-educated mothers, and a significant decrease in very low birth weights. For Hispanic mothers in this study, there was a reduction in birth weights of 7.2 grams following the introduction of statewide bans. This is an inverse dose-response effect; the authors suggest the implementation of more restrictive work place smoking bans may have led to increased smoking in the home or greater exposure to secondhand smoke in the home.

Cox 2013 observed a reduced risk of preterm births during a phased introduction of smoking bans. After the 2010 ban, there was a reduction in preterm delivery; however, there were no significant associations between the smoking ban and the risk of low and very low birth weights or small-for-gestation-age. Although Page 2012 observed reduced maternal smoking, there was no significant impact of the ban on perinatal outcomes in comparison with the control area. Page acknowledges that differences in the intervention and control areas may have influenced the outcomes.

Mortality outcomes (Analysis 4.1)

We found 11 studies investigating associations between bans and mortality rates. Five studies used interrupted time series methods (Aguero 2013; Cox 2014; De Korte-De Boer 2012; Jan 2014; Stallings-Smith 2013); two used quasi-experimental controlled before-and-after study designs (Dove 2010; Rodu 2012); and the remaining four studies used uncontrolled before-and-after methods (Hurt 2012; McGhee 2014; Pell 2009; Villalbi 2011).

Aguero 2013; Cox 2014; De Korte-De Boer 2012; Dove 2010; Pell 2009; Rodu 2012; Stallings-Smith 2013; Villalbi 2011 provide evidence of reduced smoking-related mortality (including cardiovascular and respiratory) with consistent, temporal and dose-response associations observed. Dove 2010 and Rodu 2012 observed temporal and consistent reductions in AMI mortality rates when compared to their control areas. Rodu identified significant reductions in mortality, but the changes were not immediate in comparison to the states where no smoking bans were in place. Dove observed a dose response of continued reducing AMI mortality rates in the second year of the ban. Similar trends were reported in Cox 2014. Stallings-Smith 2013 and Stallings-Smith 2014, with a follow-up period of 81 months, observed a 13% reduction in all-cause mortality and a 26% reduction in deaths from ischaemic heart disease (IHD), a 32% reduction in stroke deaths and a 38% reduction in COPD mortality. The 2014 paper identified significant reductions in inequalities in smoking-related mortality. For IHD and COPD, the reductions were strongest in the most deprived tertile. Following the smoking ban in Ireland, a reduction in stroke mortality rates was observed across all socioeconomic groups. Pell 2008 detected a significant dose response associated with higher rates of ACS mortality in nonsmokers who had higher levels of measured cotinine.

Aguero 2013 and Villalbi 2011 identified reduced AMI mortality rates, with Aguero 2013 observing lower rates in women and Villalbi 2011 reporting significant reductions, even after adjusting

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for gender and age. McGhee 2014 observed a reduction in lung cancer diagnoses, although the authors suggest that this change was not attributable to the introduction of the smoking ban. Jan 2014 identified reducing AMI mortality rates in the pre-ban years between 2001 and 2008, but found no significant association post-legislation, in the 2008 to 2010 period. Whilst Hurt 2012 observed a 17% reduction in the incidence of sudden cardiac deaths in the 18-month period post ban, the result was not statistically significant.

Active smoking and reduced secondhand exposure

Twenty-four studies investigate associations between smoking bans and passive and active smoke exposure. Six studies used interrupted time series designs, four used a quasi-experimental controlled before-and-after study design, and 14 are before-and-after studies with no control population (Analysis 5.1). Three studies did not report smoking status data from their main data sets, but accessed smoking prevalence data from national surveys (Cesaroni 2008; Cox 2014; Ferrante 2012).

We found active smoking measures including smoking prevalence, quit rates and tobacco consumption reported in 19 studies (Bajoga 2011; Bharadwaj 2012; Cesaroni 2008; Cox 2014; Federico 2012; Ferrante 2012; Gallus 2007; Gualano 2014; Hahn 2008; Hurt 2012; Jones 2015; Kabir 2009; Klein 2014; Lee 2011; Lemstra 2008; Lippert 2012; Mackay 2011; Mackay 2012; Page 2012). Reduced smoke exposure outcomes are reported in four studies (Durham 2011; Goodman 2007; Pell 2008; Rajkumar 2014). Larsson 2008 includes evidence of both active and secondhand exposures.

Active smoking (Analysis 5.1)

Five studies used ITS methods to analyse national or regional population smoking behaviour (Bajoga 2011 multinational; Federico 2012; Gualano 2014 Italy; Mackay 2011 Scotland; Jones 2015 Scotland and England). Bajoga 2011 covered 13 US states, four Canadian provinces, and four other areas (Republic of Ireland (ROI), Northern Ireland, Scotland, New Zealand). In all but three of these (Ireland, Delaware and New Mexico) there was already a significantly declining smoking prevalence prior to the introduction of smoking bans. After introduction of the bans there was an immediate decline in prevalence in two areas (Washington and ROI) and a faster rate of decline in a further six US states. In the other 13 locations there was no identifiable change in the trend. In Italy, Federico 2012 found some evidence of short-term impact, while the longer period analysed by Gualano 2014 did not detect evidence that the ban had changed the pre-existing rate of decline in prevalence. In Scotland, Mackay 2011 also detected only a short-term impact on prevalence just before the introduction of legislation, before a return to the pre-existing rate of decline. Jones 2015 did not detect an association in either Scotland or England, but in England there were only two data points after the ban.

One study used ITS methods to analyse smoking prevalence among low-income pregnant women in Ohio (Klein 2014). Preconception smoking rates had been stable in the six years prior to the ban, whereas after the ban there was a small but statistically significant reduction in prevalence.

Two studies used a controlled design to analyse population prevalence data: Ferrante 2012 (comparing Sante Fe to Buenos Aires, Argentina) and Hahn 2008 (comparing Fayette County to other counties in the state of Kentucky). Bharadwaj 2012 (Norway) and Page 2012 (Pueblo City, Colorado) (controlled before-and-after studies) reported both active and passive health outcomes. Ferrante 2012 identified a nonsignificant decline in national smoking prevalence rates in Sante Fe compared to the control area, Buenos Aires. They noted more quit attempts in Santa Fe than in Buenos Aires prior to the introduction of smoke-free legislation in Argentina. However, they reported no change in the proportion of daily smokers or the number of cigarettes consumed in either city.

Hahn 2008 identified significant reductions in smoking prevalence after the introduction of bans compared to control counties, even after controlling for seasonality, time trends and demographic characteristics. Bharadwaj 2012 identified reduced active smoking and higher quit rates during pregnancy amongst women working in bars and restaurants compared to women working in other settings with no bans. Page 2012 observed a reduction in maternal smoking in Pueblo when compared to the control area, but no reduction in maternal smoking in Pueblo post-ban. The authors acknowledge that statistically significant differences between the areas at baseline reporting may have influenced the results in Pueblo.

Eight studies used uncontrolled before-and-after methods to measure changes in active smoking: Cesaroni 2008 (Italy); Cox 2014 (Belgium); Gallus 2007 (Italy); Hurt 2012 (Minnesota); Lee 2011 (England); Lippert 2012 (17 US States); Lemstra 2008 (Saskatoon, Canada); Mackay 2012 (Scotland). Active and passive smoking were reported in a further two uncontrolled before-and-after studies: Kabir 2009 (Ireland); Larsson 2008 (Sweden).

While Gallus 2007 did not identify a reduction in smoking in the years prior to the ban, they found evidence of reduced prevalence in the population after the smoking ban was introduced. Kabir 2009 also identified a reduction in Irish maternal smoking rates post-ban and increased smoking cessation prior to pregnancy in 2005. Lee 2011 did not detect significant changes in smoking prevalence trends or in the number of cigarettes smoked per day, after controlling for time and other trends. The study reported significantly reduced smoking in cars and in homes, and increased smoking behaviours outside, with a reduced consumption of cigarettes. Similarly, Larsson 2008 did not detect any significant change in smoking prevalence in a small cohort of hospitality employees, including casino and bingo hall workers, one year following introduction of smoking bans.

Lippert 2012 reported significant reductions in smoking prevalence in 14 of the 17 US states after the introduction of smoking bans. The implementation of smoking bans in this study varied by state, ranging from either a ban in work places, restaurants and bars (Arizona, District of Columbia, Hawaii, Illinois, Iowa, Maryland, Minnesota, New Jersey, Ohio, Puerto Rico, Utah) or restaurants and bars (Colorado, New Hampshire, New Mexico). Pennsylvania had a ban in the work place, and Louisiana and Nevada had bans in work places and restaurants. The follow-up periods ranged from two to four years after the introduction of smoking bans, and reductions in smoking prevalence were noted in all states irrespective of the comprehensiveness of the ban. The highest reduction in smoking prevalence was reported in New Hampshire; Utah was the only state reporting no change in prevalence.

Mackay 2012 detected reduced smoking prevalence after the introduction of a ban, with an increased number of people who reported they had "never smoked". They found a steep decline in smoking in the three months prior to the introduction

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of the ban; however, the association with reduced prevalence was not sustained during the post-ban period. Prescribing of nicotine replacement therapy (NRT) was significantly higher prior to the legislation, with increased quit attempts. Similarly, the associations were not sustained in the post-legislation period. Lemstra 2008 detected reduced smoking and increased quit attempts in Saskatoon after the smoking ban was introduced. The study compared their results with data from the wider state of Saskatchewan and from all of Canada, and reported significant reductions in smoking prevalence in Saskatoon compared to both comparisons areas.

Cesaroni 2008 (Italy), Cox 2014 (Belgium) and Hurt 2012 (Minnesota) all reported reduced smoking prevalence rates after smoking bans were introduced. The evidence was from specific national data sources and not from their respective study data sets. Cox 2014 reported national Belgian health survey data (pre-/post-ban) identifying decreased smoking prevalence and decreasing consumption specifically amongst heavy smokers (more than 20 cigarettes a day). While Hurt 2012 identified reducing trends in smoking prevalence in Minnesota from national data, they found no evidence of significant differences in smoking prevalence from specific study data.

Effects on smoking behaviour in subgroups

A number of studies in Analysis 5.1 included subgroup analyses for a combination of variables, including gender, age and socioeconomic group (Cesaroni 2008; Cox 2014; Federico 2012; Gallus 2007; Gualano 2014; Jones 2015; Kabir 2009; Klein 2014; Lee 2011).

Cox 2014 identified a reduction in national smoking prevalence post-ban for both men and women, with specific evidence for reduced smoking trends in women. Federico 2012 found decreased smoking trends for men and women in the initial post-ban period, but the reductions were not maintained and smoking prevalence rates returned to pre-ban levels, especially amongst those with lower education. Cesaroni 2008 found the association to be statistically significant in men but not women, and observed greater reductions in smoking in residents living in lower socioeconomic areas than those living in higher socioeconomic areas. Gallus 2007 also observed reduced smoking prevalence post-ban, confirming a significant reduction in smoking in men and in those aged 15 to 44 years. Gualano 2014 identified a reduction in smoking prevalence for men and women and a reduction in smoking intensity, and found reduced smoking in younger age groups, irrespective of gender, and lower prevalence rates in older women. Increased smoking trends (prevalence and consumption) were identified in women aged 45 to 64 years, but the evidence was not statistically significant. Overall, reductions in smoking prevalence were not associated with Italian smoke-free legislation after statistical modelling Gualano 2014. Similar results were reported by Jones 2015 who found reduced consumption in men aged 18 to 34 years, but there was no significant reduction in consumption in older women and significantly higher consumption in women aged 35 to 54 years in England compared to Scotland. Evidence of reduced consumption in men aged 55 and older was reported from Scottish data (Jones 2015). The study reported inconclusive findings and limited evidence of an association with smoking prevalence after statistical adjustment.

Klein 2014 reported lower odds of preconceptual smoking amongst low-income women after the introduction of a smoking ban, even after adjusting for multiple confounders including age, income, education, residence and parity. Kabir 2009 found similar reductions in Irish maternal smoking rates after statistical adjustment.

Lee 2011 did not identify evidence of reduced smoking prevalence after adjusting for confounders; however, they detected reduced smoking trends in older respondents, with evidence of higher smoking rates in women and in younger age groups. Significant reductions in active smoking in cars and inside homes were reported in this study, consistent with evidence in Pell 2008.

Reduced secondhand exposure (Analysis 5.2)

Studies identifying specific passive smoke exposure outcomes for this update had to include evidence of health outcomes, which we have presented in previous sections. Four uncontrolled before-and-after studies (Durham 2011 (Switzerland); Goodman 2007 (Ireland); Pell 2008 (Scotland); Rajkumar 2014 (Switzerland)) provided evidence of reduced passive smoke exposure in addition to health outcomes. Larsson 2008 (Sweden) provides evidence for both active smoking and secondhand exposures, using an uncontrolled before-and-after design.

Evidence of reduced passive smoke exposure was detected following the introduction of smoking bans, consistent with evidence from the previous version of the review (Durham 2011; Goodman 2007; Larsson 2008; Rajkumar 2014; Pell 2008) (Analysis 5.2). Health outcomes for these studies are presented in Analysis 2.1 and in Analysis 1.1 for Pell 2008.

DISCUSSION

Legislation restricting or prohibiting smoking in work places and public places is a public health measure at the population level. There were no randomized controlled trials where the intervention was a smoking ban. The predominant study designs evaluating the effectiveness of smoking bans were interrupted time series studies, quasi-experimental before-and-after studies with a control area for comparison, and before-and-after studies with no control area for reference. Three studies used matched areas for comparison of controls (Hahn 2014; Khuder 2007; Seo 2007). While the before-and-after studies with no controls were often unable to control for possible confounders and changes in secular trends over time, the interrupted time series studies used statistical modelling in an attempt to adjust for these effects in analyses. However, because of uncertainty about the underlying trends, some study authors noted that their results were sensitive to the choice of model.

The evidence supports a temporal association between the introduction of national smoke-free bans and subsequent reductions in smoking-related morbidity and mortality. Evidence for smoking bans in improving cardiovascular, respiratory and perinatal health outcomes for both smokers and nonsmokers is persuasive. The evidence in this update identified a dose-response association, with sustained and improved health outcomes over time, specifically cardiovascular. As the period since bans were enacted has lengthened, improvements in health outcomes have increased or have been maintained. Evidence in this review identified improved health outcomes for nonsmokers in relation to cardiovascular and asthma health outcomes and to reduced mortality rates. Evidence of a biologically plausible effect emerged in studies examining STEMI admissions. Schmucker 2014 detected

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reduced STEMI rates for nonsmokers compared to smokers, with identified divergent trends in the incidence of disease observed. Di Valentino 2015 also suggests a biological plausibility, with reduced STEMI admissions in those aged 65 or older; however, smoking status was not reported in this study.

Perinatal outcomes provide evidence of reduced maternal smoking and acknowledged impact on foetal health. Inconsistent evidence emerged for other outcomes, including birth weights. The benefits identified in some studies are consistent with those reported in Been 2014, Jones 2014 and Kelleher 2014; however, the studies in this review do not provide compelling evidence of a clear association between smoke-free legislation and improved perinatal outcomes; we need more evidence to confirm or refute such associations.

Consistent evidence of reduced mortality is reported, with an observed temporal dose-response effect. Statistically significant reductions and downward trends were noted for cardiovascular and respiratory illnesses. Evidence of a reduction in mortality in lower socioeconomic groups is persuasive, especially in Stallings-Smith 2014, given the duration of the study period (81 months).

As in the previous version of this review, inconsistent evidence emerged of the impact of smoking bans on reducing smoking prevalence rates and tobacco consumption.

The studies in this review are heterogeneous in their design, populations and interventions, and we were unable to perform statistical comparisons or meta-analyses. Despite the different study designs, this update provides more methodologically robust studies than those reported in the first version, incorporating large data sets facilitating modelling and regression analyses and adjusting for non-linear trends and confounders. The majority of studies have evaluated comprehensive smoking bans; only 18 studies investigated partial bans. Significant improvements in health outcomes were reported in countries where comprehensive bans were in place and compared to areas with either no ban or partial bans. Since the first version of this review (2010), there has been an increase in countries worldwide implementing national smoke-free bans. The FCTC (WHO 2014) identified an 84% increase in countries implementing smoking policies, and a 61% increase in countries implementing complete smoking bans.

The 2008 MPOWER evidence-based measures include protection from tobacco smoke to reduce tobacco-related morbidity and mortality (WHO 2009; WHO 2013). The results from the original review indicated that introducing legislative smoking bans leads to a reduction in exposure to passive smoke. Key population groups benefiting from the enactment of legislative smoking bans reported in this review include pregnant women and their babies, children and nonsmokers. There is also evidence of improved cardiovascular outcomes for smokers in three studies (Bruintjes 2011; Cronin 2012; Pell 2008).

Socioeconomic gradients indicate that men in lower socioeconomic groups are benefiting from the effect of smoke-free legislation. In the original version of the review, the evidence of the impact for active smoking was unclear but indicated a downward trend. The studies included in this update provide some evidence of reductions in smoking prevalence. However, a number of studies did not detect evidence of a change in prevalence, or change in rate of decline in prevalence, associated with the introduction of bans, irrespective of the population studies. Four studies (Bharadwaj 2012; Kabir 2009; Klein 2014; Mackay 2012) identified declining smoking rates in pregnant women, but this was not borne out for all studies.

Limitations in studies included in this review are the absence of randomised trials. The inevitable reliance on observational data means that we can only identify correlations between the introduction of smoking restrictions, and the health and behavioural outcomes of interest. The studies using national population surveys employed random sampling or stratified sampling techniques. The data sets used in many studies were relatively large and allowed for statistical modelling and adjustment for possible confounders. Small sample sizes are reported in a number of the studies which used volunteer samples recruited within the hospitality sector. A number of studies did not report sample sizes, and individual-level data were not available within large registry data sets, which limited analyses for confounders, e.g. smoking status and comorbidities. Other confounders included increased pricing of cigarettes during study periods, removal of trans-fatty acids in foods, and suspension of bans. These and other factors may have led to changes in health outcomes over the study periods which could not be controlled for in analyses. These may have influenced the reported results. It is possible that some studies that did not detect changes in health outcomes have not been published and are unavailable for inclusion in this review. However, this update includes some studies that did not identify a positive impact of smoking bans. We excluded from this review studies reporting only cotinine biomarkers; studies reporting passive smoke exposure had to include a measured health outcome. This provided a wider body of literature, but there are few studies which verified smoker status. Smoker status was reported in 24 studies in this review, and verified in only four.

From a public health perspective the impact of smoking legislation is to reduce passive smoke exposure and to reduce active smoking. Since first publication of this review in 2010, the evidence is mounting and the concentration of studies clearly identifies reduced passive smoke exposure with associated reductions in morbidity and mortality post-smoking bans. Smoking policies usually comprise multicomponent efforts to tackle smoking cessation as well as the public health objective of reducing exposure to environmental tobacco smoke. Populations exposed to smoking restrictions are likely to be exposed to other interventions. The implementation of comprehensive legislation on smoking will necessitate other tobacco control measures to prepare for its successful implementation, such as increased media awareness, telephone smoking cessation helplines, and smoking cessation support services to ensure awareness, comprehension and support for those affected by it (Callinan 2010). The effectiveness of legislative efforts will also depend on successful enforcement of smoking bans and compliance with the legislation. Other tobacco control measures, such as taxation on tobacco products, limits on advertising and sponsorship, and limits on the sale of tobacco products, may vary between jurisdictions. A comprehensive approach to tobacco control will utilize both individual and population-based intervention strategies, causing difficulties in evaluating the effect of a single intervention such as the smoking ban legislation.

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AUTHORS' CONCLUSIONS

Implications for practice

This updated review identified moderate-quality evidence that countries and their populations benefit from enacting national legislative smoking bans with improved health outcomes from reduced exposures to passive smoke, specifically cardiovascular disease. There was also low-quality evidence of reduced mortality for smoking-related illnesses. The evidence on perinatal and respiratory health outcomes is not consistent, nor is the evidence on potential reductions in tobacco consumption.

Implications for research

We need research on the continued longer-term impact of smoking bans on the health outcomes of specific subgroups of the population, such as young children, disadvantaged and minority groups. More robust research on the impact of smoking bans is warranted, especially in relation to respiratory and perinatal health outcomes. Documenting of active smoking in studies should be more consistent and should use validation methods. Documentation of ex-smokers should include information on previous smoking history and duration of quit times. Robust study designs (including those with a control for comparison) reporting passive smoke exposures and health-related outcomes need to include biological coherence criteria.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Aguero 2013

Methods	Country: Spain Setting: Girona population-based registry Design: Interrupted time series study. Using population-based acute myocardial infarction (AMI) registry (REGICOR) to analyse the impact of smoke-free legislation on AMI incidence and mortality rates, and 28-day case-fatality rates. Analysis: Multivariate regression models
Participants	3703 registered AMI events from January 1 2002 until December 31 2008 on AMI registry. N = 3012 admitted to hospital. N = 891 case fatalities registered Participants aged 35 to 74 years residing in study area
Interventions	Partial smoke-free legislation 2005/28 (2006). Ban on advertising, a reduction in sales outlets and partial smoke-free legislation banning smoking in all indoor public places and work places, but exemptions in hospitality venues
Outcomes	Pre-ban period: 2002 to 2005 Post-ban period 2006 to 2008 Definitions based on ECG findings, symptoms and cardiac biomarkers AMI incidence rates and mortality rates 28-day case-fatality rates. Follow-up: 36 months
Notes	AMI events classified using 2 algorithms from the American Heart Association and European Society of Cardiology and the World Health Organization Monitoring trends and determinants in cardiovascular disease (MONICA) Case finding included all discharges with ICD codes and review of death certificates (out of hospital AMI events) Current smokers defined as persons smoking more than 1 cigarette/day or reported quitting within previous 12 months

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Aguero 2013 *(Continued)*

	Never smoked defined as never smoked or smoked less than 1 cigarette/day

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in population cohort study
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded. Imputation used
Selective reporting (reporting bias)	Low risk	All outcomes relevant to this review reported
Other bias	Unclear risk	No causal relationship with ecological studies. No control group Confounders include: comorbidities, treatment strategies and changes in air quality, other smoking cessation activities No direct observations of SHS exposure Former smokers and nonsmokers grouped as "passive smokers"

Alsever 2009

Methods	Country: USA, Pueblo Setting: Hospital admissions for AMI Design: controlled before-and-after study Intervention: City of Pueblo, Control: Pueblo county outside city limits, El Paso county Analysis: RRs and 95% CI of AMI, Poisson regression model with adjustment for seasonality; Chi^2 to test whether there were significant differences in demographic variables between pre-law and post-law groups
Participants	Total sample records of hospital admissions with a primary diagnosis of AMI admitted to hospital between January 2002 and June 2006. Numbers of fatal AMIs were also gathered. Residence within the city of Pueblo was ascertained with the participant's zip code. Data on AMI hospitalization rates was also obtained in a neighbouring county (El Paso County) during the identical period as a contemporaneous control group No totals
Interventions	Smoke-free air act implementation and enforcement began in July 2003 which banned smoking in work places and all buildings open to the public, including bars, restaurants, bowling alleys and other business establishments within city limits of Pueblo, Colorado (comprehensive)

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Alsever 2009 *(Continued)*

Outcomes	AMI hospitalization rates pre- and post-ban inside, and outside city limits of Pueblo and a neighbouring county (El Paso County); adjustment for seasonality was made Biochemical verification: No. Follow-up: 36 months post-legislation
Notes	Phase 1 study up to 18 months post-ban reported Bartecchi 2006 This paper reports Phase 2 of study up to 36 months post-legislation

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	No total sample size reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No individual-level data available No smoking status or SHS exposure Amended coded data from Colorado Hospital Association noted different periods pre/post ban from earlier publication

Amaral 2009

Methods	County: California, USA Setting: Birth outcomes data from register Design: Interrupted time series Intervention: Smoking ban Analysis: Regression analyses
Participants	California Department for Health Services, Center for Health Statistics, Birth certificate data Study period 1988 to 1999 N = 44,181 births registered
Interventions	Smoke-free ordinances 1988 to 1994

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Amaral 2009 *(Continued)*

	State work place smoking ban January 1995 (partial) Local ordinances varied in adoption between 1988 and 1994
Outcomes	Impact of local and state smoke-free ordinances on foetal development Follow-up: 3 years
Notes	No smoking status reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Unknown
Selective reporting (reporting bias)	Low risk	Expected outcomes relevant to this review reported
Other bias	Unclear risk	No smoking status No SHS exposure data Misclassification Variation in times for adoption of ordinances

Bajoga 2011

Methods	Country: 21 jurisdictions: 13 US states,4 Canadian provinces, 4 countries Republic of Ireland (ROI), Scotland, Northern Ireland, New Zealand Setting: National surveys smoking prevalence Design: Interrupted time series pre- and post-bans Intervention: Comprehensive smoking bans introduced prior to end 2009 Analysis: Parsimonious segmented regression modelling for each jurisdiction
Participants	National health surveys completed either monthly or annually per jurisdiction. Adults aged ≥ 18 years in all areas with exception of: New Brunswick and ROI (≥ 15 years), Northern Ireland and Scotland (≥ 16 years) Multiple sample sizes per jurisdiction up to 23,000 (per data collection)

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Bajoga 2011 *(Continued)*

Interventions	Comprehensive smoke-free bans implemented prior to end 2009: Northern Ireland, Republic of Ireland, Scotland, New Zealand, Arizona, Colorado, District of Columbia, Hawaii, Maine, Massachusetts, New Jersey, New Mexico, New York, Ohio, Rhode Island, Washington, New Brunswick, Nova Scotia, Ontario, Quebec
Outcomes	Impact of smoke-free legislation on smoking prevalence and number of cigarettes smoked Follow-up: not provided (multiple data collection points before and after legislation)
Notes	Smoking defined as smoking at least 100 cigarettes and now smoke every day or some day Self-reported smoking status No biochemical validation Used power calculations for modelling Regression analyses adjusted for secular changes and trends

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Uses nationally representative population surveys of randomly selected samples
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Specific sample size not reported. Samples range from 1000 to 23,000
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	Unclear risk	Self-reported smoking status Confounders of other antismoking measures, but analyses adjusted for secular changes and trends In majority of jurisdictions, work place smoking bans previously in place and may have influenced results The effect of a comprehensive smoke-free policy on quitting may be reduced Larger declines in prevalence may be in jurisdictions where work place bans not in place or recently introduced Statistical regression models may have lacked statistical power to detect small changes

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Barnett 2009

Methods	Country: New Zealand Setting: Public hospital AMI admission database Design: Interrupted time series Study Analysis: Poisson regression analyses
Participants	6928 AMI admissions recorded. A final data set identified 3079 participants registered first admission for AMI (excluded all repeat admissions, admissions from outside Christchurch city and 89 admissions without geo-coding information) Pre-ban period: January 2003 to November 2004 Post-ban period: January 2005 to December 2006 Pre-ban period: 1580 participants Post-ban period: 1499 participants Participants stratified by gender and into 3 age groups: 30 to 54 years, 55 to 74 years, ≥ 75 years
Interventions	Intervention: Smoke Free Environments Act 2003 implemented December 2004 Act extended previous 1990 restrictions which had banned indoor smoking in most work places and shops and banned smoking in half of seating in restaurants. The new legislation 2004 applied a ban on all indoor smoking in all work places including bars and restaurants (comprehensive)
Outcomes	Poisson regression analysis used to identify significant difference in rate of first AMI admissions before and after legislation for each of the three age groups. Self reported smoking status on admission Follow up:24 months post legislation
Notes	AMI admissions classified using ICD Principal Diagnosis Codes 121.0 - 122.9. Census Area Unit Data enabled socioeconomic area profile and deprivation indexing. This registry was used to obtain estimates of denominator populations of current, ex-smokers and never smokers Age/sex data for the Christchurch Urban Area was accessed from Statistics New Zealand using 2006 census

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in uncontrolled cross-sectional studies
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias)	Low risk	Attrition low as all data recorded

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Barnett 2009 *(Continued)*
All outcomes

Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No control group No individual-level data Confounders include long-term secular trends, statin prescriptions, reduced winter mortality or changed dietary trends or smoking cessation practices Unclear bias of new diagnostic criteria 2003 acute coronary events Misclassification of data Self-reported smoking status from different data source. No biochemical verification No individual-level data on socioeconomic status or risk factors including obesity

Barone-Adesi 2011

Methods	Country: Italy Setting: National Hospital Discharge Database for 20 Italian regions Design: Interrupted time series study Monthly time series 2002 to November 2006 Analysis: Mixed regression modelling
Participants	936,519 hospital admissions recorded for acute coronary events Pre-ban period: 564,832 events Post-ban period: 371,687 events Participants stratified by gender and into 2 age groups: < 70 years; ≥ 70 years
Interventions	Intervention: Smoke-free legislation 10th January 2005 Act extended previous restrictions 1975 and 1995. New legislation banned smoking in all indoor public places including cafes, bars, restaurants and discos
Outcomes	Pre-ban period: January 2002 to December 2004 Post-ban period: January 2005 to November 2006 Follow-up: 23 months post-legislation Poisson regression analysis used to identify significant difference in rate ratios for acute coronary admissions before and after legislation
Notes	No smoking status AMI admissions classified using ICD Principal Diagnosis codes

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Barone-Adesi 2011 *(Continued)*

	Mixed effects regression modelling used with fixed coefficients for national trend reporting; random coefficients reported for region-specific deviations Population data obtained from National Statistics Office Seasonal variations included in statistical modelling

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No control group No smoking status or SHS recorded Not individual-level data Adjusted for seasonality

Barr 2012

Methods	Country: USA, 9 states: Illinois, Ohio, Minnesota, New York, Washington, New Jersey, Arizona, Massachusetts, Delaware Setting: Hospital admissions for AMI during 1999 to 2008 from Medicare enrollees registered on National Claims History Files for 387 counties across 9 states Design: Interrupted time series study Monthly hospitalization rates constructed for each county. Minimum of 12 months data pre- and post-legislation Analysis: Poisson regression
Participants	64,000 annual admissions for AMI recorded from 1st January 1999 to 31st December 2008 for 387 counties N = 640,000 over 10-year period
Interventions	Intervention: Comprehensive smoke-free legislation enacted across 9 states:

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Barr 2012 *(Continued)*

	Illinois, Ohio, Minnesota, New York, Washington, New Jersey, Arizona, Massachusetts, Delaware
Outcomes	Poisson regression analysis used to identify difference in rate ratios for acute coronary admissions before and after legislation Statistically significant results in hospital admissions for AMI were found when strict linearity of secular trends of AMI admission rates was assumed. The effect was attenuated to zero under relaxation of assumptions No significant results identified following non-linear adjustments for secular trends Follow-up:12 months post-legislation for each area
Notes	AMI admissions classified using ICD Principal Diagnosis codes Poisson regression modelling used. Adjustment for demographic and seasonal and secular trends in admission rates. State-level modelling with county-specific random effects used to estimate change in AMI admission rates

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No control group Adjusted for secular trends

Basel 2014

Methods	Country: USA Setting: Colorado hospital admissions for AMI 1st January 2000 to 31st March 2008 Design: Interrupted time series study Analyses: Poisson regression analyses
Participants	58,339 unique admissions for AMI recorded from 1st January 2000 to 31st March 2008

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Basel 2014 *(Continued)*

Interventions	Intervention: Comprehensive smoke-free legislation 1st July 2006. Colorado statewide Clean Indoor Air Act
Outcomes	Poisson regression analysis to identify differences in monthly AMI admissions post-legislation No significant reduction in AMI rates observed post-legislation Results identified a steep decline in AMI rates 2000 to 2005 prior to legislation. 2 smaller communities in Colorado previously enacted smoke-free legislation and identified 27% reduction in AMI hospitalizations (Bruintjes 2011) Follow-up: 20 months
Notes	AMI admissions classified using ICD Principal Diagnosis codes Secondary diagnoses of AMI excluded to enhance diagnostic accuracy Poisson regression modelling used to fit time series for AMI monthly admissions. Adjusted models for secular trends, seasonal trends and post-ordinance effect Adjusted for 11 local smoke-free ordinances

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No control group Confounders include: smoking status Unclear bias for changes in smoking prevalence and health policy Only non-fatal AMI hospitalizations included. Sudden cardiac death from ventricular arrhythmia in community settings not included Analyses and model adjustments for 11 strict local smoke-free ordinances were enacted prior to the statewide ordinance

Bharadwaj 2012

Methods	Country: Norway

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Bharadwaj 2012 *(Continued)*

	Setting: National birth records registry Design: Controlled before-and-after study Treatment group: Mothers working in bars and restaurants Comparison: Mothers on birth register not employed in bars and restaurants (no ban) Analysis: Descriptive and regression analyses
Participants	Pregnancy data registry 1967 to 2006 Treatment group: Mothers working in bars and restaurants Comparison: Mothers on birth register not employed in bars and restaurants No totals
Interventions	Smoking ban 1st June 2004 extended to include bars and restaurants
Outcomes	Low birth weights/pre-term births in mothers who work in bars and restaurants post-legislation Reduction in self-reported smoking Follow-up: 24 months
Notes	Low birth weights defined 1000, 1500, 2000, 2500 grams Pre-term prior to 36 weeks gestation Self-reported smoking status

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	No total sample size reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	High risk	Misclassification Self-reported smoking status Follow-up period post-ban adjusted 5 months and 9 months Mothers switched occupation during study period

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Bharadwaj 2012 *(Continued)*

	Occupational codes assigned when missing

Bonetti 2011

Methods	Country: Switzerland, Canton Graubünden Control: Canton Lucerne Setting: Hospital AMI admission database Design: Controlled before-and-after study Monthly time series 1st March 2006 to 28th February 2010 4 time periods reported: Pre-ban: 1st March 2006 to February 2007 Pre-ban: 1st March 2007 to 28th February 2008 Post-ban: 1st March 2008 to 28th February 2009 Post-ban: 1st March 2009 to 28th February 2010 Analysis: Pearson's correlation tests, 2 x 2 tables
Participants	Control: AMI and unstable angina in Switzerland (AMIS Plus) Register accessed for Lucerne Canton (established 1st January 2007) for 3 study periods 842 AMI admissions in Graubünden recorded during 4 time periods 830 AMI admissions in Lucerne recorded 1st March 2007 to 28th February 2010 Pre-ban period Graubünden: 471 participants; post-ban period Graubünden: 371 participants Pre-ban period Lucerne: 227 participants; post-ban period Lucerne: 603 participants
Interventions	Intervention: Smoke-free legislation 1st March 2008 in Graubünden (partial) National smoke-free legislation introduced 1st May 2010 Details of smoke-free legislation not included
Outcomes	Comparison of AMI cases between 4 time periods reviewed Participants stratified by gender and smoking status Pearson's correlation test used to assess the relationship between monthly AMI and ambient air pollution Effects of comorbidities, previous AMI and modelling air pollution and lipid-lowering medications included in statistical modelling Follow-up:12 and 24 months
Notes	Data on sales of lipid-lowering drugs used Outdoor air pollution and concentrations of particulate matter measured monthly Self-reported smoking status
Risk of bias	

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Bonetti 2011 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Small population area with relatively low numbers of AMI cases AMIS Plus registry in Lucerne may not include all AMI cases as participation is voluntary. Hospital is only tertiary centre Confounder: Increased sales of lipid-lowering therapy; same increased sales recorded in Lucerne Statistical adjusting for air pollution, lipid-lowering prescriptions used Self-reported smoking status

Bruckman 2011

Methods	Country: Ohio, USA Setting: De-identified data from Ohio Hospital Association reporting monthly hospital discharges for AMI 2004 to 2009 Design: Interrupted time series Analysis: Mixed linear modelling, adjusting for age and gender
Participants	All hospital discharges post-AMI recorded on Ohio Hospital Association Register pre- and post-legislation Total population and included sample unknown
Interventions	work place smoking ban enacted May 2007 covering all work and public places
Outcomes	Reduction in AMI discharges post-legislation Follow-up: 24 months
Notes	No smoking status ICD codes used for diagnosis
Risk of bias	

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Bruckman 2011 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design
Allocation concealment (selection bias)	High risk	All events registered on Ohio database. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Not clear as only modelling data reported. Total population unknown. Age group analysis not presented
Selective reporting (reporting bias)	Low risk	Modelling data reported
Other bias	Unclear risk	Smoking status not recorded SHS exposure not reported Age-adjusted data rates on monthly basis presented No individual-level data Comorbidities not reported

Bruintjes 2011

Methods	Country: Greeley, Colorado and surrounding area, USA Setting: Colorado hospital admissions for AMI July 2002 to June 2006 Design: Controlled before-and-after study Control areas: Outside city area Analysis: Poisson regression models
Participants	706 unique admissions for AMI recorded in Greeley, analysis available on 482; and 224 admissions (control) within adjacent (comparison) zip code area
Interventions	Colorado statewide Clean Indoor Air Act. December 2003. Banned smoking in all places of public assembly including restaurants, bars, bowling alleys and bingo halls. Banned smoking outdoor public gathering places where seating provided 17 months pre-ban and 31 months post-ban
Outcomes	Poisson regression analysis used to identify differences in AMI admissions post-legislation
Notes	AMI admissions classified using ICD Principal Diagnosis codes Adjusted models for seasonal trends Self-reported smoking status

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Bruintjes 2011 *(Continued)*

	Legal challenge to local ordinance until November 2004

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Analysis on 482 admissions in Greeley and 224 in comparison area
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	High risk	Data extracted from hospital records Used of zip codes could lead to misclassification of exposure Not a true control population No causal relationship Confounders (comorbidities, obesity, physical activity) and secular trends not adjusted for in analysis Self-reported smoking Variable ordinance compliance during legal challenge period

Cesaroni 2008

Methods	Country: Italy, Rome Setting: Acute coronary events: hospital admissions and out-of-hospital events Design: Uncontrolled before-and-after study. Age-standardised rates of hospital admissions for acute coronary event from 2000 to 2005 in Rome. Population of Rome is denominator and the number of daily episodes is the dependent variable Analysis: Poisson regression analysis used to evaluate changes over time and relative rate (RR) and 95% CI of acute coronary events after the ban with those occurring before implementation of the ban
Participants	Residents of Rome registered on 1 hospital discharge database and regional register Survey participants: Age: ≥ 15 yrs for region of Rome in 2000 - 2003 & 2005 People admitted to hospital for acute coronary events (out-of-hospital deaths and hospital admissions) between 2000 and 2005. Age: 35 - 84 yrs Pre-ban N = 11,939

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Cesaroni 2008 *(Continued)*

	Post-ban N = 2136 Follow-up: 12 months
Interventions	Legislation implemented in Italy on January 10th, 2005 which prohibits smoking in indoor public places including bars, restaurants, cafes unless they have a separate smoking area with continuous floor-to-ceiling walls and a ventilation system
Outcomes	Smoking prevalence as measured by self-reported smoking status from secondary data source. Age-standardised rates of acute coronary events annually, stratified prior to analysis by age categories 35 - 64 yrs, 65 - 74 yrs, 75 - 84 yrs for 2000 to 2005 Acute coronary event defined as AMI and other acute and subacute forms of Ischaemic heart disease, ICD-9, Code 411. Myocardial infarction defined as all diagnoses with principle diagnosis of AMI (ICD-9-CM code 410) or a secondary diagnosis of AMI where principal diagnosis indicated AMI complications
Notes	ICD codes used for principal diagnosis 2 events within 28 days of each other defined as single episode Adjusted analysis for time trend and all-cause hospitalization rates as well as subgroup analysis carried out for age, gender, socioeconomic status, type of event (out-of-hospital, hospital, only incident case-no admission for acute coronary event in the previous 4 yrs). National Institute of Statistics health surveys before and after the ban Data on cigarette sales in Rome 2003 to 2005 Italian National Health Institute Data on smoking habits in region of Rome accessed from National Institute of Statistics Census information used for socioeconomic analyses

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Ecological study and no control Possible confounders are that measurement of troponin as a new diagnostic criterion for AMI became available in hospitals in Rome during the study period Misclassification

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Cesaroni 2008 *(Continued)*

	There was an increase in daily dose of cardiac medication such as statins from 10 to 55 per 1000 residents when this study was carried out Other outcomes are economic impact as measured from cigarette sales in Rome, air quality by average concentrations of PM_{10}, temperature and flu epidemics No individual level of data smoking status or SHS exposure pre- or post-legislation; population statistics provided

Christensen 2014

Methods	Country: Denmark Setting: National patient registry data for all hospital admissions for AMI Design: Interrupted time series study Pre-ban 1st September 2002 to 31st August 2007 Post-ban 1st September 2007 to 31st August 2009 Analysis: Poisson regression modelling estimating relative rates of AMI admissions during study period
Participants	109,094 AMI admissions during study period on national patient registry Data on type 2 diabetes obtained from National Diabetes Register Excluded participants aged < 30 years Age analysed in 3 categories : 30 - 49 years, 50 - 69 years, and 70 years and older
Interventions	Legislative smoking ban introduced 15th August 2007. All indoor smoking banned in public places, exceptions in pubs and bars under 40 m^2 where no food served, private schools, one-person offices and psychiatric wards
Outcomes	Change in AMI admissions during study period Adjusted for age and gender Adjusted for type 2 diabetes Follow-up: 24 months
Notes	AMI definition eliminated repeated admissions within 28-day period Seasonal differences accounted for in study No smoking status

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered.

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Christensen 2014 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Ecological study design increases risk of confounding No control population Confounders including socioeconomic status, flu and pollution No individual-level data available including body mass index, smoking status National Diabetes Register does not distinguish between type 1 and type 2 diabetes. Age limit minimises the inclusion of cases with type 1 diabetes May under estimate type 2 diabetes 2004 legislation banning industrially produced trans-fatty acids in foods Increase in statin prescribing during study period from 35 users / 1000 inhabitants (2003) to 98 users / 1000 (2009) Antismoking campaigning during study period Exceptions in ban may impact on results and ban not enforced Socialising culture of homes is common and smoking not banned in homes Publication bias

Cox 2013

Methods	Country: Belgium Setting: Registered on Perinatal Epidemiology Database. Rates of spontaneous and overall preterm births Design: Interrupted time series over 10 years: January 2002 to December 2011. Pre-ban: January 2002 to December 2005 1st post-ban: 1st January 2006 2nd post-ban: 1st January 2007 3rd post-ban: 1st January 2010 * comprehensive smoking ban Analysis: Regression analyses
Participants	Registered on Perinatal Epidemiology Database Data limited to singleton, live born infants delivered 24 - 44 weeks gestation

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Cox 2013 *(Continued)*

	Total deliveries 631,794 registered. 24,917 excluded as did not meet inclusion criteria: sample 606,877 Total spontaneous deliveries 448,520
Interventions	Intervention: Partial smoke-free legislation introduced 1st January 2006 and 1st January 2007 Comprehensive smoke-free legislation introduced 1st January 2010 Pre-ban period January 2002 to December 2005
Outcomes	Impact of smoke-free legislation on rate of preterm births. Step change in risk of spontaneous preterm delivery. Changes observed could not be explained by personal factors including age, sex, maternal age, socioeconomic status, time-related factors or population-related factors including pollution, air temperature, influenza No effect of smoking ban on risk of low birth weight or small for gestational age, nor on birth weight Study shows consistent pattern of reduction in risk of preterm delivery following smoke-free legislation. Findings are not definitive, but support public health benefits of smoking legislation from early life Follow-up: 48 months
Notes	Preterm delivery defined as gestational age below 37 weeks Small for gestational age was defined as a birth weight below the 10th centile for the gestational age and sex of the baby Low birth weight was defined as below 2500 g Data on education and national origin of mothers available from 2009 and used in sensitivity analysis National data on influenza epidemics, temperature and humidity, particulate matter and air quality obtained

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design
Allocation concealment (selection bias)	High risk	All events registered on national database. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Possibility of unmeasured confounders, however, statistical modelling accounted for all known confounders No individual smoking status recorded

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Cox 2013 *(Continued)*

	Birth records did not contain data on known risk factors for preterm births (maternal weight, occupational, marital status, psychosocial stressors, nutrition)

Cox 2014

Methods	Country: Flanders, Belgium Setting: Study of Flemish Agency for Care and Health registry data on AMI deaths Design: Interrupted time series Study Pre-ban: 2000 to 2005 Post-ban: 2006 to 2009 Analysis: Segmented Poisson regression analyses
Participants	AMI deaths recorded for people aged ≥ 30 years during 2000 to 2009 Residents of Flanders. N = 38,992
Interventions	Smoke-free ban (partial) January 2006: public places and most work places (phase 1) January 2007: extended to restaurants (phase 2)
Outcomes	Impact of stepwise smoke-free legislation on AMI mortality rates Follow-up: 3 years
Notes	ICD definition for principal diagnosis AMI on national registry No smoking status data available Flemish population data used Mean daily air temperature recordings from Belgian Royal Meterological Institute Mean daily particulate matter concentrations from Belgian Inter-regional Environmental Agency Weekly influenza rates obtained from National Influenza Centre

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design
Allocation concealment (selection bias)	High risk	All events registered on national database. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable

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Cox 2014 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Possibility of unmeasured confounders, however, statistical modelling accounted for all known confounders No individual smoking status recorded Ecological study design with no controls

Croghan 2015

Methods	Country: Olmsted County, Minnesota, USA Setting: All ED visits during study period for primary diagnosis of COPD or asthma Design: Interrupted time series study Analysis: Poisson regression analysis
Participants	1st January 2005 to 31st December 2009 5293 ED visits for COPD 5906 ED visits asthma Adult age > 18 years and children < 18 years included
Interventions	Smoke-free law passed 16 May 2007 in all work places including bars and restaurants. Smoke-free law enacted 1 October 2007
Outcomes	Reduction in admissions pre- and post-ban for COPD and asthma Poisson segmented regression analyses for age and sex. Adjusted modelling for linear trends prior to legislation and step-change modelling post-legislation. Follow-up: 26 months
Notes	ED visits classified using ICD codes Multiple visits included for individuals Temporal trends in ED visits, age and sex adjusted for in analyses No smoking status recorded Linkage of medical records through Rochester Epidemiology project

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design

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Croghan 2015 *(Continued)*

Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Ambulatory ED visits only Hospital admissions from other local hospitals not included Confounder of other tobacco control effects including reduction in sales, increase in smoke-free homes, marketing and tobacco cessation activities in state Smoking status not recorded

Cronin 2012

Methods	Country: Ireland Setting: Admissions for ACS in counties Cork and Kerry collected on Coronary Heart Attack Ireland Register (CHAIR) Design: Interrupted time series study Data collection: March 2003 to March 2007 Pre-ban: 29th March 2003 to 28th March 2004 Post-ban: 29th March 2004 to 28th March 2008 (3 years) Analysis: Poisson regression modelling
Participants	Aged ≥ 18 years Smoker defined as patient who smoked ≥ 1 cigarette/week Patients with discharge diagnosis of ST-elevated MI, non ST-elevated MI or unstable angina included Pre-ban total admissions: 1216 Post-ban 2004 to 2005: 1069 Post-ban 2005 to 2006: 1065 Post-ban 2006 to 2007: 927 Follow-up: 24 months
Interventions	Intervention: Comprehensive smoke-free legislation 29th March 2004

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Cronin 2012 *(Continued)*

Outcomes	Poisson regression analyses used to model numbers of ACS events post-legislation Reduction in ACS admissions compared pre- and post-legislation Sensitivity analyses undertaken by gender, smoking status and type of ACS. Impact of time examined using local cubic polynomial
Notes	Sensitivity analyses undertaken by gender, smoking status and type of ACS. Impact of time examined using local cubic polynomial

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No individual-level data. Unit of analysis was admission for ACS and not individual patient

De Korte-De Boer 2012

Methods	Country: Limberg, Netherlands Setting: Weekly incidence data on sudden cardiac arrest from ambulance registry South Limberg Design: Interrupted time series Pre-ban 1 January 2002 to 1 January 2004 1st post-ban 1 January 2004 to 1 July 2008 2nd post-ban 1 July 2008 to 1 May 2010 Analysis: Poisson regression analysis
Participants	2305 sudden cardiac arrest cases recorded Participants aged between 20 and 75 years
Interventions	General work place smoking ban 1st January 2004

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De Korte-De Boer 2012 *(Continued)*

	Included hospitality sector from 1st July 2008 (catering, sports and cultural sectors)
Outcomes	Reduction in incidence of out-of-hospital sudden cardiac arrest post-2004 and -2008 bans Poisson regression analysis adjusted for population size, temperature, air pollution and influenza rates Follow-up: 24 months and 48 months
Notes	Data on register prospectively collected from ambulance dispatch records Definition of sudden cardiac death: unexpected, non-traumatic loss of vital signs without preceding complaints within 24 hrs of onset of complaints Excluded: people with cardiac symptoms > 24 hrs, people of unknown age, people < 20 years or > 75 years, people with terminal chronic disease or after traumatic event or intoxication Consensus with researchers to agree inclusion

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Inclusion criteria aged 20 to 75 years, excluded on basis of diagnosis or trauma Definition for inclusion and consensus required No control population Used routine collected data and therefore no individual information on smoking status or exposure to SHS Small population size

Di Valentino 2015

Methods	Country: Canton of Ticino, Switzerland Setting: Hospital discharge data STEMI in Canton Ticino Control: Canton of Basel

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Di Valentino 2015 *(Continued)*

	Design: Controlled before-and-after study Analysis: Incidence of admissions, descriptive statistics, Poisson regression
Participants	Retrospective data collection for all patients discharged following STEMI (survivors and non-survivors) during study periods Ticino: Pre-ban: April 2004 to March 2007, N = 968 Post-ban: April 2007 to March 2010, N = 765 Control Basel: Pre-ban: April 2005 to March 2007, N = 287 Post-ban: April 2007 to March 2010, N = 385
Interventions	Public smoking ban Canton of Ticino 12th April 2007 (partial)
Outcomes	Effect of smoking legislation on incidence of STEMI in Ticino compared to Basel
Notes	Ticino smoking ban introduced 12th April 2007. No reduction in age for sales to minors Basel smoking ban introduced 1st May 2010 (national ban). Introduced legislation restricting sales of cigarettes to minors 2007 and 2009 (< 18 yrs). Advertising laws introduced ICD codes used for diagnosis

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No individual-level data on smoking status, cardiovascular risk or socioeconomic status Small sample size No control for air pollution, epidemics or holidays Secular trends not controlled Out-of-hospital STEMI deaths not considered

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Di Valentino 2015 *(Continued)*

	Only residents of 2 cantons included
	Other legislation in control area

Dove 2010

Methods	Country: Massachusetts, USA
	Setting: US census data of vital records and statistics. AMI deaths
	Design: Controlled before-and-after study
	Intervention group: 290 cities and towns with no smoking bans before state ban 2004
	Control: 61 cities and towns with previous smoking bans (pre-2004)
	Analysis: Poisson regression data
Participants	AMI deaths 1999 to 2006
	Participants residing in Massachusetts
	26,982 deaths recorded
Interventions	Comprehensive state smoking legislation July 2004. Banning smoking in physical environments, restaurants, bars, municipal buildings and publicly accessible spaces and all work places not accessed by public
Outcomes	Reduction in AMI mortality rates
	Follow-up: 24 months
Notes	ICD codes used
	Adjusted for seasonality, influenza
	No smoking status

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported

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Dove 2010 *(Continued)*

Other bias	Unclear risk	Misclassification as person could have lived in smoke-free area and worked in Massachusetts Death certificate information not verified with medical records May overrepresent AMI deaths No smoking history available No SHS exposure data

Durham 2011

Methods	Country: Canton of Vaud, Switzerland Setting: Hospitality workers Design: Cohort (prospective) study Intervention group: Smoking ban in public places in canton of Vaud Analysis: Descriptive statistics, Fishers exact test, longitudinal modelling
Participants	Employees in hospitality sector employed 30th April 2009 to 10th September 2009 Baseline: 105 participants Follow-up 1 year: 66 participants
Interventions	Smoking ban Canton of Vaud September 2009 (partial)
Outcomes	Reduction in ETS exposure in hospitality workers following smoke-free legislation in restaurants, bars, tearooms and discotheques ETS exposure measured using personal monitors Physiological respiratory data measurements and lung function via spirometry SF6 Health outcomes short form Smoking status BMI Follow-up: 1 year
Notes	Participants measured spirometry at start and end of shift, but only end point considered for analysis Physiological respiratory data used to calculate number of cigarettes inhaled or cigarette equivalents during exposure through personal monitoring Lung function testing completed Never-smoker defined as never having smoked at least 20 packs of cigarettes (360 g of tobacco) in life-time Ex-smoker defined as having quit smoking at least 6 months before study enrolment Biochemical validation of exposure

Risk of bias

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Durham 2011 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Attrition rate high
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	High risk	Self-reported smoking status Voluntary enrolment and non-random selection of venues Small study Attrition rate high in follow-up of smokers, younger participants and women

Dusemund 2015

Methods	Country: Graubünden, Switzerland Control: Rest of Switzerland (without Ticino) Setting: Admissions for acute exacerbated COPD Design: Controlled before-and-after study Analysis: Poisson regression analysis
Participants	National database of hospital admissions 1st March 2003 to 28th February 2010 Pre-ban (Canton): 1st March 2003 to February 2008 Post-ban (Graubünden and other cantons): 1st March 2008 to February 2009 and March 2009 to February 2010 Residents of Graubünden Pre-ban N = 946 Post-ban (March 2008 to Feb 2009) N = 172 Post-ban (March 2009 to Feb 2010) N = 127 Control (rest of Switzerland) Pre-ban N = 24,665

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Dusemund 2015 *(Continued)*

	Post-bans: March 2008 to Feb 2009: N = 5077; March 2009 to February 2010: N = 4435
Interventions	Smoking ban Graubünden 1st March 2008 (affecting public buildings, restaurants, bars and cafes) (partial) National no-smoking ban 1st May 2010
Outcomes	Reduction in admission for acute exacerbated COPD admissions Follow-up: 24 months following local ordinance
Notes	ICD code for primary diagnosis Rest of Switzerland excluded Ticino with ban

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Reported totals
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Only hospitalized cases included Misclassification of data Smoking status and SHS exposure not available Population-level data Other cantons in Switzerland implemented different smoking bans 2009 National ban 1 May 2010

Federico 2012

Methods	Country: Italy Setting: 11 Population Health Survey data sets Design: Interrupted time series study Pre-ban: 1999 to 2005

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Federico 2012 *(Continued)*

	Post-ban: 2005 to 2010 Analysis: Linear regression and time series modelling
Participants	11 yearly surveys “Aspects of everyday life” National Institute of Statistics 1999 to 2010 Large representative samples of non-institutionalised population and independent samples drawn for annual surveys In each household, data on all members included Analyses stratified by sex and age, socioeconomic status Adults aged 20 to 64 years 1999: 34,953 2000: 36,639 2001 – March 2002: 32,949 2002: 34,330 2003: 33,389 2004: 19,488 2005: 30,321 2006: 29,696 February–March 2007 29 131 February – March 2008: 29,360 March 2009: 28,979 March 2010: 29,342
Interventions	Comprehensive legislation implemented in Italy on January 10th 2005 which prohibits smoking in in-door public places including bars, restaurants, cafes unless they have a separate smoking area with continuous floor-to-ceiling walls and a ventilation system
Outcomes	Effect of smoking legislation on smoking prevalence, quit ratio (prevalence of former smoking among ever-smokers) and number of cigarettes smoked Additional analyses on aged 20 to 24 years to identify if ban had stronger impact on young people Follow-up: 5 years
Notes	No "Aspects of everyday life survey" data available in 2004. For this year, data from Health interview Survey used Weights provided by ISTAT used to adjust prevalence rates and means Self-reported smoking status No biochemical validation

Risk of bias

Bias	Authors' judgement	Support for judgement

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Federico 2012 *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Study uses data from national health surveys which used randomly selected samples of the population
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Outcome data reported
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	Unclear risk	Cross-sectional surveys Self-reported smoking data Seasonal variation in smokers' behaviours may have influenced results Data 2004 is different from other 10 surveys used Increases in price of cigarettes from 1999 to 2010: A 65% increase and largest increases in price noted between 2003 and 2005. However number of cigs smoked did not show any change during this period Other antismoking campaign measures

Ferrante 2012

Methods	Country: Santa Fe, Argentina Comparison: Buenos Aires City Setting: ACS hospital admissions in Santa Fe province and Buenos Aires city January 2004 to December 2008 Design: Controlled before-and-after study using time series data Analysis: Descriptive analysis and multiple linear regression analysis
Participants	Public hospital admissions for ACS compiled by National Department of Health Information and Statistics Aged 18 years and older Sante Fe, N= 6320 Buenos Aires, N=8425
Interventions	Santa Fe: Comprehensive smoking ban enacted August 2006 Buenos Aires City: Partial smoking ban with designated indoor smoking areas in bars and restaurants enacted October 2006

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Ferrante 2012 *(Continued)*

Outcomes	Reduction in ACS admissions Impact of 100% ban Follow-up: 28 months
Notes	Only public hospital data included and only represents ⅓ of population No individual-level data No smoking status data. Prevalence reported from national survey figures

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No individual-level data Only represents ⅓ of population

Gallus 2007

Methods	Country: Italy Setting: Italian population surveys Design: Uncontrolled before-and-after study (2004, 2005, 2006) Analysis: Total percent prevalence of current smokers
Participants	Representative multistage sampling of adults from 147 municipalities Baseline sample (2004): 3535 respondents. Women: 1836 (52%) 2005 sample: 3114 respondents. Women: 1603 (51.4%) 2006 sample: 3039 respondents. Women: 1578 (52%) Age: ≥ 15 years
Interventions	Legislation implemented in Italy on January 10th 2005 which prohibits smoking in indoor public places including bars, restaurants, cafes unless they have a separate smoking area with continuous floor-to-ceiling walls and a ventilation system (Law n. 3)
Outcomes	Self-reported smoking status and mean number of cigarettes consumed per day

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Gallus 2007 *(Continued)*

	Follow-up: 2 years
Notes	Biochemical verification: No Other outcomes reported are support for economic impact

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Study uses large population surveys that report random sampling
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Totals reported
Selective reporting (reporting bias)	Unclear risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No validation of smoking status Cross-sectional surveys None reported

Gasparrini 2009

Methods	Country: Tuscany, Italy Setting: Acute Myocardial Infarction Registry of Tuscany Design: Interrupted time series study Pre-ban: 2000 to 2004 Post-ban: 2005 Analysis: Descriptive statistics, linear regression and time series modelling
Participants	All incident cases of AMI due to mortality or hospitalizations calculated from Registry Population aged 30 to 64 years included Age and sex distributions from Tuscany Regional Mortality Registry Pre-ban: 13,456 (2000 to 2004) Post-ban: 2190 (2005)

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Gasparrini 2009 *(Continued)*

Interventions	Comprehensive legislation implemented in Italy on January 10th 2005 which prohibits smoking in indoor public places including bars, restaurants, cafes unless they have a separate smoking area with continuous floor-to-ceiling walls and a ventilation system (Law n. 3)
Outcomes	Effect of smoking legislation on incidence of AMI Follow-up: 12 months
Notes	Cases occurring in same individual within 28 days recorded as 1 event Cases occurring in same individual more than 28 days apart were recorded as separate events Adjusted for seasonality, time trends linear and non-linear ICD codes used

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	None reported

Gaudreau 2013

Methods	Country: Prince Edward Island, Canada Setting: Hospital admission rates for cardiovascular and respiratory conditions Design: Controlled before-and-after study using time series data Intervention: Prince Edward Island Control: Province of New Brunswick Pre-ban: 1st April 1995 to 31st December 2003 Post-ban: June 1st 2003 to 31st December 2008 Analysis: Descriptive statistics, linear regression and monthly time series modelling. ARIMA models

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Gaudreau 2013 *(Continued)*

Participants	All hospital admissions Prince Edward Island access from National Discharge Database. 1st April 1995 to 31st December 2008 for 3 cardiovascular conditions (AMI , angina, stroke) and 2 respiratory conditions (COPD and adult and paediatric asthma) COPD and cardiovascular conditions restricted admission to 35 years and older Asthma admissions restricted to aged 15 years and younger for paediatric rates Control admissions for New Brunswick and for control conditions appendicitis, pancreatitis, bowel obstruction: participants aged 35 years and older No totals
Interventions	Comprehensive smoke-free law 1st June 2003. Law banned smoking in public places with exemptions for smoking rooms 1st July 2006 amendments introduced by Prince Edward Island banning smoking on school grounds
Outcomes	Effect of smoking legislation on admission rates Age and sex adjustments Follow-up: 24 months
Notes	Cases occurring in same individual within 28 days recorded as 1 event Cases occurring in same individual more than 28 days apart were recorded as separate events New Brunswick introduced smoke free law 1st October 2004 New Brunswick selected as similar population, climate and pollution Validated patient registry accessed. Population rates from national census ICD codes used

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Total sample not reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported.
Other bias	High risk	Ban changed during post-ban period Environmental data not included

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Gaudreau 2013 *(Continued)*

	Misclassification of residence: Fredericton enacted smoke-free law 1 month after Prince Edward Island and represented 11.1% of control province No adjustment for confounders comorbidities, smoking status, SHS exposure, exercise

Goodman 2007

Methods	Country: Dublin, Ireland Setting: Dublin pubs Design: Cohort study Analysis: McNemar's test for changes in responses using Chi^2. Pulmonary function tests used the paired-sample t test
Participants	Recruited bar workers from 1100 trade union members. Women: 20% 81 volunteer participants, Women: None 75 participated pre- and post-law, 2 participants excluded as their smoking status changed 73 participants (90%) included for analysis. Mean age: 47.9 yrs (range: 22 - 68 yrs). Smoking status: 8/73 (11%) current smokers, 34/73 (47%) never-smokers, 31/73 (42%) ex-smokers
Interventions	Evaluated the effect of Public Health (Tobacco) Act 2002 in Ireland which implemented prohibition on smoking in indoor work places including bars and restaurants in March 29th 2004 (comprehensive)
Outcomes	Study period data collection: Pre-ban September 2003 to March 2004 Post-ban September 2004 to March 2005 Exposure to SHS (air quality) assessed pre-ban in 42 selected pubs October 2003 to March 2004 42 pubs assessment post-ban 1 year later Self-reported exposure to SHS in the work place as defined by number of hrs exposed in the work place and total hrs exposed Self-reported respiratory and sensory irritant symptoms Pulmonary function tests Biochemical verification: Yes; exposure to SHS measured by saliva cotinine and exhaled CO Follow-up: 1 year
Notes	Barworkers recruited through their trade union and participation was voluntary. Other outcomes reported are support for the ban, air quality as well as compliance with the ban by observations of smoking pre- and 1 yr post-law 2 participants changed smoking status during study and were excluded from analysis No women

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Volunteer participants
Allocation concealment (selection bias)	High risk	Volunteer participants. No allocation as pre- and post-ban

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Goodman 2007 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	None
Incomplete outcome data (attrition bias) All outcomes	Low risk	Participant attrition rate low in small sample size. Benzene levels completed post-ban in 26 of 42 public houses
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	High risk	Volunteer participants Small sample size Self-reported health outcomes No women included

Gualano 2014

Methods	Country: Italy Setting: Population smoking prevalence Design: Interrupted time series study Analysis: Descriptive statistics, Poisson regression models, time series analysis, expected annual percentage change
Participants	Annual survey from National Institute of Health and Mario Negri Institute for Pharmacological Research and Italian Cancer League 2001 to 2013 More than 3000 adults aged ≥ 15 years
Interventions	Comprehensive legislation implemented in Italy on January 10th 2005 which prohibits smoking in indoor public places including bars, restaurants, cafes unless they have a separate smoking area with continuous floor-to-ceiling walls and a ventilation system (Sirchia Law)
Outcomes	Effect of smoking legislation on smoking prevalence and daily consumption of cigarettes Follow-up: 8 years
Notes	Self-reported smoking status No biochemical validation 2009 was peak recession in Italy

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Study uses nationally representative population health surveys using random sampling

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Gualano 2014 *(Continued)*

Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	No total sample size reported
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	High risk	Self-reported data Aggregate data – not individual level Ecological study Bias in survey Lack of recall 2009 peak period in national recession and increased smoking may be due to stress

Hahn 2008

Methods	Country: Fayette County, Kentucky, USA Setting: Population surveys of smoking prevalence Design: Controlled before-and-after study (Behavioral Risk Factor Surveillance Survey) from 2001 - 2005 using stratified random sampling and telephone questionnaire Intervention: Fayette County Control: (matched) 30 counties with similar demographics which did not have smoking legislation Analysis: Smoking behaviour assessed pre-law period (January 2001 - April 2004) and post-law period (May 2004 - December 2005). Counties ranked for each demographic variable. Data weights are adjusted prior to analysis. Logistic regression estimates from the model to compare smoking rates between intervention and control groups. Regression coefficient, Wald χ^2
Participants	Total sample: 10,413 respondents. men and women, age ≥ 18 yrs. Fayette County: Education (% of adults aged ≥ 25 yrs with a high school diploma) 85.8%, Income (median annual household income) USD 39,813, smoking rate: 26.1% 30 control counties: Education (% of adults aged ≥ 25 yrs with a high school diploma) 79.3%, Income (median annual household income): USD 40,390, smoking rate: 27.9% Pre-law: 7139 respondents. Fayette County: 579 (8.1%). Control counties: 6560 (91.9%) Post-law : 3274 respondents. Fayette County: 281 (8.6%). Control counties: 2993 (91.4%)
Interventions	Implementation of a smoking policy which banned smoking in all public places including bars, restaurants, bingo parlours, pool halls and public areas of hotels/motels in April 2004 in Lexington-Fayette County, Kentucky

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Hahn 2008 *(Continued)*

Outcomes	Smoking prevalence as measured by self-reported smoking status. Current smokers defined as smoking on "some days", "every day", and having smoked at least 100 cigarettes in their lifetime. nonsmoker defined as former and never smokers Follow-up: 1 year up to 19 months
Notes	Biochemical verification: No Self-reported smoking status Analyses controlling for seasonality, time (continuous variable to control for secular trends) and respondents' age, gender, ethnicity and education, marital status and household income In the period after implementing smoke-free ordinance, no change was reported in activities relating to smoking cessation, media campaigns or discounts for medications to quit smoking in Fayette County

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Stratified random sampling telephone surveys
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Limitation as data from 1 county with ban Could not control for secular trends at county level Self-reported smoking status Controls chosen from 112 countries. No different to Lexington Cross-sectional telephone surveys used Recall bias

Hahn 2011

Methods	Country: Lexington-Fayette County, Kentucky, USA Setting: Hospital admissions for AMI Design: Interrupted time series

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Hahn 2011 *(Continued)*

	Analysis: Poisson regression analyses
Participants	Registered on Lexington-Fayette County hospital billing records Resident in Lexington-Fayette County Aged ≥ 35 years Study period 1 January 2001 to 31 December 2006 ICD coding on discharge used Pre-ban 40 months data and 32 months post-legislation. N = 2692 AMI hospitalizations Pre-ban: N = 1564 Post-ban: N =1128
Interventions	Implementation of a policy which banned smoking in all public places including bars, restaurants, bingo parlours, pool halls and public areas of hotels/motels in April 2004 in Lexington-Fayette County, Kentucky (comprehensive)
Outcomes	Primary outcome: Impact of smoke-free legislation on AMI admissions Follow-up:32 months post-legislation
Notes	ICD coding used for diagnosis Diagnosis at discharge recorded Kentucky is a rich tobacco-growing state

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Misclassification of data Smoking status not available SHS exposure data not included

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Hahn 2011 *(Continued)*

	No control group
	Race/ethnicity data not available
	Underestimation of AMI cases due to migration of workers
	Not all work places covered

Hahn 2014

Methods	Country: , Kentucky, USA
	Setting: Hospital discharges for COPD
	Design: Controlled before-and-after study
	Control: counties with smoking policy < 12 months or no ban
	Analysis: Chi^2 analyses
Participants	Secondary analysis of hospital discharges for primary diagnosis COPD in all Kentucky hospitals
	Resident in Kentucky: 120 counties in state classified into 58 regions using system from University of Kentucky Markey Cancer Control Program and College of Public Health
	Aged 45 years and older
	Study period 1 July 2003 to 30 June 2011
	ICD coding on discharge used
	Length of stay codes: < 24 hrs = 0.5 day
	Age groups for regression analyses: 45 to 64 years, 65 to 84 years, ≥ 85 years
	N = 146,218 residents discharged during study period
Interventions	Smoke-free bans in state at county level, 2004, 2008, 2011. Smoking ban enacted at various times during period (1 year minimum pre-/post-ordinance)
Outcomes	Primary outcome: Impact of smoke-free legislation on COPD admissions
	Effect of duration of ban on COPD admissions
	Follow-up: 1 year after each phase
Notes	ICD coding used for diagnosis
	De-identified records
	Kentucky Center for Smoke-free Ordinances accessed for ordinance dates
	Analysis used to ensure 1 year minimum pre-/post-local ordinances
	Geographic pooling used in analysis where admission rates were low
	Coded types of smoking policies: city, county level
	Census data used from Behavioral Risk Factor Surveillance System to estimate population, quit attempts
	Adjusted for secular trends

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Hahn 2014 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	High risk	Small counties with fewer hospitalizations grouped together in analyses Not all cases of COPD in state may have been included if patients died before hospital admission or residents may have been admitted to hospital in another state Includes readmissions – unable to link cases No smoking status at individual level. Uses national data for quit Air quality data unavailable Enforcement of legislation may not be consistent Reclassified smoke-free counties even if only a city ban and not entire county (Table 2 in paper)

Head 2012

Methods	Country: Beaumont City, Texas, USA Setting: Hospital discharge rates smoking-related diseases Control: Tyler, Texas Control: All Texas Design: Controlled before-and-after study Pre-ban: July 2004 to June 2006 Post-ban: July 2006 to June 2008 Analysis: Descriptive data and risk ratios
Participants	Hospital admissions in residents of Beaumont pre-/post-legislation compared to Tyler and then all Texas

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Head 2012 *(Continued)*

	3 hospitals Tyler 2 Hospitals Beaumont No totals or sample sizes
Interventions	Smoking ban June 2006 smoking prohibited in all public places including work places, restaurants and bars
Outcomes	Discharge data compared for AMI, stroke, transient ischaemic attack, COPD and asthma admissions Racial disparities assessed Follow-up: 24 months post-legislation
Notes	ICD codes used Texas Inpatient Discharge Register accessed Includes estimates of smoking prevalence data from BRFSS Texas Zip code address used All-Texas rates not limited to residents Population demographic data from census

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Total sample size not reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Misclassification Smoking status reported from other data source SHS exposure unknown Individual data not available Impact of hurricanes in 2005 on residents Change in referral patterns, admissions

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Herman 2011

Methods	Country: Arizona, USA Setting: Hospital monthly discharge data for AMI, angina, stroke and asthma Design: Controlled before-and-after study Comparison with 10 no-ban counties in Arizona Comparison with 5 counties with indoor work site smoking bans (Coconino, Maricopa, Santa Cruz, Pima, Yavapai) Analysis: Poisson regression analysis
Participants	Discharge data from 87 hospitals in Arizona reporting to Arizona Department of Health Services Residents 1 January 2004 to 31 May 2008 with primary diagnoses as coded No totals
Interventions	Statewide smoking ban 1 May 2007
Outcomes	Effect of smoking legislation on admissions for AMI, angina, stroke and asthma Comparison: Discharges for appendicitis, kidney stones, acute cholecystitis and ulcers Follow-up: 12 months post-legislation
Notes	ICD codes used for diagnosis Adjusted models for seasonality and admission trends Estimated cost savings June 2008 data not included as patients were not discharged No age or sex adjustments possible as no population data available

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Total sample size not reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported.
Other bias	Unclear risk	Generalizability limited

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Herman 2011 *(Continued)*

	No age or sex adjusted
	No smoking status or SHS exposure data
	Differences in rates reflect urban rural divide

Humair 2014

Methods	Country: Geneva, Switzerland Setting: University hospital admissions in Geneva Design: Interrupted time series study Analysis: Poisson regression data
Participants	Patients aged 16 years and older admitted 1st July 2006 and 31st December 2010 in 1 hospital in Geneva 5 primary diagnoses: • Acute coronary syndrome (90% of admissions for acute coronary syndrome) • Cerebrovascular diseases • COPD • Pneumonia or influenza • Asthma N = 5345 patients included
Interventions	Legislative smoking ban in Canton Geneva 1 July 2008 banning smoking in public places 3 months later law cancelled Supreme Court 2nd ban applied 30th October 2009 Pre-ban: 2 years to July 2008 Post-ban: 3 month period July to October 2008 Suspended ban period: 1st October 2008 to 31st October 2009 Post-ban 30th October 2009 to 31st December 2010
Outcomes	Reduction in respiratory and cardiac admissions post-smoking ban Follow-up: 12 months post-legislation after suspension period
Notes	ICD codes used 1st hospital stay recorded Transient Ischaemic attack definition changed 2009 and transient Ischaemica attack and Ischaemic stroke diagnoses were combined into 1 category

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable

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Humair 2014 *(Continued)*

Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported. Patients admitted included
Other bias	High risk	Quarter of patients had residence outside of Canton of Geneva Smoking ban voluntary basis during suspended ban period Single hospital data Misclassification of data Outpatient data not included (impacts on asthma and pneumonia data) Ambulatory patients excluded No smoking status or SHS exposures

Hurt 2012

Methods	Country: Olmsted County, Minnesota, USA Setting: Data from Rochester Epidemiology Project during study period for primary diagnosis of MI and sudden cardiac death Design: Uncontrolled before-and-after study. 18 months pre- and post- (each ordinance) observational study Analysis: Poisson regression analysis
Participants	Rochester Epidemiology register. Patients admitted for MI and residents identified from death certificates with diagnosis of SCD Used BRFSS for self-reported smoking, hypertension, diabetes mellitus and hypercholestaeremia and obesity (2000 to 2010) 717 incident cases of MI 514 cases of SCD recorded
Interventions	Smoke-free ordinance 1 (restaurant ban) 2002 Smoke-free law 2 (all work places including bars passed May 2007) Smoke-free law enacted 1 October 2007 (comprehensive)
Outcomes	Impact of legislation on MI and SCD

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Hurt 2012 *(Continued)*

	Follow-up: 18 months post-legislation
Notes	Data extraction from notes First MI included SCD deaths defined and classified on death certificates ICD codes used for diagnosis - validated by biomarkers Smoking status reported SCD defined as out-of-hospital deaths assigned to ICD code Death certificates accessed

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate low as all data recorded
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Misclassification of data on register or death certificates Missing data - imputed scores Self reported smoking status No SHS exposure data Other campaigns / activities for smoking cessation

Jan 2014

Methods	Country: Panama Setting: Hospital admission rates for AMI Design: Interrupted time series study 1st January 2006 to 31st December 2010 Analysis: Poisson regression analyses and ARIMA

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Jan 2014 *(Continued)*

Participants	Chart review of patients admitted to 13 regional public hospitals and from 3 largest private hospitals in Panama. Patients included: • Admitted January 2006 and December 2010 • Aged ≥ 30 years • Permanent residents or citizens of Panama • Primary diagnosis of AMI and all of its subclassifications Pre-ban: 1 January 2006 to April 2008 Post-ban 1: May 2008 – April 2009 Post-ban 2: May 2009 to November 2009 Post-tobacco tax: December 2009 to December 2010 N = 2191 AMI cases National Cancer institute data used to estimate annual percentage change and trends in MI deaths January 2001 to December 2012
Interventions	Legislative smoking ban May 2008. The law banned smoking in all public places and private institutions, in closed working and domestic spaces, and in all public places with the exception of areas where high flow of air circulation. Tobacco Tax November 2009
Outcomes	Reduction in AMI admissions post-smoking ban and impact of tax increase Trends in MI deaths Follow-up: 31 months post-smoke-free legislation
Notes	2009 legislation increased tobacco tax and price of cigarettes increased from USD 1.84 to USD 4.20 Temperature and PM_{10} data and ozone data accessed ICD codes used for diagnosis AMI diagnostic criteria: ECG change compatible with AMI and abnormal cardiac biomarkers

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate low as all data recorded

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Jan 2014 *(Continued)*

Selective reporting (reporting bias)	Low risk	Not all hospital records could be accessed as diagnostic blood test results unavailable Cases that died prior to admission were excluded
Other bias	Unclear risk	Reported smoking prevalence from other data sources in Discussion Confounders include other antismoking legislation Retrospective data

Jones 2015

Methods	Country: England and Scotland Setting: Population smoking prevalence surveys Design: Controlled before-and-after study (using Interrupted time series data) Control: England and Scotland each used as control during analyses Analysis: Difference in difference 2-way fixed-effect modelling, Poisson models, Hausman tests for fixed-effect estimators
Participants	Active smoking data from British Household survey panels. Annual surveys Wave 15 pre-ban in Scotland Wave 16 post-ban Scotland England data used as control Wave 16 is pre-ban England and wave 17 post-ban England 18 waves of surveys (pooled data) 1991 to 2009 Wave 1 5500 private households/10,264 individuals Age 16 years and older Scotland prevalence total. Men N = 22,210; Women N = 24,752 England 1-year impact totals. Men N = 24,552; Women N = 24,559
Interventions	Smoking banned in all enclosed public places in Scotland and England Smoke-free legislation Scotland 26 March 2006 Smoke-free legislation England 1st July 2007
Outcomes	Impact of smoke-free legislation on active smoking Follow-up: 2 years (England), 3 years (Scotland)
Notes	Before 1999, wave 9, Scottish individuals only sampled if resided south of Caledonian Canal Defined half-packet cigarettes = 5 cigarettes Analysis used Scotland or England as control for each area

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Jones 2015 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Study uses data sets from large nationally representative population surveys in both countries which both use multistage sampling techniques
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Unknown
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	Unclear risk	No validation Self-reported smoking Survey data could indicate occasional smoker cigarettes consumption. Recorded as zero Analysis with data included and excluded Tax changes in cigarette prices over duration of survey 1999 to 2009

Juster 2007

Methods	Country: New York, USA Setting: New York State hospital admissions for AMI and stroke Design: Uncontrolled before-and-after study Analysis: Linear regression model to adjust for the effects of pre-existing smoking restrictions, seasonal trends, differences across counties, and secular trends
Participants	Study period: January 1995 to December 2004 Total sample (baseline and follow-up): Monthly hospital admissions for AMI and stroke - residents of New York state Accessed New York State Department of Health Register for all non-federal public and private inpatient admissions 62 counties Aged ≥ 35 years Principal primary diagnosis at discharge data N = 7440 total observations
Interventions	Comprehensive smoking ban implemented in New York state in 2003. Ban prohibited smoking in all work places including restaurants and bars

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Juster 2007 *(Continued)*

Outcomes	Impact of legislation on hospital admission rates for AMI and stroke Direct healthcare costs. Follow-up: 12 months post-legislation
Notes	Biochemical verification: No ICD codes used Used population census data for age adjustments

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Misclassification of data Smoking status not available SHS exposure data not included No individual-level data available including confounders including comorbidities

Kabir 2009

Methods	Country: Ireland Setting: Maternity hospital Design: Uncontrolled before and after study Analysis: Multivariate logistic regression
Participants	Singleton live births recorded on clinical database Pre ban 2003 n=7593 Post ban 2005 n=7648

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Kabir 2009 *(Continued)*

Interventions	Comprehensive smoke free legislation Ireland March 2004
Outcomes	Impact of smoking legislation on maternal smoking rates, mean birth weights, low birth weight (LBW) and pre term births Follow up: 9 months post legislation
Notes	One maternity hospital annual births>7800 Gestational age based on ultrasound examination. LBW defined as those weighting less than 2.5kg Preterm babies classified if born before 37 weeks. Self report smoking status

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomisation not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	SHS exposure in home or work place during pregnancy unknown No causality as cross sectional study Confounding despite adjusting in regression analyses Misclassification of data Self report smoking status No information on pre-eclampsia

Kabir 2013

Methods	Country: Ireland Setting: Maternity hospitals Design: Interrupted time series study

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Kabir 2013 *(Continued)*

	Analysis: Mixed models using Durbin Watson statistic, random intercept and fixed effect
Participants	Singleton live births recorded on National Perinatal Reporting System Register January 1999 to December 2008: N = 588,997 Individual-level data obtained for all national births in 10-year period Pre-ban January 1999 to April 2004 Post-ban May 2004 to December 2008
Interventions	Smoke-free legislation March 2004
Outcomes	Impact of smoking legislation on small-for-gestation-age Follow-up: 55 months post-legislation
Notes	Month of conception unknown Exact dates of births were not available to study Smoking data available from 1 maternity hospital 2000 to 2008 Preterm babies classified if born before 37 weeks Self-reported smoking status Gestation weight estimated on previous study using global reference: foetal weight and birth weight percentile

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Retrospective study Confounding Linkage of smoking data from 1 hospital only Self-reported smoking status

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Kent 2012

Methods	Country: Ireland Setting: ED hospital admissions for pulmonary, cardiac and cerebrovascular diseases Design: Interrupted time series study Analysis: Poisson regression analyses
Participants	Patients aged 20 to 70 years registered on Hospital Inpatient Data Register Diagnoses: acute respiratory, cardiac and cerebrovascular diseases (stroke and transient ischaemic attack), acute coronary syndrome (MI and unstable angina) . Pulmonary diagnoses: exacerbation COPD, pneumonia, lower respiratory tract infection, exacerbations of asthma and spontaneous pneumothorax Pre-ban 2002 to 2003 N = 72,975 Post-ban 2005 to 2006 N = 70,021
Interventions	Comprehensive smoke-free legislation, Ireland, March 2004
Outcomes	Impact of smoke-free legislation on pulmonary, cardiac and cerebrovascular admissions Age adjusted models for each diagnosis for ages 20 and 69 years Follow-up: 24 months post-legislation
Notes	ICD diagnostic codes used Census data used for population estimates National data on influenza incidence obtained Air quality data obtained from Irish Meteorological Service for temperature, rainfall Atmospheric particulate matter data obtained from Irish Environmental Protection Society and European Environmental Agency

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Unknown

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Kent 2012 *(Continued)*

Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Misclassification bias Smoking status not reported SHS exposure unknown Individual data not available

Khuder 2007

Methods	Country: Bowling Green, Ohio, USA Matched control city: Kent, Ohio Setting: Hospital discharge data for CHD admissions Design: Controlled before-and-after study using time series data Analysis: Mantel-Haenszel. Chi^2 test. ARIMA intervention time series analysis was used to model the monthly distribution of hospital admissions
Participants	Total sample admissions to hospitals with primary diagnosis for smoking-related diseases Accessed data from Health Resources and Services Administration Register Residents of both cities 6-year time period 1999 to 2004 and January to June 2005 Aged ≥ 18 years CHD admissions: angina, heart failure, atherosclerosis, AMI No totals
Interventions	Clean indoor air ordinance banning smoking in work places and public places implemented in March 2002 in Bowling Green, Ohio. Partial
Outcomes	Monthly admission rates for coronary heart disease and non-smoking-related admissions Follow-up: 36 months post-legislation
Notes	Population census data used for estimates ICD codes used for principal diagnosis Biochemical verification: No Analysis of ban from October 2002

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Randomization not applicable

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Khuder 2007 *(Continued)*

Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	No blinding possible
Incomplete outcome data (attrition bias) All outcomes	High risk	Total sample size not reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No individual-level data No smoking status No measure of exposure to SHS Control city 150 miles away but may have been influenced by media Confounders unknown including diet, exercise Greater number of black population in Kent (control)

Klein 2014

Methods	Country: Ohio, USA Setting: Pregnancy Nutrition Surveillance System (PNSS). CDC database monitors birth outcome in low-income pregnant women who participate in federally-funded public health programmes Design: Interrupted time series Analysis: Spline regression analyses
Participants	Cross-sectional sample of mothers (pregnant and post partum) who gave birth March 2002 to December 2009 (ITS) Total N = 543,718 Excluded mothers without post partum record, missing, incomplete records, gestational age < 20 weeks or > 44 weeks all excluded. Records with missing smoking status excluded Final N = 483,911
Interventions	Work place smoking ban enacted May 2007
Outcomes	Reduction in preconceptual smoking rates Follow-up: 24 months post-legislation
Notes	Self-reported smoking status Data collected during prenatal and post partum clinics and submitted to CDC quarterly Smoking defined as smoking at any point during the 3 months before pregnancy, recorded at initial clinic visit

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Klein 2014 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable in study design
Allocation concealment (selection bias)	High risk	All events registered on Ohio database. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Excluded cases due to incomplete or missing data
Selective reporting (reporting bias)	Low risk	All expected outcomes reported
Other bias	Unclear risk	Smoking status self reported for women on pregnancy register No individual-level data Comorbidities not reported Changes in cigarette tax during period from 0.24 to 1.25 – significant P < 0.001 Misclassification of data Income not an element for registration to PNSS post-2007, increases in records with no poverty data reported Missing data = 6.3% of cases

Landers 2014

Methods	Country: 12 States: Arizona, Colorado, Florida, Hawaii, Iowa, Maryland, New Jersey, New York, Rhode Island, Utah, Vermont, Washington, USA Setting: Hospital discharges for asthma Design: Controlled before-and-after study Intervention: State smoke-free legislation 5 Control states: Arkansas, Kentucky, Michigan, South Carolina, Wisconsin Control: appendicitis admissions Analysis: Descriptive and multivariate analysis, difference in difference modelling
Participants	Data from Health Costs Utilization Project register 2002 to 2009. Hospital inpatient discharges at state level for asthma Children and working adults included

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Landers 2014 *(Continued)*

	American Non smokers Rights foundation Smoke-Free Laws database. Provides list of states, counties with smoke-free law data. Up to 2011
	No totals
Interventions	Smoke-free legislation enacted
	Arizona May 2007
	Colorado July 2006
	Florida July 2003
	Hawaii November 2006
	Iowa July 2008
	Maryland February 2008
	New Jersey April 2006
	New York July 2003
	Rhode Island May 2005
	Utah May 2006
	Vermont September 2005
	Washington December 2005
Outcomes	Impact of smoke-free legislation (state, county or city) on adult and child asthma discharges
	Follow-up: 2 years up to 6 years
Notes	12 states included with smoke-free laws up to April 2011
	5 states controls as no smoke-free legislation
	States included had to be registered on Health Costs Utilization Project register
	Represents 35% of US population
	12 quarters of data pre-, during and post-laws accessed per state
	Difference in difference modelling reduced possibility of temporal precedence

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not applicable
Allocation concealment (selection bias)	High risk	Selected states intervention or control. Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias)	High risk	Total sample size not reported

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Landers 2014 *(Continued)*
All outcomes

Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	High risk	Exposure to SHS unknown Individual smoking status unknown Laws enacted various time Controlled for state effects, state taxes, seasonality, county-level factors

Larsson 2008

Methods	Country: Sweden Setting: Bingo halls, casino, bars and restaurants in 9 Swedish communities Design: Cohort study, 1 month pre- and 12 months follow-up post-legislation Analysis: Total sample. Chi^2 test to test statistical significance of participant characteristics and test for trend for changes in tobacco consumption.Change in symptoms between pre- and post- using XT-logit logistic regression Paired-sample t-test to compare pre- and post- pulmonary function tests as well as linear regression analysis, adjusting for gender, age and height, and smokers excluded from analysis
Participants	Pre-ban 91 employees volunteered. Women: 70%, Smoker: 26%, Gaming workers: 41%, Other hospitality workers: 59%, Spirometry: 99%, Urine cotinine: 79% Post-ban 71 employees (79%). Women: 70%, Smoker: 20%, Gaming workers: 38%, Other hospitality workers: 62%, Spirometry: 94%, Urine cotinine: 79%. Attrition: 21.97% 71 participated in pre- and post-ban surveys. Criteria for inclusion: must be employed in bars, restaurants, casinos, nightclubs or bingo halls in venues where smoking was allowed before implementation of the legislation and employees who work a minimum of 3 consecutive days per wk. Smokers and nonsmokers included
Interventions	Smoke-free work place legislation in Sweden extended to include bars and restaurants on the 1st June 2005
Outcomes	Self-reported exposure to SHS over the previous 7 days Self-reported number of cigarettes consumed by smokers Self-reported respiratory and sensory symptoms Measurements of lung function: FVC and FEV_1, excluding smokers Biochemical verification: Yes. Smoking status verified by urinary cotinine Follow-up: 12 months post-legislation
Notes	Other outcomes measured are attitudes such as support for the legislation and air quality. nonsmokers wore nicotine samplers Attended 1 of 9 pulmonary function clinics for spirometry

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Volunteer sample

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Larsson 2008 *(Continued)*

Allocation concealment (selection bias)	High risk	Volunteer sample
Blinding of participants and personnel (performance bias) All outcomes	High risk	None
Incomplete outcome data (attrition bias) All outcomes	High risk	21.97% attrition
Selective reporting (reporting bias)	Low risk	Home smoke exposure data not presented
Other bias	High risk	Small sample size Self-reported data supported by biochemical verification 30% sample men Urinary cotinine level calculated for 79% of participants

Lee 2011

Methods	Country: England Setting: Population Health Surveys for England Design: Uncontrolled before-and-after study Analysis: Logistic regression analyses
Participants	Cross-sectional surveys Health Survey for England 2003 to 2008 (pooled data) National Centre for Social Research and University College London General population sampling and sampling from groups of interest (ethnic minorities) and older people Interviewer administered Aged 18 years and older N = 54,333 Response rates 61% to 73% over the period of the surveys
Interventions	Smoke-free legislation 1st July 2007. Smoking banned in all enclosed public places and work places
Outcomes	Impact on smoking behaviours, prevalence, smoking public places and cars Follow-up: 12 months post-legislation
Notes	Power calculation used to detect a 5% relative reduction in smoking prevalence due to legislation Self-reported smoking status No biochemical validation as cotinine measures not available for all of study period

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Lee 2011 *(Continued)*

	1 year post-ban data Adjusted for confounders

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Study uses large nationally representative population surveys that use multi-stage stratified sampling techniques
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Excluded missing data
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	Unclear risk	Excluded age 16 to 18 years as legislation had increased age to purchase to 18 years Only 18 months post-legislation Systematic differences in respondents over time in cross-sectional surveys data Impact on ethnic groups unknown due to small sample size Did not include salivary cotinine measures as not available for all study years Self-reported smoking status SHS exposure unknown

Lemstra 2008

Methods	Country: Saskatoon, Saskatchewan, Canada Setting: Population. Saskatoon and linked to hospital discharge data for AMI Design: Uncontrolled before-and-after population-based cross-sectional surveys Analysis: Paired samples t-test. Stratification used to test for confounding by age, gender and previous MI Analysis of hospital admissions from age-standardised incidence rate of AMI per 100,000 population 4 yrs before the ban and in the follow-up 1 yr post-ban using incidence rate ratio and CI
Participants	Strategic Health and Planning Services in Saskatoon data on all hospital discharges primary diagnosis cardiovascular event.1st July 1996 to 30th June 2005 Participants: Residents of Saskatoon Canadian Community Health Survey data accessed and following recorded randomly selected for changes in smoking prevalence:

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Lemstra 2008 *(Continued)*

	Baseline survey: 1301 respondents in 2003 in Saskatoon Follow-up survey: 1244 respondents in 2005 in Saskatoon July 2005: Saskatoon Health conducted random telephone survey with 1255 adult residents to identify behaviour and attitudes to smoking legislation Stratification used to test for confounders of age, gender and previous MI
Interventions	Legislation implemented on July 1st 2004 in the city of Saskatoon which bans smoking or holding a lit tobacco product in any enclosed public space including outdoor seating areas of restaurants and licensed premises
Outcomes	Smoking prevalence as measured from self-reported survey data. Age-standardised incidence rates of hospital admissions for AMI (using ICD-10 codes) per 100,000 population for 12-month period post-ban from 1st July 2004 to 30th June 2005 was compared with period from 1st July 2000 to June 30th 2004 Follow-up: 12 months post-legislation
Notes	Conversion from ICD-9 to ICD-10 coding occurred in April 2000. Other outcomes measured were compliance with the smoking ban legislation ICD codes for principal diagnosis Biochemical verification: Not for smoking status or exposure to SHS

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Register covered 90% of discharge records. Survey employed random sampling techniques
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All outcomes reported
Selective reporting (reporting bias)	Low risk	Outcomes reported
Other bias	High risk	Ecological study No individual-level data No smoking status or SHS exposure data for AMI data. Smoking prevalence from health survey data Misclassification

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Lippert 2012

Methods	Country: 17 States: Arizona,Colorado, District of Columbia, Hawaii, Illinois, Iowa, Louisiana, Maryland, Minnesota, Nevada, New Hampshire, New Jersey, New Mexico, Ohio, Pennsylvania, Puerto Rico, Utah, USA Setting: Population survey data on cardiovascular outcomes Design: Uncontrolled before-and-after studies Intervention: State Clean Indoor Air legislation Analysis: Z tests to test for differences in proportions
Participants	Data from BRFSS CDC telephone survey data sets in year prior to each state 350,000 adults interviewed yearly in each US state Adults aged ≥ 18 years Clean Indoor Air Act (CIAA) implementation 17 states included Arizona 2007, Colorado 2006, District of Columbia 2007, Hawaii 2006, Illinois 2008, Iowa 2008, Louisiana 2007, Maryland 2008, Minnesota 2007, Nevada 2006, New Hampshire 2007, New Jersey 2006, New Mexico 2007, Ohio 2006, Pennsylvania 2008, Puerto Rico 2007, Utah 2006 **17 States/ Territories** CHD prevalence: Pre-ban N = 6213, post-ban N = 7008 AMI prevalence: Pre-ban N = 5805, post-ban N = 6886 Current smokers: Pre-ban N = 20,140, post-ban N = 19,330
Interventions	Clean Indoor Air Act prohibits smoking in most public places Varied in jurisdiction to include work places and either/or restaurants and bars Work places, restaurants and bars: Arizona, District of Columbia, Hawaii, Illinois, Iowa, Maryland, Minnesota, New Jersey, Ohio, Puerto Rico, Utah Restaurants and bars; Colorado, New Hampshire, New Mexico, work places: Pennsylvania work places and restaurants: Louisiana, Nevada
Outcomes	Impact of smoke-free legislation on CHD admissions Smoking prevalence of current and former smokers Follow-up: up to 3 years
Notes	States that implemented CIAA prior to 2006 excluded as BRFSS data from 2006 Validated BFRSS instrument Self-reported cardiovascular outcomes Self-reported smoking status Self-reported questions: "Has Dr, nurse or health professional - Ever told you had heart attack also called myocardial infarction?

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Lippert 2012 *(Continued)*

	- ever told you had angina or CHD? Have you smoked at least 100 cigarettes in your entire life? Do you now smoke cigarettes every day, some days or not at all? During past 12 months have you stopped smoking for 1 day or longer because you were trying to quit?"

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Nationally representative population health telephone surveys employs random sampling techniques
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Unknown
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	High risk	Self-reported data Ecological study No individual-level data BRFSS does not include mobile phones and excludes this cohort Confounders: obesity, diabetes, hypocholesteraemia, race, gender No controls used as city/regional bans in areas Interval time < 5 years

Liu 2013

Methods	Country: Liverpool, England Setting: Hospital admissions for CHD and MI Design: Interrupted time series study Analysis: Joinpoint regression , ARIMA models, rate ratios and trend analysis
Participants	56,995 episode statistics on admissions for CHD aged 16 years and older 2004 to 2012 30 wards of Liverpool manually categorised into 3 groups of 10 wards " Most deprived", " Least deprived", "Middle ranked" .

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Liu 2013 *(Continued)*

	6356 admissions for MI during study period
Interventions	Comprehensive smoke-free legislation enacted 1 July 2007
Outcomes	Trend analysis in age-standardised admissions for MI by sex and socioeconomic status. Follow-up: 5 years
Notes	ICD codes used No smoking status data No control group Joinpoint regression fitted to provide estimated annual percentage change and detect the points of change in the trends

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition low as all data recorded. All expected outcomes relevant to this review reported
Selective reporting (reporting bias)	Low risk	All outcomes reported. Gender-specific data not analysed as denominators low
Other bias	Unclear risk	All events registered as per international classifications No control group Joinpoint regression analyses Deprived area with higher rates of smoking and higher rates of heart disease

Loomis 2012

Methods	Country: Florida, New York, USA Comparison: Oregon Setting: Hospital admissions for MI and stroke Design: Controlled before-and-after Analysis: Poisson regression and trend analysis

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Loomis 2012 *(Continued)*

Participants	Hospital admission data for AMI and stroke from Department of Health in Florida (quarterly data) , New York and Oregon (monthly data) Data period Q1 1990 – Q4 2006 Florida January 1998 to December 2006 Oregon January 1995 to December 2006 New York No totals
Interventions	Smoke-free legislation enacted Florida statewide smoke-free air law July 2003 banning smoking in all work places and restaurants but exempting freestanding bars. No local ordinances prior to state law New York statewide smoke-free law July 2003 covering freestanding bards in addition to work places and restaurants. New York had ordinances from 1985. New York City ban March 2003 Oregon: No statewide ban. 2 localities enacted smoke-free comprehensive bans during study period. Local ordinances 1998, 2000. Statewide ban in Oregon January 2009
Outcomes	Impact of comprehensive smoke-free legislation on MI and stroke admissions Follow-up: 3 years post-legislation
Notes	ICD codes used No smoking status data Adjusted for effects of pre-existing moderate laws, seasonal variation and secular time trends

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Total sample size not reported
Selective reporting (reporting bias)	Low risk	All outcomes reported.
Other bias	Unclear risk	All events registered as per international classifications Rates of admissions reducing due to other confounders Exposure to SHS not available Adjusted for trends

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Mackay 2010

Methods	Country: Scotland Setting: Hospital admission for childhood asthma Design: Interrupted time series Analysis: Subgroup analyses and binomial regression models
Participants	Registered hospital admissions on Scottish Morbidity Register Death certificates registered General Register Office for Scotland January 2000 to October 2009 N= 21,415 admissions N =5 deaths registered Emergency admission for principal diagnosis Asthma (whether discharged alive or dead) Pre school age 0 to 4 years School age 5 to 14 years
Interventions	Comprehensive smoke free legislation 26 March 2006
Outcomes	Impact of smoke free legislation on admissions for childhood asthma Follow up: 43 months post legislation
Notes	ICD principal diagnosis codes used Definition: emergency admission irrespective of whether patient was discharged alive or died in hospital

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomisation not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Household exposure unknown

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Mackay 2010 *(Continued)*

	Includes asthma exacerbations requiring hospital admission
	No causality
	Confounders including other campaigns, air pollution
	SHS exposure unknown
	Misclassification

Mackay 2011

Methods	Country: Scotland Setting: National Population data from Scottish Household Surveys Design: Interrupted time series study Analysis: Box Jenkins auto regressive integrated moving averages (ARIMA) modelling. Akaike information criterion statistic modelling techniques
Participants	4000 adults participating in quarterly Scottish Household health surveys (approx 26,000 annually) January 1999 to July-September 2010
Interventions	Comprehensive smoke free legislation 26 March 2006
Outcomes	Self reported smoking prevalence and quit attempts post smoke free legislation Follow up: up to 48 months post legislation
Notes	Self reported smoking status No validation NRT Scottish prescribing data used as proxy for quit data

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Uses nationally representative social surveys of Scottish Households which employ multi stage sampling techniques.
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Total sample size not reported. Uses large surveys 26000+
Selective reporting (reporting bias)	Low risk	All outcomes for study reported
Other bias	Unclear risk	No validated smoking status

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Mackay 2011 *(Continued)*

	No individual data on NRT use
	Cannot infer prevalence due to quit attempts
	Did not include NRT OTC purchase data

Mackay 2012

Methods	Country: Scotland Setting: National register of pregnancy data Design: Interrupted time series Analysis: Logistic regression analyses
Participants	Registered hospital admissions on Scottish Morbidity Register SMR 2 data on discharges from maternity hospitals. Participants were singleton, live born infants delivered 24 to 44 weeks gestation. 1 January 1996 to 31st December 2009 Analyses restricted conceptions between 1st August 1995 and 10th February 2009. N= 756,795 deliveries N=716,968 deliveries met the inclusion criteria/ data complete. (Smoking status available for 99.9% of women; 716,941)
Interventions	Comprehensive smoke free legislation 26 March 2006
Outcomes	Primary outcome: Impact of smoke free legislation on pre-term delivery and small for gestation age. Secondary outcomes included: Low birth weight , spontaneous delivery, labour and very small for gestational age Follow up: up to 44 months post legislation
Notes	Date of conception calculated by subtracting gestation at delivery from date at delivery + 2 weeks. Census data set for Scottish Indicators of Multiple deprivation accessed Self reported smoking status Registered hospital admissions on Scottish Morbidity Register, subject to regular quality checks

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomisation not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias)	High risk	Not applicable

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Mackay 2012 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported. 1.9% missing data on mode of delivery. Imputation of smoking status had little effect on multi variate results
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	SHS exposure unknown Smoking status self reported Misclassification Pre eclampsia data not reported

Mackay 2013

Methods	Country: Scotland Setting: Hospital admission for stroke Design: Interrupted time series Analysis: Binomial regression model and adjusted for sub group analyses
Participants	Registered hospital admissions on Scottish Morbidity Register Death certificates registered General Register Office for Scotland Emergency admission for principal diagnosis stroke (whether discharged alive or dead) 2000 to 2010 (11 years) registered: Registered events: 86,835; Complete data available: 85,662 events (98.6%) N = 35,810 cerebral infarctions N = 35,308 cerebral infarctions N = 9210 intracerebral haemorrhages N = 9050 intracerebral haemorrhages N = 41,815 unspecified strokes N = 41,304 unspecified strokes Subgroups: Aged < 60 years Aged 60 years and older
Interventions	Comprehensive smoke-free legislation 26 March 2006
Outcomes	Impact of smoke-free legislation on admissions Follow-up: up to 57 months post-legislation
Notes	ICD principal diagnosis codes used Events included both pre-hospital deaths and hospital admissions irrespective of whether patient discharged alive or died in hospital Census data set for Scottish Indicators of multiple deprivation accessed

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Mackay 2013 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Confounders SHS exposure unknown Smoking status unknown Misclassification Changes in stroke management over 11-year period

McGhee 2014

Methods	Country: Hong Kong Setting: Hospital admissions and mortality Design: Uncontrolled before-and-after study Analysis: Poisson regression analyses
Participants	Hospital Authority Clinical Management system database on admissions to hospital and mortality accessed. All weekly discharges from 31 acute hospitals collated for the following diagnoses: Ischaemic heart disease, acute myocardial infarction, cerebrovascular disease, cardiovascular disease, respiratory disease, lung cancer, all natural causes, injury poisonings and external causes, cancer excluding lung cancer Comparison: Natural causes excluding cardiovascular and respiratory disease and other causes Pre-ban 1997 to 2006 Post-ban 2007 to 2008 No totals
Interventions	October 27 2006 Hong Kong smoke-free law. Smoking banned in indoor work places and public places. 1st January 2007 statutory no-smoking areas were extended to indoor areas of restaurants, indoor

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McGhee 2014 *(Continued)*

	work places, public indoor places and some public outdoor places. Bars and bathhouses, nightclubs, massage establishments and mahjong-tin kau premises were exempted until July 2009
Outcomes	Change in rate of hospital admissions and mortality post-legislation smoking-related diseases Follow-up: 1 year post-legislation
Notes	No sample size ICD coding for diagnoses on database 2003 excluded due to outbreak of SARS Census data used for information on deaths Statistics department data used to examine mortality Adjusted for seasonal changes, pollutants

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	No totals reported.
Selective reporting (reporting bias)	Low risk	Proportional changes reported for each condition reported
Other bias	Unclear risk	2 years of data post-legislation available (24 months) Impact of SARS Bans enacted in stages No individual-level data No smoking status or SHS exposure Included age groups unknown Gender analyses unknown

Millett 2013

Methods	Country: England Setting: Hospital episodes of emergency admissions for asthma

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Millett 2013 *(Continued)*

	Design: Interrupted time series study Analysis: Negative binomial regression analyses
Participants	Children registered emergency hospital admissions for childhood asthma on National Hospital Episode Statistics Database 1 April 2002 to 30 November 2010 Age 14 years and younger 0 - 4 years pre-school 5 - 14 years school age N = 217,381 admissions
Interventions	Comprehensive smoke-free legislation July 2007
Outcomes	Primary outcome: Impact of smoke-free legislation on emergency hospital admissions for childhood asthma Impact of socioeconomic status Follow-up: 40 months post-legislation
Notes	ICD coding for diagnosis Excluded admissions if asthma was secondary diagnosis Census data used for denominators Deprivation index scores and classification of residence from National Statistics

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Home exposure of SHS unknown No control group Misclassification

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Millett 2013 *(Continued)*

	Deaths not included
	Linear secular trends in regression cannot account for other potential confounders
	Confounding in different treatments and admissions over time

Naiman 2010

Methods	Country: Toronto, Canada
	Setting: Hospital admission rates
	Design: Controlled before-and-after study
	Pre-ban January 1996 (3 years pre-)
	Post-ban March 2006 (2 years post-)
	13 municipalities had bans
	Control cities: Durham Region, Thunder Bay (no bans)
	Analysis: ARIMA modelling
Participants	Discharge abstract Database of the Canadian Institute for Health Information accessed
	January 1996 to April 2006
	Intervention
	Residents in 13 municipalities with bans
	Controls
	Residents in 2 cities with no bans.
	3 cardiovascular conditions selected:
	• AMI, angina and ischaemic stroke
	3 respiratory conditions selected:
	• COPD, asthma and bronchitis or pneumonia
	Control conditions:
	• acute cholecystitis, bowel obstruction and appendicitis
	Admission data for cardiovascular and COPD were limited to persons ≥ 45 years
	Asthma admissions limited to persons < 65 years
	Population totals
	Toronto N = 2,503,281
	Thunderbay N = 109,140
	Durham Region N = 561,256
Interventions	Legislative smoking ban in Toronto – municipal bans until May 2006 when comprehensive state ban enacted

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Naiman 2010 *(Continued)*

	Law 441 - 1999 banned smoking in all public places and work places over 3 phases: Phase 1 October 1999 all public places and work places Phase 2 June 2001 extended to restaurants, dinner theatres, bowling centres except in designated smoking areas Phase 3. June 2004 extended to bars, billiard halls, bingo halls, casino, race tracks, except in designated smoking areas
Outcomes	Reduction in respiratory and cardiac admissions post-smoking ban Follow-up: 24 months to final phase legislation
Notes	National Canadian Health Survey Data accessed for smoking prevalence at baseline Canadian Community Health Survey data used for SHS exposure, rates of influenza vaccine Census data used for population estimates

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	All events registered as per international classifications. Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Population totals provided and outcomes presented/10,000 population
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported. Hospital admissions recorded
Other bias	Unclear risk	Self-reported smoking status from population health survey at baseline Varying ban dates Misclassification Ecological study No individual-level data No data on comorbidities Confounders include other antismoking legislation

North Carolina 2011

Methods	Country: North Carolina, USA

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North Carolina 2011 *(Continued)*

	Setting: Hospital episodes of emergency hospital admissions for AMI Design: Uncontrolled before-and-after study Analysis: Poisson regression analyses
Participants	North Carolina Disease Event Tracking and Epidemiological Tool used to extract any emergency department visit from 2008 to 2010 Aged 18 years and older Primary diagnosis of AMI Residents of North Carolina Pre-ban 2008 N = 9428. Pre-ban 2009 N = 8317. Post-ban 2010 N = 8000
Interventions	Smoke-free legislation 1st January 2010. Comprehensive ban
Outcomes	Primary outcome: Impact of smoke-free legislation on emergency hospital admissions for AMI Follow-up: 12 months post-legislation
Notes	ICD coding for diagnosis Excluded non-residents from analyses Census data used for denominators Temperature, climate and influenza data included

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Low risk	Ecological study No other bias reported

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Page 2012

Methods	Country: Pueblo, Colorado, USA Setting: Pueblo registry. Department of Health Colorado Birth Registry and Infant Mortality Registry Design: Controlled before-and-after study Intervention: Pueblo County Control: El Paso County (no ban) Pre-ban: 1 April 2001 to 1 July 2003 Post-ban 1 April 2004 to 1 July 2006 Analysis: Univariate and logistic regression analyses
Participants	Patients registered on Pueblo or El Paso County Health Department records Residents using zip codes Singleton birth records of babies born to mothers who were residents N = 6717 births identified in Pueblo and 32,293 in El Paso during study Included in analyses: Single births Pueblo N = 3421 El Paso N = 16,348
Interventions	Smoke-Free Air Act implementation and enforcement began in 1 July 2003 which banned smoking in work places and all buildings open to the public, including bars, restaurants, bowling alleys and other business establishments within city limits of Pueblo, Colorado
Outcomes	Reduction maternal smoking rates, preterm births and LBW babies post-ban Follow-up: 12 months post-legislation
Notes	Preterm births < 37 weeks gestation LBW classifications used: < 2500g (WHO) and < 3000g (CDC) Maternal smoking number/day self-reported De-identified data Multiple births excluded

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Based on residence
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable

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Page 2012 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate low as all data recorded
Selective reporting (reporting bias)	Low risk	Singleton births reported
Other bias	High risk	Self-reported smoking status SHS exposure unknown Ecological study Contamination of groups working in different locations Maternal characteristics, including baseline smoking rates, very different between areas

Pell 2008

Methods	Country: Scotland Setting: Hospital monthly admissions for ACS Design: Prospective cohort study Comparative analysis of hospital admissions for ACS for 10 months before the ban (June 2005 to March 2006) and in the follow-up period up to 10 months after the legislation was implemented (June 2006 to March 2007) in Scotland Comparison area: England (control area without similar legislation). Data from England obtained from Hospital Episode Statistics Analysis: Chi^2 test used to calculate P values for trend. 2-sample t-tests to logarithmically transform data on cotinine. Calculated % reduction in the number of admissions and subgroup analysis according to gender and age group
Participants	Patients admitted to 9 hospitals for ACS representing 63% of all hospital admissions in Scotland ACS (ICD-10) defined by a detectable level of cardiac troponin after emergency admission for chest pain Hospital Episode Statistics Register accessed for geographical control region (no smoking ban) N = 3235 patients admitted for ACS Participation rate patients with ACS: pre-law 2806/3235 (87%), post-law 2322/2684 (87%), P = 0.80, Chi^2 test
Interventions	Smoke-free legislation (Smoking, Health and Social Care (Scotland) Bill) implemented on 26th March, 2006 prohibiting smoking in indoor work places including bars, restaurants and cafes
Outcomes	Self-reported exposure to SHS as defined by the number of hrs per wk in the home, work, “bars, pubs or clubs”, “cars, buses or trains”, other public places, other people’s homes and “all locations”. Number of hospital admissions and risk ratio reduction (95% CI) of acute coronary syndrome (ACS) by age, gender and smoking status. Analysis of ACS in men < 55 yrs and > 55 yrs, in women < 65 yrs and > 65 yrs and for all patients with ACS Self-reported smoking status Biochemical verification: Yes; smoking status and exposure to SHS as measured by geometric mean serum cotinine ng/ml

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Pell 2008 *(Continued)*

	Follow-up: 10 months post-legislation
Notes	nonsmokers defined as those with 12 ng/ml serum cotinine or less. Limit of detection 0.1 ng/ml Adjusted for seasonal changes ICD code used for principal diagnosis and clinical markers Death certificate data accessed to verify deaths without hospitalization

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not applicable
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All outcomes reported
Selective reporting (reporting bias)	Low risk	Outcome relevant to paper reported
Other bias	Low risk	None reported

Pell 2009

Methods	Country: Scotland Setting: Hospital monthly admissions for ACS amongst nonsmokers Design: Prospective cohort study. Data collected pre- and post-ban in Scotland on consecutive patients who were nonsmokers admitted with ACS to 9 Scottish acute hospitals. Follow-up data were obtained from routine hospital admissions and death databases Analysis: Chi^2 tests for trend and logistic regression, both univariate and multivariate
Participants	Consecutive admissions who were nonsmokers admitted with ACS to 9 Scottish acute hospitals from May 2005 to March 2007 Baseline:1261 nonsmokers with cotinine level data collected (Participants recruited from larger study sample n = 5815 who consented to participate (87%)) Follow-up: 30 days post-admission 50 had died and 35 had a non-fatal MI
Interventions	Smoke-free legislation (Smoking, Health and Social Care (Scotland) Bill) implemented on 26th March, 2006 prohibiting smoking in indoor workplaces, including bars, restaurants and cafes
Outcomes	Cotinine levels. All-cause death, cardiovascular death or readmission for a principal diagnosis of AMI

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Pell 2009 *(Continued)*

	Follow-up: 12 months post-legislation
Notes	Biochemical verification: Yes. Urinary cotinine measured exposure to SHS

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	All expected outcomes for nonsmokers reported. Data for smokers limited
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Data from those with cotinine levels included Data on current smokers outcomes : total not explained

Rajkumar 2014

Methods	Country: Zurich, Basel City and Basel County, Switzerland Setting: Work place hospitality sector Design: Prospective cohort Analysis: Within-subject correlations, mixed linear regression modelling
Participants	92 participants recruited: 62 nonsmokers employed in hospitality venues (had local ban prior to National legislation for at least 1 year). *55 participants followed up in this group 14 non smokers employed hospitality venues working in smoke free environment at baseline. * follow up once 16 nonsmokers exposed to SHS at work and not employed in hospitality sector Participants must work in 1 of the included Cantons Aged 18 to 65 years. Data collection March 2010 to December 2011 Pre-ban 3 months prior to legislation Post-ban 1: 3 to 6 months

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Rajkumar 2014 *(Continued)*

	Post-ban 2: 9 to 12 months
Interventions	National smoking legislation May 2010 (partial with exemptions)
Outcomes	Impact of smoking legislation on spirometry, heart rate variability and pulse wave velocity measures in non-smoking hospitality workers Health questionnaire and air quality measurements recorded Follow-up: up to 9 to 12 months post-legislation (final collection)
Notes	Hospitality employers identified from phone lists and were invited to participate via letter, follow-up phone calls and a visit Non-hospitality sector recruitment via online advertisement Participants defined as asthmatics if they reported asthma diagnosis at an adult age Asthma group using corticosteroids were excluded from analysis spirometry Rhinitis was defined as sneezing and running nose during past 12 months in the absence of cold or influenza SHS biochemically measured using Monitor of Nicotine (MoNIC) passive sampling badges. Each venue agreed to 1 badge in place near the bar area. Nicotine measured on badge determined by gas chromatography and used to calculate cigarette equivalent 0.2 mg/cigarette and ventilation rate 10 L/min Health examinations comprised cardiovascular and respiratory tests, spirometry and ECG, pulse wave velocity and blood pressure (reported in Rajkumar 2014, additional reference) 55 participants reported as Intervention group - employed in hospitality venues (had local ban prior to National legislation for at least 1 year)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	High risk	Self-reported symptoms Sample size Recruitment strategy Misclassification

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Rajkumar 2014 *(Continued)*

	Exposed group were younger, more active and increased asthma reported

Roberts 2012

Methods	Country: Rhode Island, USA Setting: Hospital admissions AMI and asthma Design: Interrupted time series Pre-ban: 2003 to 2004 Post-ban 1: 2006 to 2008 Post-ban 2: 2008 to 2009 Analysis: Regression analyses
Participants	Adult admissions to Rhode Island's 11 acute general hospitals for AMI, asthma registered on Rhode Island Hospital Discharge Dataset Comparison diagnosis: appendicitis Residents of Rhode Island Aged > 18 years AMI Pre-ban: 2003 to 2004 N = 5807 2005 N = 2664 Post-ban 1: 2006 to 2008 N = 4674 Post-ban 2: 2008 to 2009 N = 4346 Asthma Pre-ban: 2003 to 2004 N = 1844 2005 N = 1079 Post-ban 1: 2006 to 2008 N = 2048 Post-ban 2: 2008 to 2009 N = 2245
Interventions	Smoke-Free Public Places and Workplaces Act March 2005 implemented in 2 phases: Phase 1: 2006/2007 Phase 2: 2008/2009
Outcomes	Reductions in AMI and asthma admissions post-legislation Reduction in AMI and asthma medical costs Follow-up: up to 36 months post-legislation
Notes	ICD codes used

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Roberts 2012 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No biomarkers for smokers No active smoking data No SHS exposure Small number of admissions for asthma and appendicitis Misclassification of data

Rodu 2012

Methods	Country: States: California, Utah, South Dakota, Delaware, Florida, New York, USA Control: Other US states with no bans Setting: National Center for Health Statistics AMI mortality deaths Design: Controlled before-and-after study Intervention: Smoking bans Analysis: Age-standardised mortality rates
Participants	Deaths registered by National Center for Health Statistics AMI mortality deaths 1995 to 2003 Primary diagnosis cause of death AMI Resident in selected states: California, Utah, South Dakota, Delaware, Florida, New York Age 45+ years Data analysed 3 years pre- and 1 year post-ban California N = 17,656 Utah N = 767

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Rodu 2012 *(Continued)*

	South Dakota N = 686 Delaware N = 433 Florida N = 10,073 New York N =10,347
Interventions	Smoke-free legislation enacted at different periods: California 1st January 1995 Utah 1st January 1995 South Dakota 1st July 2002 Delaware* 27th November 2002 Florida 1st July 2003 New York* 24th July 2003 * comprehensive bans. Remaining states have no bans
Outcomes	Primary outcome: Impact of smoke-free legislation on immediate reductions in AMI Follow-up: 1 year post-legislation
Notes	ICD coding for diagnosis on database Data obtained for all US states (with and without bans)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Based on state
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Attrition rate low as all data recorded
Selective reporting (reporting bias)	Low risk	All outcomes relevant to study reported
Other bias	Unclear risk	Secondary data analysis Not hospital admissions California had pre-existing 1992 ordinance New York had pre-existing ordinance

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Rodu 2012 *(Continued)*

	Older data sets

Sargent 2004

Methods	Country: Helena, Montana, USA Control: Non-residents of Helena Setting: AMI hospital admissions Design: Controlled before-and-after study Analysis: Poisson regression analysis
Participants	Hospital records and billing database accessed for all admissions and AMI admissions: December 1997 to November 2003 Charts reviewed June to November 1998 to 2003 (period when ban in place 2002) 10,497 admissions from residents of Helena and 3367 for non-residents of Helena ICD code for principal diagnosis AMI Included sample: 304 admissions living in and outside Helena aged ≥ 18 years During ban period: 42 admissions
Interventions	Local law in place in Helena, Montana from June - Nov 2002 which banned smoking in work places and public places. Law suspended
Outcomes	Number of admissions for AMI Follow-up: 12 months post-legislation
Notes	ICD Code used for diagnosis zip codes used for resident/non-resident status Criteria for diagnosis changed 1999, to using troponin I concentration

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Consecutive patients included
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Totals not presented
Selective reporting (reporting bias)	High risk	Not clear

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Sargent 2004 *(Continued)*

Other bias	High risk	Small sample size Confounding systematic, misclassification Change in definition for diagnosis - results adjusted for change and no change observed No individual-level data No SHS exposure data Hospital billing records Ban suspended after 6 months

Sargent 2012

Methods	Country: Germany Setting: Hospital admissions for acute coronary events Design: Interrupted time series study Analysis: Logistic regression analyses
Participants	Accessed Insurance company claims database for cohort admitted for coronary events Individuals included aged > 30 years 1st January 2004 to 31st December 2008 N = 3,700,384 unique records providing data on age, sex and occupation
Interventions	Smoke-free legislation September 2007 banned smoking in federal buildings, transportation system and allowed private employers to introduce partial or total ban to protect nonsmokers in the work place States to each legislate for limiting smoking in hotels, restaurants and bars. State laws introduced between August 2007 and July 2008. The laws introduced at state level permitted indoor smoking in small bars (without food) and in separate rooms in large restaurants
Outcomes	Primary outcome: Impact of smoke-free legislation on hospital admissions for acute coronary events Impact of socioeconomic status Follow-up: up to 15 months post-legislation (varies)
Notes	ICD coding for diagnosis on database Excluded anyone who left or joined during study period Analyses accounted for differing implementation periods Excluded recurrent admissions for AMI within 28 days of initial event

Risk of bias

Bias	Authors' judgement	Support for judgement

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Sargent 2012 *(Continued)*

Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported.
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Home exposure of SHS unknown Smoking status unknown No control group Misclassification Insurance industries that employ larger numbers of women Confounding in different treatments and admissions over time

Schmucker 2014

Methods	Country: Bremen, Germany Setting: Hospital admissions for STEMI Design: Interrupted time series Pre-ban: 2006 to 2007 Post-ban: 2008 to 2010 Analysis: Chi^2, Fischer's exact, multivariable analyses
Participants	Accessed Bremen interventional STEMI Registry database. Prospective register of all patients admitted to hospital with STEMI Data accessed: January 2006 to December 2010 Smoking status, demographics and cardiovascular risk factor data collected from register N = 3545 admissions to Bremen Heart Centre
Interventions	Smoke-free legislation 1st January 2008 in Bremen Smoke-free legislation 1st August 2007 Federal State of Lower Saxony Smoking banned in public areas
Outcomes	Primary outcome: Impact of smoke-free legislation on hospital admissions for STEMI in nonsmokers

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Schmucker 2014 *(Continued)*

	Follow-up: 24 months post-legislation
Notes	STEMI defined as presence of 2 criteria: persistent angina pectoris for ≥ 20 minutes and ST-segment elevation of ≥ 1 mm in ≥ 2 mm standard leads or ≥ 2 mm in ≥ 2 contiguous precordial leads or the presence of a left bundle branch block Never-smokers and ex-smokers combined in group " non smoking"

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all prospective events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported.
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No medical histories Incomplete records Smoking status self-reported No information on active smokers e.g. number of cigs smoked SHS exposure unknown nonsmokers included ex-smokers in analyses (< 6% of group) Duration smoking/quantity of cigarettes smoked - incomplete records Non-STEMI data not available on Register

Sebrié 2014

Methods	Country: Uruguay Setting: Hospital admissions AMI Design: Interrupted time series Pre-ban: 1st March 2004 to 28th February 2006 Post-ban 1: 1st March 2006 to 28th February 2008 Post-ban 2: 1st March 2008 to 28th February 2010

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Sebrié 2014 *(Continued)*

	Analysis: Binominal regression analyses
Participants	Review of hospital records to identify all patients admitted to 37 public and private hospitals Resident of Uruguay Aged 20 years and older Primary diagnosis AMI N = 11,135 over study period
Interventions	Smoke-free legislation March 2006 100% comprehensive ban
Outcomes	Reductions in AMI admissions Follow up: up to 48 months post legislation
Notes	ICD code used for diagnosis. 10% of hospital records checked for verification of diagnosis AMI definition criteria of Joint European Society of Cardiology/American College of Cardiology Committee adopted in Uruguay since 2002 Non-country residents excluded Patients with AMI after coronary angioplasty, bypass or complication of another disease were excluded

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No individual-level data No smoking status No SHS exposure data No data on morbidity or medications No death certificates reviewed and patients who died prior to arrival in hospital are not included

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Sebrié 2014 *(Continued)*

	2006 additional legislation of pictorial health warnings and education campaigns Not all hospitals participated

Seo 2007

Methods	Country: Bloomington Hospital, Monroe County and Ball Memorial Hospital, USA Control: Delaware County, Indiana Setting: Hospital admissions for AMI in nonsmokers Design: Controlled before-and-after study Analysis: Poisson analysis
Participants	Study period: 1st August 2001 to 31st May 2005 (except 1st June 2003 to 31st July 2003) for comparison 22 month periods Pre-ban: 1st August 2001 to May 2003 Post-ban 1st August 2003 to 31st July 2005 Patients 1) who had a primary or secondary diagnosis of AMI (ICD-9-CM codes 410.xx); 2) with no past cardiac procedure that could have precipitated AMI nor comorbidity such as hypertension, high cholesterol that could have precipitated AMI Selection criteria also included having chemical evidence such as increased troponin I concentrations or creatine phosphokinase activity and onset of symptoms in the study area. For the secondary diagnosis of AMI, the chemical evidence had to be present at the time of admission nonsmokers included Control county (matched) was selected from Indiana Counties. Delaware County is geographically distant; at least 50 miles away from Monroe County. Delaware did not have a similar ordinance in place banning smoking in public places and it had similar demographic profiles to those of Monroe County, primarily in terms of population size (120,563 Monroe vs 118,769 Delaware), racial/ethnic proportions, similar median household income to that of Monroe County, similar heart disease mortality rate to that of Monroe County among annual deaths Totals in study unclear
Interventions	Local ordinance which banned smoking in restaurants, retail stores and work places in Monroe County in August 1st 2003 (extended to bars and clubs in January 2005) was compared to a control county, Delaware County, Indiana. Medical records from Bloomington Hospital, Monroe County and Ball Memoria,l Hospital in Delaware County, Indiana were used to compare the incidence of admission for AMI in non-smoking and smoking patients who were resident in Monroe County and Delaware County
Outcomes	Incidence rates of non-smoking and smoking patients admitted to hospital with a primary or secondary diagnosis of AMI for 22-month period and who did not have any past cardiac history before the admission nor have hypertension or high cholesterol comorbidity for the periods (August 2001 - May 2003 vs August 2003 - May 2005) Biochemical verification of smoking status: No Follow-up: 2 years following 1st ordinance
Notes	Population increased by 0.4% in Monroe and decreased by 0.8% in Delaware County between 2000 and 2004. ICD coding for principal diagnosis

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Seo 2007 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not applicable
Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	High risk	Unclear and no total sample size reported. Totals in tables in paper indicate very small sample size
Selective reporting (reporting bias)	Unclear risk	Unclear
Other bias	Unclear risk	Total admissions for AMI not reported Overall sample size not reported and sample sizes reported in 2 tables are very small Self-reported smoking status Misclassification No SHS exposure data

Sims 2013

Methods	Country: England Setting: Hospital emergency admissions for asthma Design: Interrupted time series 10 years and 3 months pre-ban 3 years and 6 months post-ban Analysis: Poisson regression analyses
Participants	Review of NHS Hospital Episode Statistics register. April 1997 to December 2010 Emergency admissions for asthma – finished consultant admission episode Aged ≥ 16 years Resident in England in 1 of 9 regions. N = 502,000 (nonsmoker) emergency admissions, primary diagnosis asthma

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Sims 2013 *(Continued)*

Interventions	Smoke-free legislation 1st July 2007
Outcomes	Reductions in emergency asthma admissions post-legislation (immediate change and magnitude) Follow-up: 42 months post-legislation
Notes	ICD-10 code used for diagnosis (post-1997) Adjusted for non-linear and seasonal trends Adjusted analyses for influenza

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	No smoking status No SHS exposure data No causation Confounding Misclassification of data Admission may differ from region where person was exposed

Stallings-Smith 2013

Methods	Country: Ireland Setting: Reductions in cardiovascular, cerebrovascular and respiratory mortality Design: Interrupted time series study Comparison analyses: non-smoking-related mortality Analysis: Poisson regression analyses
Participants	National mortality register accessed from Central Statistics Office

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Stallings-Smith 2013 *(Continued)*

	1st January 2000 to 31st December 2007 Age and gender estimates obtained from census Age ≥ 35 years Primary causes of death: - All causes - Non-trauma mortality Smoking-related mortality : - Cardiovascular diseases - Ischaemic heart disease - Acute myocardial infarction - Stroke - All respiratory diseases - COPD Comparison: All non-smoking-related mortality N = 215,878 non-trauma deaths (2000 to 2007)
Interventions	Comprehensive smoke-free legislation 29th March 2004
Outcomes	Impact of smoke-free legislation on all-cause and specific-cause mortality rates Follow-up: 45 months post-legislation (up to 81 months Stallings-Smith 2014)
Notes	ICD codes used for primary causes of death CSO population estimates used Adjusted analyses for seasonal trends, influenza rates Smoking prevalence from Office of Tobacco Control data N = 1000/month aged ≥ 15 years

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported

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Stallings-Smith 2013 *(Continued)*

Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	Smoking status data from separate monthly surveys 2002 to December 2007 No SHS exposure data Confounders including additional legislation and antismoking campaigns No direct adjustment for weather/air pollution

Séguret 2014

Methods	Country: France Setting: Hospital rates for ACS Design: Interrupted time series Analysis: Poisson regression analyses
Participants	National hospitalization database accessed for primary diagnosis at discharge of ACS 1st January 2003 to 31st December 2009 Patients aged 18 years and older Gender and age stratified ≤ 55 years men; > 55 years men; ≤ 65 years women; > 65 years women N = 867,164 hospital admissions recorded
Interventions	Smoke-free legislation Evin's law 1991 November 2006 enacted February 2007 comprehensive ban in smoking in public places 2nd legislation January 2008 extended ban to bars, hotels, restaurants, discos and casinos
Outcomes	Primary outcome: Impact of phased smoke-free legislation on ACS admissions Immediate effect before/after 1st February 2007 Before/after 1st January 2008 Before/after 30th June 2008 (delay) Follow-up: 34 months post-legislation (1 to 84 months in study)
Notes	Evin's law banned smoking in certain enclosed areas, included advertising and signage ICD coding used for diagnosis Adjusted for seasonal effect and historical trend Census data for analyses

Risk of bias

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Séguret 2014 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Allocation concealment not applicable as all events registered
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	All expected outcomes reported
Selective reporting (reporting bias)	Low risk	All expected outcomes relevant to this review reported
Other bias	Unclear risk	ACS rate declining in France Evin's law in place since 1991, ineffective in bars and restaurants, it was in place in most work places Misclassification of data Smoking status not available SHS exposure and pollution data not included Individual patients' identifier not reliable in early years of study. Analysis based on monthly admissions by gender and age

Vander Weg 2012

Methods	Country: USA Intervention: Counties with ban Control: Counties with no bans Setting: Secondary analysis of US Tobacco Control Laws Database and Medicare Provider Database Design: Controlled before-and-after study Analysis: Poisson regression analyses
Participants	Medicare Provider Database accessed for hospital admission for patients aged 65 years and older, diagnoses: AMI, COPD, hip fracture and gastrointestinal haemorrhage from 1991 to 2008 **Data analyses:** Pre-ban 1 to 3 months post-ban 4 to 12 months post-ban

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Vander Weg 2012 *(Continued)*

	13 to 36 months post-ban > 36 months post-ban 1991 and 2008 number of counties: N = 1294 (any ban), N = 1838 no bans 1991 Medicare enrollees N (SD) = 14,147 (38,957) (ban); N = 6632 (18,418) (no ban) 2008 Medicare enrollees N (SD) = 16,861 (44,459) (ban); N = 7984 (20,262) (no ban)
Interventions	Implementing comprehensive smoke-free laws covering work places, restaurants, and bars in 387 US counties between January 2000 and December 2007
Outcomes	Primary outcome: Impact of comprehensiveness of smoke-free legislation and impact on health outcomes Follow-up: 36 months post-legislation
Notes	ICD coding for diagnosis on database Census data for population estimates

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Based on state
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Totals reported
Selective reporting (reporting bias)	Low risk	All outcomes relevant to study reported
Other bias	Unclear risk	Secondary data analysis Selected databases No SHS exposure data No smoking status data Confounding medical history data unknown Varying implementation periods No demographic data Restricted to population aged 65 years and older

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Villalbi 2011

Methods	Country: Spain Setting: Secondary data analysis of AMI deaths Design: Uncontrolled before-and-after study Analysis: Poisson regression analyses
Participants	Deaths registered by National Statistics Unit (INE) Primary diagnosis cause of death: AMI Resident in Spain Age > 34 years 2004 to 2007 study period 2004 N = 23,409 2005 N = 23,487 2006 N = 21,966 2007 N = 21,520
Interventions	Smoke-free legislation 28/2005 enacted 1st January 2006. Smoking advertising banned, points of sale reduced and smoking prohibited in work places (exemption for bars, cafes, restaurants, night clubs and discos)
Outcomes	Primary outcome: Impact of smoke-free legislation deaths due to AMI Follow-up: 2 years post-legislation
Notes	ICD coding for diagnosis on database Excluded data 2003 as Spain had heat wave and a significant increase in mortality 6595 to 8648 excess deaths recorded Population estimates provided by Statistics unit 1-year post-ban data

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Randomization not applicable
Allocation concealment (selection bias)	High risk	Based on residence, not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias)	Low risk	Attrition rate low

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Villalbi 2011 *(Continued)*

All outcomes

Selective reporting (reporting bias)	Low risk	All outcomes relevant to study reported
Other bias	Unclear risk	Secondary data analysis No individual-level data No smoking status No SHS exposure Denominators could be overestimated No control Impact of other confounders including regulation on smoking cessation

Yildiz 2015

Methods	Country: Kocaeli City Turkey Setting: Retrospective study of emergency department admissions for smoking-related diseases in 13 hospitals Design: Uncontrolled before-and-after study Analysis: t-tests and time series trend analysis
Participants	Retrospective analysis of hospital records from all emergency admissions for smoking-related diseases in the first 6 months of 2009 and January to June 2010 (before and after legislation) 13 hospitals in Kocaeli city (10 state and 3 private hospitals) Admissions for: asthma, COPD, MI, allergic rhinitis, bronchitis, lower respiratory tract/pneumonia/nasopharyngitis admissions (ICD codes) Total admissions: 2009: N = 83,089 2010: N = 64314
Interventions	Smoking banned in all indoor public places including cafes and restaurants 19 July 2009
Outcomes	Primary outcome: Impact of smoke-free legislation on admissions for smoking-related diseases Follow-up: 12 months post-legislation
Notes	ICD coding for diagnosis No smoking status reported

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not applicable

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Yildiz 2015 *(Continued)*

Allocation concealment (selection bias)	High risk	Not applicable
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not applicable
Incomplete outcome data (attrition bias) All outcomes	Low risk	Totals reported
Selective reporting (reporting bias)	Low risk	Expected outcomes reported
Other bias	High risk	Hospital admissions only included. Treatment via family physicians in primary care unknown Confounders of other antismoking measures, seasonality, PM levels No data on all emergency admissions No demographic data (age, sex) No smoking status No SHS exposure data No individual-level data

ACS: acute coronary syndrome; AMI: acute myocardial infarction; ARIMA: auto-regressive integrated moving average; BRFSS: Behavioural Risk Factor Surveillance System; CI: confidence interval; cigs: cigarettes; CO: carbon monoxide; COPD: chronic obstructive pulmonary disease; CSO: Central Statistics Office; CVD: cardiovascular disease; DF: degrees of freedom; ED: Emergency Department; FEV: forced expiratory flow; FEV1: forced expiratory volume in one second; FVC: forced vital capacity; hr: hour(s); IRR: Inter rater reliability; IHD: ischaemic heart disease; LBW: Low birth weight; LRTI: Lower respiratory tract infection; Mass: Massachusetts; MI: myocardial infarction; NI: Northern Ireland; NRT: nicotine replacement therapy; NS: nonsmoker; OR: odds ratio; $PM_{2.5}$: particulate matter of less than 2.5 micrometers in diameter; ppm: parts per million; ROI: Republic of Ireland; RR: risk ratio; RSP: respirable suspended particles; SARS: severe acute respiratory syndrome; SCD: sudden cardiac death; SD: standard deviation; SE: standard error; SGA: small for gestational age; SHS: secondhand smoke: T1, T2: timepoint 1, timepoint 2; UK: United Kingdom; vSGA: very small for gestational age; vs: versus; wk: week; yr: years
Ireland and Republic of Ireland (ROI) are used interchangeably within this review as documented in studies.

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Abrams 2006	Passive exposure, cotinine measure
Akhtar 2007	Passive exposure, cotinine measure
Akhtar 2010	No health outcome data
Alcouffe 1997	Not population prevalence study
Allwright 2005	Passive exposure, cotinine measure
Biener 2007	Passive exposure, self-reported outcomes

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Study	Reason for exclusion
Bondy 2009	Passive exposure, cotinine measure
Braverman 2008	Not population prevalence study
Brownson 1995	Passive exposure, self-reported outcomes
CDC 2007	Passive exposure, cotinine measure
Eagan 2006	Passive exposure, self-reported outcomes. Not population prevalence study
Eisner 1998	Follow-up not 6 months. Passive exposure. Measure FVC and FEV
Ellingsen 2006	Passive exposure, cotinine measure
Farrelly 2005	Passive exposure, cotinine measure
Fernandez 2009	Passive exposure, cotinine measure and self-reported symptoms
Fernando 2007	Passive exposure, cotinine measure
Fichtenberg 2000	Tobacco control programme. Multiple laws
Fong 2006	Passive exposure, self-reported outcomes
Fong 2013	Not national population smoking prevalence study
Fowkes 2008	Not national prevalence. Participants were enrolled on RCT of low aspirin
Galán 2007	Passive exposure, self-reported outcomes
Gilpin 2002	Passive exposure, self-reported outcomes
Gorini 2008	Passive exposure, self-reported outcomes
Gorini 2011	Multiple laws
Gotz 2008	Passive exposure, cotinine measure
Hahn 2006	Passive exposure, self-reported outcomes
Haw 2007	Passive exposure, cotinine measure
Hawkins 2011	Not a minimum follow-up of 6 months for all children. 45% of all interviews in Scotland completed during the first 6 months following smoking legislation
Helakorpi 2008	Multiple tobacco control laws
Heloma 2003	Not population prevalence. Passive exposure
Hyland 2009	Passive exposure, self-reported outcomes
Jiménez-Ruiz 2008	Passive exposure, self-reported outcomes
Klein 2009	No pre- and post-law data

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Study	Reason for exclusion
Lu 2013	Effect of smoking ban not focus of study
Martínez 2009	Meso level. Evaluates tobacco control policies in hospitals
Menzies 2006	Follow-up 2 months
Mulcahy 2005	Passive exposure, cotinine measure
Mullally 2009	Not national population prevalence study. Focus is prevalence and quitting in hospitality workers
Nagelhout 2011a	Multiple tobacco control laws
Nagelhout 2011b	Not national prevalence study. Passive exposure in hospitality sector
Nebot 2009	Measured air quality as measure of exposure to SHS
Nguyen 2013	Not pre-/post state ban. Pre- state ban data reporting impact of ordinances in municipalities
Palmersheim 2006	Follow-up 3 to 5 months
Pearson 2009	Passive exposure, cotinine measures
Regidor 2011	Not population prevalence study. Study of working population
Sanchez-Rodriguez 2014	Not pre-/post- tobacco legislation smoke-free laws
Semple 2007	Passive exposure, cotinine measure
Shetty 2011	Meta-analysis paper
Vasselli 2008	Follow-up 2 months
Verdonk-Kleinjan 2009	Passive exposure, self report
Waa 2006	Passive exposure, self report

FEV: forced expiratory volume; FVC: forced vital capacity; SHS: secondhand smoke

Characteristics of studies awaiting assessment *[ordered by study ID]*

Chambers 2013

Methods	Country: USA Setting: Asthma admissions emergency departments during 2010s decade Design: Interrupted time series
Participants	Unknown from abstract
Interventions	Intervention: Smoke-free legislation in number of states
Outcomes	Chi^2, linear and logistic regression analysis used to identify significant difference pre- and post-legislation

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Chambers 2013 *(Continued)*

Notes	Published abstract 2013 only

Leung 2012

Methods	Country: Hong Kong Setting: Population Method: Uncontrolled before-and-after study
Participants	Current daily smokers who were 15 years old in the analysis. A total of 3740 and 2958 current daily smokers responded to the THS2005 and THS2008 respectively Hardcore smokers defined using 6 criteria: (1) daily smokers, (2) had a smoking history of at least 6 years, (3) had no history of quit attempts in the past, (4) did not want to give up smoking, (5) smoked at least 11 cigarettes per day on average, and (6) were 26 years or above
Interventions	Comprehensive smoke-free legislation 1 January 2007
Outcomes	To estimate the age- and sex-specific prevalence of hardcore smokers before and after the comprehensive legislation in Hong Kong The response rate was 77% for THS2005 and 75% for THS2008 Results: 21.8% and 27.4% of Hong Kong daily smokers aged 15 years or older were considered hardcore in 2005 and 2008 respectively. The prevalence of hardcore smokers increased from 23.8% to 29.4% in men and from 10.6% to 16.3% in women, and also increased in all the 5 age groups from 2005 to 2008. The hardcore smoking prevalence increased with age, reaching the highest in the 50 - 59-year age group, and then dropped in the 60+ age group in both cohorts
Notes	Conference abstract Contacted author; paper submitted for review. No further details available

Perez-Rios 2015

Methods	Country: Spain Setting: Population-based Method: Uncontrolled before-and-after study Analysis: Descriptive and Chi^2 analysis
Participants	2 independent, cross-sectional, population-based surveys were carried out among adults 18 years and older in 2006 and 2011 Telephone interviews Surveys used the same methods and questionnaire Nicotine dependence was assessed with the Fagerström Test for Nicotine Dependence and readiness to quit The study participants were selected by 2-stage sampling strategy with stratification in households. To guarantee national representativeness, households were stratified by geographical region and the size of the municipality. Second-stage units were residents in the previously selected households, where only 1 person was selected at random. Households within each municipality were randomly selected using a landline telephone directory as the sampling frame

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Perez-Rios 2015 *(Continued)*	2522 adults were interviewed in 2006 and 2504 in 2011
Interventions	December 2010, Spanish parliament passed a comprehensive smoking law amending and strengthening 2006 ban. The amended law extended smoking restrictions to all hospitality premises, thereby making Spanish work places smoke-free from January 2, 2011
Outcomes	Tobacco prevalence, tobacco consumption, readiness to quit
Notes	Fagerström Test instruments used Self-reported smoking status No biochemical validation

DATA AND ANALYSES

Comparison 1. Cardiovascular health outcomes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Cardiac outcomes			Other data	No numeric data
1.1 ITS studies			Other data	No numeric data
1.2 Controlled before-and-after studies			Other data	No numeric data
1.3 Uncontrolled before-and-after studies			Other data	No numeric data
2 Stroke outcomes			Other data	No numeric data
2.1 ITS studies			Other data	No numeric data
2.2 Controlled before-and-after studies			Other data	No numeric data
2.3 Uncontrolled before-after studies			Other data	No numeric data

Analysis 1.1. Comparison 1 Cardiovascular health outcomes, Outcome 1 Cardiac outcomes.

Cardiac outcomes			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
ITS studies			
Aguero 2013	Spain, Girona Partial 2006	All AMI events 1 January 2002 to 31 December 2008 for people aged 35 to 74 years: 3703 cases. 2142 events pre-legislation. 3012 were admitted to hospital AMI incidence rates significantly decreased (RR 0.89, 95% CI 0.81 to 0.97); similar significant decreases observed in mortality rates, RR 0.82 (95% CI 0.71 to 0.94). Decrease observed in both genders, particularly women (RR 0.72) and in people 65 to 74 years (RR 0.74) Nonsmokers showed diminished incidence rates; passive smokers signifi-	Smoking status reported No validation

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Cardiac outcomes			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
		cant reductions in AMI RR 0.88, (95% CI 0.80 to 0.97) (AHA definition); RR 0.82, (95% CI 0.72 to 0.92) (WHO MONICA definition). Non-significant in smokers; RR 0.93 (95% CI 0.82 to 1.05) (AHA definition); RR 0.91, (95% CI 0.80 to 1.04) (MONICA definition)	
Barnett 2009	New Zealand, Christchurch Comprehensive 2004	Poisson regression analysis pre- and post-ban. Deprivation coding for socioeconomic profile. Overall RR was 0.92 (95% CI 0.86 to 0.99) between first AMI admissions pre- and post-smoke-free legislation Gender stratification identified a significant reduction for men RR 0.90 (95% CI 0.82 to 0.99) when compared to women RR 0.94 (95% CI 0.84 to 1.05) Age stratification identified significant reductions for men in admissions for first AMI event in 55 to 74 year olds RR 0.86 (95% CI 0.75 to 0.99) and 75+ age group RR 0.85 (95% CI 0.73 to 0.98) Highest RR differences in admissions were recorded for nonsmokers (aged 30 to 54 years) following smoking legislation: RR 1.71 (95% CI 1.16 to 2.52) Significant differences noted for non-smokers in 55 to 74 year age group, compared to regular and ex-smokers RR 0.83 (95% CI 0.69 to 1.00). Significant reductions in admissions in those aged 55 to 74 years living in quintile 2, RR 0.76 (95% CI 0.59 to 0.97) No significant differences observed for smokers	Smoking status reported No validation
Barone-Adesi 2011	Italy 20 Italian regions Comprehensive 2005	Poisson regression analysis pre- and post-ban. Mixed effects regression modelling used with fixed coefficients for national trend reporting; random coefficients reported for region-specific deviations Overall rate ratio (RR) 0.96 (95% CI 0.95 to 0.98) for ACE admissions among people aged 70 years and younger. This was a 4% reduction in hospital admissions post-smoke-free legislation Men RR 0.97 (95% CI 0.95 to 0.98) Women RR 0.95 (95% CI 0.93 to 0.98) There was no effect in people aged over 70 years; RR 1.00 (95% CI 0.99 to 1.02)	No smoking status reported
Barr 2012	USA, 9 States: Illinois, Ohio, Minnesota, New York, Washington, New Jersey, Arizona, Massachusetts, Delaware. Comprehensive	Poisson regression modelling used. Adjustment for demographic and seasonal and secular trends in admission rates. State level modelling with county-specific random effects used to estimate change in AMI admission rates Approx. 64,000 admissions for AMI per year. Statistically significant results in AMI hospital admissions post-ban were found when strict linearity of secular trends of AMI admission rates was assumed: -5.4% (95% CI -8.2 to -2.5) The effect was attenuated to zero under relaxation of assumptions No significant results identified following non-linear adjustments for secular trends.	No smoking status reported
Basel 2014	USA, Colorado Comprehensive 2006	Poisson regression analysis used to identify differences in monthly AMI admissions post legislation 63.9% of patients were men and 36.1% were women. Mean age 66.9 years SD ± 14.4	No smoking status reported

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Cardiac outcomes			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
		No significant reduction in AMI rates observed post-legislation risk ratio (RR) 1.059 (95% CI 0.993 to 1.131) Results identified a steep decline in AMI rates 2000 to 2005 prior to legislation. Two smaller communities in Colorado previously enacted smoke-free legislation and identified 27% reduction in AMI hospitalizations (Bruintjes 2011) Current study adjusted for this population of 5411 patients and adjusted population census. No significant difference post-legislation adjusting for this group, RR 1.038 (95% CI 0.971 to 1.11) No significant impact of smoke-free legislation demonstrated even after accounting for pre-existing ordinances	
Bruckman 2011	USA, Ohio Comprehensive 2007	Interrupted monthly time series study. Mixed linear modelling data adjusting for gender and age AMI rate reduced 1.9775 per 1000 in 2005 to 1.680 per 1000 in 2009 (1680 discharges per one million Ohio residents) For men and women the mean age adjusted discharge rate decreased over study period P < 0.0001. (men: 2.6334 vs 2.2567, P < 0.001; women: 1.432 vs 1.992, P < 0.001) Significant decrease in discharge rates before and after statewide indoor tobacco smoke ban	No smoking status reported
Christensen 2014	Denmark Partial ban (not fully enforced) 2007	Smoking prevalence decreased from 27% in 2003 to 21% in 2010 (National survey data) 109,094 admissions recorded during study period. Adjusted modelling for age, gender and type 2 diabetes No significant differences in hospital admissions for AMI identified post-ban after adjusting for age and gender Significant differences in hospital admissions for AMI identified after adjusting for age, gender and incidence of type 2 diabetes: 1 year pre-ban RR 0.86 (95% CI 0.79 to 0.94) 1 year post-ban RR 0.77 (95% CI 0.71 to 0.85) 2 years post-ban RR 0.77 (95% CI 0.70 to 0.84) Significant reduction in number of AMI admissions may be explained by incremental enactment of smoking ban activities in Denmark and implementation of nationwide ban on trans-fatty acids in food in 2004	Smoking status not reported from AMI data Smoking prevalence reported from national surveys
Cronin 2012	Ireland Comprehensive 2004	At baseline, percentage of current smokers admitted with ACS 2003/2004 was 34%. This reduced in 2005/2006 to 31% and reduced further in 2006/2007 to 29% Pre-legislation 205.9 ACS admissions/100,000 population. In the year following ban there was a statistically significant 12% reduction in the rate of admissions 177.9/100,000 (95% CI 164.0 to 185.1, P = 0.002) There was no change in the rate of ACS admissions in the following year. A further 13% reduction was observed in the 3rd year post-legislation March 2006 to March 2007; 149.2 (95% CI 139.7 to 159.2) Reductions in admissions between 2003 to 2004 and 2004 to 2005 were	Smoking status self reported No validation

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Study	Location/ Intervention	Cardiac outcomes Outcomes	Smoking status
		due to smaller number of cases among men: 281.5 vs 233.5/100,000, P = 0.0011, and current smokers 408 vs 302 admissions, P < 0.0001; no significant change among women, former smokers, and never-smokers The 2nd reduction in ACS admissions 2005 compared to 2006 to 2007 was due to a reduction among men, 235.4 vs 195.2, P = 0.0021 and in current smokers 325 vs 271, P = 0.0269, and in never-smokers 355 vs 302, P = 0.0386 There was no significant change in total deaths for all causes during the study period and the number of deaths from circulatory causes declined 6.5% Smoking legislation was associated with early significant decrease in hospital admissions for ACS. A further reduction was noted 2 years post-legislation	
Gasparrini 2009	Italy, Tuscany Comprehensive 2005	2000 to 2004 pre-ban 13,456 AMI cases registered. 2005 post-legislation 2190 cases registered A decrease of 5.4% in AMI rates was observed in age group 30 to 64 years post-legislation, RR 0.95 (95% CI 0.89 to 1.00, P = 0.07 (NS)). Adjusting for linear or non-linear time trends (age groups in 10 year bands) or gender did not provide any statistical significant differences post-legislation	No smoking status reported
Hahn 2011	USA, Kentucky, Lexington- Fayette County Comprehensive 2004	AMI hospitalization rates in age group ≥ 35 years decreased for women after law enacted; adjusted RR 0.77 (95% CI 0.62 to 0.96, P < 0.05). A decrease in rate from 334.1/100,000 to 237.3/100,000. The rate for men increased 424.6/100,000 to 438.4/100,000, RR 1.11 (95% CI 0.91 to 1.36, NS). The post-law decline for women was maintained during the study period Gender differences observed in post-legislation period for different workers covered by laws Pre-ban admission age 67.3 years, post-ban 65.5 years, t = 3.2, P = 0.001	No smoking status reported
Humair 2014	Switzerland, Geneva Partial ban with period of suspension 2008	10% trend in reduced admissions for ACS IRR 0.90 (95% CI 0.80 to 1.00, P = 0.24)	No smoking status included
Jan 2014	Panama Comprehensive 2008	Adjusted RR for AMI comparing baseline with 1st post-smoking ban period was 0.982 (95% CI 0.967 to 0.997, P = 0.023), 1.8% decrease. The adjusted RR increased in the 2nd post-ban period, RR 1.049 (95% CI 1.022 to 1.077, P = 0.0001) The adjusted AMI RR for women was 1.075 (95% CI 1.033 to 1.119, P = 0.0001), NS for men The adjusted RR reduced following the tax increase (final post-ban period) RR 0.985 (95% CI 0.971 to 0.999, P = 0.041) No seasonality trends or linear trends in AMI case series tests	No smoking status reported Authors report results of reduced prevalence from other national data source
Kent 2012	Ireland Comprehensive 2004	Significant differences in admissions for ACS observed adjusted RR 0.82 (95% CI 0.70 to 0.97, P = 0.02). Reduced admissions in aged 50 to 55 years and 60 to 69 years. No changed in admissions in other age groups	No smoking status reported
Liu 2013	England, Liverpool Comprehensive 2007	Age-adjusted CHD admissions increased in men by 8%, RR 1.08 (95% CI 1.06 to 1.11) and increased in women by 12%, RR 1.12 (95% CI 1.09 to 1.16)	Smoking status not reported

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Study	Location/ Intervention	Cardiac outcomes Outcomes	Smoking status
		Age-adjusted rates for MI admissions decreased post-legislation by 41.6% for men, RR 0.584 (95% CI 0.542 to 0.629) and 42.6% for women, RR 0.574 (95% CI 0.520 to 0.633) Modelling identified that MI admissions reduced by 45% (95% CI 58.0 to 28.4), post-legislation (2010 to 2011 compared to 2005/2006) in the 10 most deprived wards In comparison, the middle-ranked wards identified 42.3% reduction in MI admissions (95% CI 56.4 to 23.6) For the 10 most affluent wards, MI admissions reduced 38.6% (95% CI 57.5 to 11.2). Absolute risk difference between least-deprived wards for first 2 years was 69.8 MI admissions/100,000 person years compared to 2010 and 2011 data, 32 MI admissions/100,000 person years; RR 0.46 (95% CI 0.044 to 4.76) ARIMA analysis identified statistically significant effects of smoking ban for men in the most deprived wards and middle-ranked wards Reduction in MI admissions following smoking ban was greater than secular trends. Upstream intervention	
Roberts 2012	USA, Rhode Island Comprehensive 2006/2007 2008/2009	AMI age-adjusted admission rate pre-ban (2003) was 35.2/10,000 population (95% CI 34.0 to 36.5) and post-phase 11 of the ban in 2009, 23.1/10,000 population (95% CI 22.1 to 24.1) Between 2003 and 2007, following the 1st implementation of the smoking ban, the number of admissions for AMI decreased 17.1%, with a reduction in reimbursed hospital costs	No smoking status reported
Sargent 2012	Germany Federal and State bans Partial 2007 to 2008	Cohort aged 30 to 105 years, mean 56 years. 66.5% women registered. 43.5% of cohort were retired, 39.9% of members were employed. 2.2% of cohort were hospitalized for angina pectoris, and 1.1% of cohort had been hospitalized for AMI during the study period At 1 year follow-up, smoking bans associated with 13.28% (95% CI 8.19 to 18.36) reduction in admissions for angina pectoris and an 8.58% (95% CI 4.99 to 12.17) reduction in AMI hospitalizations The percent reduction in AMI did not differ with respect to gender. Reductions in admissions for AMI higher for younger participants (30 to 68 years) compared to older group, 15.77% (95% CI 10.57 to 20.97) After the law, there was a statistically significant downward trend in admissions for angina with slope resulting in a decline of about 5 hospitalizations per month slope = −5.33 (95% CI 7.18 to 3.48). The percent reduction in angina was not significantly different for older vs younger individuals, or men vs women. Larger reductions in hospitalizations for angina were observed in older participants,15.66% (95% CI 10.9 to 20.39) Hospitalization costs reduced during study period. Overall the introduction of smoking ban was associated with prevention of 1880 hospitalizations and savings of EUR 7.7 million	No smoking status reported

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Study	Location/ Intervention	Outcomes	Smoking status
		Cardiac outcomes	
Schmucker 2014	Germany, Breman Partial 2008	3545 patients admitted. Mean age 63 ± 10 years. 72% were men, 20% diabetes mellitus and 44% active smokers Smokers with STEMI were younger than nonsmokers 56 years ± 12 vs 69 ± 12, P < 0.01; men, 80% vs 66%, P < 0.01 Smokers with STEMI had significantly fewer coronary vessels diseased compared to nonsmokers, 1.76 ± 0.8 vs 1.99 ± 0.8, P < 0.01. (Nonsmokers in study included ex-smokers in analyses) Hospitalization rates for STEMI decreased post-smoking ban, a reduction from 65 ± 10 per month to 55 ± 9 Number of nonsmokers admitted for STEMI significantly decreased from 39 cases/month pre-ban to 29 cases, P < 0.01. This reduction was observed in both genders and all ages in nonsmokers. Greatest reductions in nonsmokers were in those aged ≤ 65 years, 32%, P < 0.01 and in those > 65 years, P < 0.01 (after adjusting for confounders hypertension, obesity, diabetes mellitus). 16% (P < 0.01) reduction in total STEMI admissions post-ban. Overall 26% reduction (P < 0.01) in admissions among nonsmokers. There was no significant difference in the number of smokers admitted for STEMI post-smoking ban	Self-reported smoking status
Sebrié 2014	Uruguay Comprehensive 2006	11,135 cases identified over study period. 65% were men (n = 7287). In 2008 there was a significant drop in AMI monthly admissions -35.9 ± 10.1 (SE), constant 167 ± 7, a 22% drop. A similar reduction was observed for men, women and people aged 40 to 65 years and aged 56 years and older The 2nd follow-up analyses 2004 to 2010 identified a drop of 30.9 cases/month AMI admissions (95% CI -49.8 to -11.8, P = 0.002) The effect of the law did not increase or decrease over time The overall drop in AMI monthly admissions was 17%, IRR 0.829 (95% CI 0.743 to 0.925, P = 0.001) (to 2010) following smoke-free legislation The results from 2010 analyses confirm the sustained impact of smoke-free legislation on AMI admissions	No smoking status reported
Séguret 2014	France Comprehensive 1991, 2006, 2008	Adjusted for age and sex admission rates for ACS admissions observed a reduction from 269.1/100,000 2003 to 234, RR 0.87 (95% CI 0.85 to 0.89) in 2009. A reduction of 12.8% After adjusting for linear trends, reductions linked to the ban were not significant when analysed for gender or age groups (men aged ≤ 55 years or > 55 years and women ≤ 65 years or > 65 years). The study did not demonstrate a significant effect of a 2-phase ban on ACS admissions. ACS rate was reducing in France during this 7-year period	No smoking status reported
		Controlled before-and-after studies	
Alsever 2009	USA, Pueblo City, Colorado Control: Pueblo county outside city limits, El Paso county Comprehensive 2003	Significant drop in admissions for AMI among residents within Pueblo city limits continued in Phase 2 of the study (follow-up 36 months) Decrease 152 per 100,000 person years, a decline of 19% since Phase 1 and a	No smoking status reported

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Study	Location/ Intervention	Cardiac outcomes Outcomes	Smoking status
		decline of 41% pre-legislation RR 0.59 (95% CI 0.49 to 0.70) Males RR 0.67 (95% CI 0.52 to 0.82); Females RR 0.48 (95% CI 0.36 to 0.60) (pre-legislation to Phase 2) No significant changes were observed among residents outside the city limits RR 1.03 (95% CI 0.68 to 1.39) or in El Paso County, RR 0.95 (95% CI 0.87 to 1.03) Adjusting for secular trends in pre ban period was not significant. Sustained reduction in rates of AMI admissions observed over 3-year period	
Bonetti 2011	Switzerland, Canton Graubünden Control Canton Lucerne Partial Canton Ban 2008 (National Ban up to 2010)	Adjusted for air pollution, drug prescribing and comorbidities Statistically significant differences in admissions post-legislation identified in Graubünden (229 and 242 admissions pre-law; 183 and 188 admissions post-law; P < 0.05) Overall reduction in number of AMI admissions in Graubünden in the 2 years post-ban; 21% lower than in the 2 pre-ban years. The reduction most pronounced in nonsmokers, women and individuals with documented coronary artery disease, including those with prior AMI and prior coronary intervention or graft surgery Decrease in 2nd year of ban limited to nonsmokers 151 (2006) vs 108 (2010), P < 0.05 No decrease observed in control Lucerne No association found between magnitude of outdoor air pollution and incidence of AMI. Use of lipid-lowering drugs increased in Graubünden and in Lucerne	Smoking status reported No validation
Bruintjes 2011	USA, Greeley, Colorado and surrounding area Smoking ordinance Greeley Control: areas outside city Comprehensive 2003	Prevalence of smoking: 482 hospitalizations analysed in Greeley with 224 in residents of surrounding area. 23.7% active smokers in Greeley; 61.4% of patients were men. (30.0% smokers in control area). A significant decrease in hospital incidence rates in Greeley observed post-ordinance RR 0.73 (95% CI 0.59 to 0.90). NS result in comparison area. Difference between Greeley and comparison area was NS, P = 0.48 Regression analyses identified smokers experienced statistically significant reductions in hospitalizations in Greeley RR 0.44 (95% CI 0.29 to 0.65) Reduction in AMI rates in smokers in surrounding area did not differ from Greeley, P = 0.38 Significant difference observed post-ordinance, but not in comparison with surrounding area	Smoking status reported
Di Valentino 2015	Switzerland, Canton Ticino Partial (local smoke-free ordinance) 2007 Compared to Canton of Basel (no ban)	Mean incidence of STEMI reduced post-legislation in Ticino 123.7/100,000 pre-ban, to post ban 92.9 (2007 to 2008), P = 0.002; 101.6 (2008 to 2009), P = 0.024; 89.6 (2009 to 2010), P = 0.001 Post-ban reduction in STEMI admissions observed in age group 65 years and older irrespective of gender, each year post-ban, P = 0.0001 In the under-65-year age group , the mean incidence of STEMI admissions decreased in 1st year post-ban 109.0 vs 85.3, P = 0.01 No significant differences in annual number of STEMI admissions in Basel	No smoking status reported

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Cardiac outcomes			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
		during the study period except in age group 65 years and older 362.3 (pre-) vs 223.6, 234.4, 199.8. Lower STEMI admissions noted in Basel compared to Ticino during study period	
Ferrante 2012	Argentina, Santa Fe Comprehensive August 2006 Control: Buenos Aires City: partial October 2006	Significant reduction in in ACS admissions in Santa Fe -2.5 admissions/100,000, P = 0.03 and persistence change over time post-law 0.26 fewer admissions/100,000 inhabitants per month (95% CI -0.39 to -0.13, P < 0.001). 13% reduction compared to control city, RR 0.74 (95% CI 0.63 to 0.86) In Buenos Aires City no change post-ban, P = 0.28 or over time P = 0.89 Slight decrease (P = 0.84, NS) in smoking prevalence during study period (2005 to 2009) from national prevalence survey. More quit attempts in Sante Fe prior to ban than in control 53.2% (95% CI 42.5% to 63.6%) vs 44.4% (95% CI 34.3% to 55.0%, P = 0.045). No change in proportion of daily smokers or cigarettes consumed 100% smoke-free law more effective in reducing and sustaining reduction in admissions for ACS in Sante Fe	No smoking status reported from data Prevalence reported from other data source
Gaudreau 2013	Canada, Prince Edward Island Comprehensive 2003 Control: New Brunswick Province	Significant reduction in mean rate of AMIs 5.92 cases/100,000 person months, P = 0.04 post-smoking ban. The trend of admissions for angina in men reduced -0.44 cases/100,000 person months, P = 0.01 at 1 to 67 months post-smoke-free law. No significant difference when comparing age groups 35 to 64 years and 65 to 104 years No significant difference for other cardiovascular admissions in study population	No smoking status included
Head 2012	USA, Beaumont City, Texas Control: Tyler Texas and All Texas Comprehensive 2006	Texas BRFSS data estimated ethnicity of current smokers 23% black, 20% white during 2005 to 2008 Discharges for all participants (non-Hispanic black and non-Hispanic white) declined significantly post-legislation in Beaumont for AMI, RR 0.74 (95% CI 0.65 to 0.85) and stroke RR 0.71 (95% CI 0.62 to 0.82)	No smoking status reported from data Reports state smoking prevalence from other data source
Herman 2011	USA, Arizona counties with bans Control: counties with no bans Comprehensive 2007	Statistically significant reduction in hospital admissions comparing ban counties with no-ban counties, AMI 159 cases, 13% reduction in cases, P = 0.01, angina 63 cases, 33% reduction, P = 0.014	No smoking status reported
Khuder 2007	USA, Intervention city: Bowling Green, Ohio Control city: Kent, Ohio Partial ban 2002	Admission rates for CHD-related diseases showed downward trend during study period Admission rates CHD in intervention city reduced 36/10,000 population in 2002 to 22 per 10,000 in 2003; 39% decrease (95% CI 33% to 45%) and to 19/10,000 in 2005, 47% decrease (95% CI 41% to 55%). Further ARIMA models identified a downward trend in admissions in Bowling Green, omega estimates: ω = -1.69, P = 0.036 compared to Kent City, ω -1.14, P = 0.183 No observed changes noted in Kent compared to reduced CHD admissions in Bowling Green	No smoking status reported
Loomis 2012	USA, Florida 2003, (partial) New York 1985, 2003 Comprehensive	The effect of comprehensive smoking ban on AMI rates in aged > 35 years was	No smoking status reported

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Cardiac outcomes			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
	Control: Oregon (partial ban)	significant in New York, marginally significant at 10% level in Florida The interaction of time and law is significant for Florida and New York. This indicates rates of AMI decreasing over time post-comprehensive legislation Moderate smoke-free laws in Oregon were associated with lower AMI rates β = 3.846, P < 0.05. The interaction with time was negative and significant β = -0.242, P < 0.01 Rates for AMI hospitalizations reduced 18.4% (95% CI 8.8 to 28.0) in Florida (annual decline of 5.3%) and 15.9% (95% CI 11.0 to 20.1), β = -1.483, P < 0.05 in New York This is equivalent to 28,649 fewer age-adjusted admissions (95% CI 20,292 to 37,006; annual decline of 4.4%) for New York The few comprehensive smoke-free laws in Oregon were not associated with state reduction in admissions for MI or stroke	
Naiman 2010	Canada, Toronto 1999, 2001 Comprehensive 2004 13 municipalities had bans Control cities: Durham Region, Thunder Bay (no bans)	A 39% reduction in cardiovascular conditions (95% CI 38 to 40), and a 33% reduction in admissions for respiratory conditions (95% CI 32 to 34) were observed after 2001 ban A significant reduction in admissions for angina were observed after the first ban, –0.913 (95% CI -1.24 to -0.59, P < 0.001) A significant reduction in admissions for all other conditions observed after the 2nd phase of the ban was enacted (restaurants) Only a significant reduction in admissions for AMI were noted after the 3rd phase of the ban, -0.611 (95% CI -1.03 to -0.19, P = 0.004). Authors suggest that reduction in hospital admissions unlikely due to decreased active smoking No significant results detected for specific age group or gender reported	Smoking status reported from national Canadian survey. No smoking status data from main data set.
Sargent 2004	USA Helena, Montana, Ordinance Partial ban (then suspended) June 2002 Control: non-residents	Reduction in monthly AMI admissions in residents Helena – 16 (95% CI -31.7 to -0. 3) post-ordinance. No significant decrease in admissions for those living outside of Helena	No smoking status reported
Seo 2007	USA, Monroe County Comprehensive 2005 Control: Delaware County, Indiana	Admission rates for AMI. There was a significant decrease in Monroe County but not in matched control Delaware County from the period August 2001 to May 2003 to the period August 2003 to May 2005 during which the smoke-free law was in effect for nonsmoking people. Monroe: 17 to 5 (95% CI -21.19 to -2.81) vs Delaware:18 to 16 (95% CI -13.43 to 9.43). There were no admissions for AMI among nonsmoking people from January 1st to May 2005 when the ban was extended to include bars and clubs. Non-significant reduction in admissions for AMI amongst smokers in Monroe from 8 pre-law to 7 post-law and in Delaware from 8 pre-law to 6 post-law during this period There was a significant difference in AMI admissions rates from August 2003 to May 2005 between Monroe and the control area 5 vs 16, change 11 (95% CI 2.02 to 19.98)	Self-reported smoking status
Vander Weg 2012	USA	1991 to 2008 data analysed	No smoking status reported

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Study	Location/ Intervention	Outcomes	Smoking status
		Cardiac outcomes	
	state bans 1991 to 2008 Ban varied by state Control: states with no bans	Risk-adjusted hospital admission rates for AMI reduced 20 to 21% in the 36 months post-implementation of smoking bans in restaurants, bars and workplaces (P < 0.001 for each ban) At baseline, counties with bans in place had higher admission rates for AMI compared to controls (and higher admissions for hip fractures) Counties with bans in 2008 had more Medicare enrollees and larger proportion of white residents At 36 months post-legislation, counties with bans had significantly lower AMI admission rates compared to no bans: RR 0.79, (No CI reported) P < 0.001 (workplace ban in place). Significant downward trends over time as increase in bans in different settings	
		Uncontrolled before-and-after studies	
Cesaroni 2008	Italy, Rome Comprehensive 2005	Prevalence: men: 34.9% pre-law period (2002 - 2003) to 30.5% post-law period (2005); women: 20.6% pre-law to 20.4% post-law Significant reduction in acute coronary events in 35- to 64-year-olds from pre-law to post-law period, RR 0.89 (95% CI 0.85 to 0.93) and in 65- to 74-year-olds, RR 0.92 (95% CI 0.88 to 0.97) No change in 75- to 84-year-olds, RR 1.02 (95% CI 0.98 to 1.07) Data from the post-law was compared with data in the previous year, the effect of the law was statistically significant on men but not on women and was greater for residents living in lower socioeconomic areas than those from higher socioeconomic areas Fewer acute coronary events in 35- to 64-year-olds identified (11.2%)	Self-reported smoking status from other survey No smoking status from admissions data
Hurt 2012	USA, Minnesota, Olmsted County 2002, 2007 Comprehensive 2007	Significant differences noted pre-ordinance 1 and post-ordinance 2 for MI. Incidence of MI declined by 33%, P < 0.001 from 150.8 to 100.7/100,000 population adjusted (age and gender) RR 0.67 (95% CI 0.53 to 0.83, P < 0.001)	Smoking status self-reported
Juster 2007	USA, New York Comprehensive 2003	In 2004, hospital admissions for AMI were reduced by 8% as a result of the comprehensive ban, equivalent to 3813 fewer admissions for AMI The smoking ban was associated with a reduction in admissions for AMI on average 0.32/100,000 persons per month in all counties in New York state (95% CI -0.47 to -0.16, P < 0.001)	No smoking status reported
Lemstra 2008	Canada, Saskatoon Comprehensive 2004	Age-standardized incidence rate of AMI per 100,000 population in Saskatoon 176.1 (95% CI 165.3 to 186.8) before smoke-free ban (1st July 2000 to 30 June 2004) to 152.4 (95% CI 135.3 to 169.3) post-ban (1 July 2004 to 30 June 2005) Incidence rate ratio: 0.87 (95% CI 0.84 to 0.90). 13% reduction in AMI discharges in period following legislation	Smoking status reported from survey data
Lippert 2012	Country: USA, Arizona 2007* Colorado 2006 District of Columbia 2007 Hawaii 2006* Illinois 2008* Iowa 2008* Louisiana 2007 Maryland 2008*	7 States had significant decrease in prevalence of CHD/angina post-ban: Arizona, District of Columbia, Hawaii, New Hampshire, New Jersey, New Mexico, Pennsylvania (state N) Arizona: (311) 4.7% (95% CI 3.6 to 5.8) vs (346) 3.4% (95% CI 2.8 to 3.9, P ≤ 0.0001)	Self-reported smoking status and reported health outcomes

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Cardiac outcomes			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
	Minnesota 2007 Nevada 2006 New Hampshire 2007 New Jersey 2006* New Mexico 2007 Ohio 2006* Pennsylvania 2008 Puerto Rico 2007* Utah 2006* Clean Indoor Air Act (varied implementation) * all comprehensive bans. Remaining states: partial bans.	District of Columbia: (141) 2.9% (95% CI 2.3 to 3.5) vs (132) 2.0% (95% CI 1.6 to 2.4, P < 0.001) Hawaii: (257) 3.4%(95% CI 2.8 to 4.0) vs (247) 2.6% (95% CI 2.2 to 3.1, P < 0.001) New Hampshire: (377) 4.5% (95% CI 4.0 to 5.0) vs (336) 3.6% (95% CI 3.1 to 4.1, P ≤ 0.001) New Jersey: (801) 4.6% (95% CI 4.2 to 5.0) vs (592) 3.6% (95% CI 3.2 to 4.0, P ≤ 0.0001) New Mexico: (340) 3.8% (95% CI 3.3 to 4.3) vs (438) 3.2% (95% CI 2.8 to 3.6, P ≤ 0.01) Pennsylvania: (891) 5.4% (95% CI 4.8 to 6.0) vs (625) 4.7% (95% CI 4.2 to 5.2, P ≤ 0.01) 2 states had increased prevalence of CHD/angina: Colorado, Louisiana 7 states/Territory had significant reductions in AMI post-ban (state N) District of Columbia: (149) 3.3% (95% CI 2.7 to 3.9) vs (127) 1.9% (95% CI 1.5 to 2.3, P ≤ 0.0001) Hawaii: (260) 3.6% (95% CI 3.0 to 4.2) vs (263) 2.9% (95% CI 2.4 to 3.4, P ≤ 0.01) Iowa: (317) 4.7% (95% CI 4.1 to 5.3) vs (344) 4.1% (95% CI 3.6 to 4.6, P < 0.05) Minnesota: (202) 3.4% (95% CI 2.9 to 3.9) vs (271) 2.8% (95% CI 2.4 to 3.2, P < 0.05) New Hampshire: (321) 4.0% (95% CI 3.5 to 4.5) vs (296) 3.4% (95% CI 2.9 to 3.9, P < 0.05) New Jersey:(676) 3.9% (95% CI 3.5 to 4.3) vs (567) 3.5% (95% CI 3.1 to 4.0, P < 0.05) Puerto Rico: (301) 4.7% (95% CI 4.1 to 5.3) vs (268) 4.0% (95% CI 3.4 to 4.7, P < 0.05) Four states had increased prevalence of AMI post-ban: Colorado, Louisiana, Nevada, Pennsylvania (NS) 14 States had significant decrease in prevalence of current smokers. Highest difference post-ban observed in New Hampshire, 3% change	
McGhee 2014	Hong Kong Partial 2007	Study period prior to comprehensive ban (July 2009). Partial smoking bans associated with 9% decrease in admissions for ischaemic heart disease (95% CI -13.59 to - 4.17, P < 0.05)	No smoking status reported
North Carolina 2011	USA, North Carolina Comprehensive 2010	Regression analyses identified a 21% decrease in emergency admissions for AMI 12 months following implementation of smoke-free restaurant and bars legislation RR 0.79 (95% CI 0.75 to 0.83) Reduction in admissions: men aged 18 to 59 years 2385 vs 1916; aged ≥ 60 years 3196 vs 2885 Women aged 18 to 59 years 946 vs 778; aged ≥ 60 years 2901 vs 2421 Additional modelling including interaction variables including time, gender, age category did not improve the model Additional modelling analyses identified improved outcomes were calculated using false start dates for legislation	No smoking status reported
Pell 2008	Scotland Comprehensive March 2006	In people admitted for ACS in Scotland, there was no significant reduction in self-reported number of cigarettes smoked in the pre- or post-law periods or the geometric mean cotinine level, 152 to 147 ng/ml, P = 0.72	Smoking status validated

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Cardiac outcomes			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
		Never-smokers reported decrease in SHS exposure and biochemically verified, serum cotinine mean 0.68 to 0.56 ng/ml; P < 0.001 No significant change for nonsmokers or ex-smokers (all admitted for ACS) reporting "no exposure" to SHS from pre- to post-law period in either "own home" or "other people's homes". Never-smokers reporting "no exposure" in own home: 83% (565/677) pre-law vs 86% (460/537) post-law, P = 0.64. Never-smokers reporting "no exposure" in "other people's homes": 91% (617/677) pre-law vs 92% (495/537) post-law, P = 0.34 14% reduction in ACS admissions among smokers, 19% reduction among ex-smokers and 21% reduction in never-smokers. Greater reduction in admissions current smokers: women 19% (95% CI 15% to 23%) compared to men 11% (95% CI 9% to 13%) Reductions highest in women non-smokers 23% (95% CI 20% to 26%) compared to men nonsmokers 18% (95% CI 16% to 20%) Greater reduction in admissions detected in male smokers aged ≤ 55 years and in women ≤ 65 years 9% (95% CI 6% to 12%) when compared to older people 8% (95% CI 15% to 21%) Similar results obtained for nonsmokers 8% (95% CI 4 to 12) vs 22% (95% CI 20 to 24).	
Rajkumar 2014	Switzerland, Basel City, Basel County and Zurich Partial 2010	Pulse wave velocity and heart rate variability parameters significantly changed (dose-dependent) for the 55 nonsmoking hospitality employees. A 1 cpd decrease was associated with a 2.3% (95% CI 0.2 to 4.4; P < 0.031) higher root mean square of successive differences, a 5.7% (95% CI 0. to 10.2; P < 0.02) higher high-frequency component and a 0.72% (95% CI 0.4 to 1.05; P < 0.001) lower pulse wave velocity The measures significantly improved after introducing smoke-free legislation and identify a decreased cardio vascular risk	SHS validated measure Self-reported smoking status
Yildiz 2015	Turkey, Kocaeli City Comprehensive 2009	Admissions for diagnoses of COPD and MI were unchanged (NS differences) post-legislation	No smoking status reported

Analysis 1.2. Comparison 1 Cardiovascular health outcomes, Outcome 2 Stroke outcomes.

Stroke outcomes			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
	ITS studies		
Mackay 2013	Scotland Comprehensive 2006	Pre-legislation rates for stroke, intracerebral haemorrhage and unspecified stroke were decreasing Rates for cerebral infarction were increasing 0.97%/year Following smoke-free legislation there was a reduction in admissions for cerebral infarction, persisting for 20 months. An 8.9% (95% CI 4.85 to 12.77, P < 0.001) stepwise reduction was observed at time of implementation	No smoking status reported

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Study	Location/ Intervention	Stroke outcomes Outcomes	Smoking status
		No interactions between subgroups were significant after adjustment for confounders (sex, age, residence or deprivation index)	
Controlled before-and-after studies			
Head 2012	USA, Beaumont City, Texas Comprehensive 2006 Control: Tyler Texas and All Texas	Discharges for all participants (non-Hispanic black and non-Hispanic white) declined significantly post-legislation in Beaumont for stroke, RR 0.71 (95% CI 0.62 to 0.82) Significant differences in stroke admissions observed for non-Hispanic white residents in Tyler (control area) RR 0.71 (95% CI 0.58 to 0.86). Reduction in admissions for all diagnoses in all Texas (mixed policies)	No smoking status reported Reports state smoking prevalence from other data source
Herman 2011	USA, Arizona counties with bans Comprehensive 2007 Control: counties with no bans	Statistically significant reduction in hospital admissions comparing ban counties with no-ban counties, stroke 198 cases, 14% reduction, P = 0.001	No smoking status reported
Loomis 2012	USA, Florida 2003, (partial) New York 1985, 2003 Comprehensive Control: Oregon (partial ban)	Significant reductions in hospitalizations for stroke admissions observed in Florida; 18.1% (95% CI 9.3% to 30.0%, β= -16.194, P < 0.01). This equates to a 5.2% reduction in hospital admissions. Moderate laws were significantly associated with a decrease in stroke hospitalizations over time, β= -0.122, P < 0.01. The few comprehensive smoke-free laws in Oregon were not associated with state reduction in admissions for MI or stroke	No smoking status reported
Naiman 2010	Canada, Toronto 1999, 2001, 2004 Comprehensive 2004 13 municipalities had bans. Control cities: Durham Region, Thunder Bay (no bans)	A 39% reduction in cardiovascular conditions (95% CI 38% to 40%). No significant reductions in admissions were noted in control cities or for control conditions. No significant results for specific age group or gender reported.	Smoking status reported from national Canadian survey. No smoking status data from main data set.
Uncontrolled before-after studies			
Juster 2007	USA, New York Comprehensive 2003	No effect on stroke admissions	No smoking status reported

Comparison 2. Respiratory health outcomes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 COPD			Other data	No numeric data
1.1 ITS studies			Other data	No numeric data
1.2 Controlled before-and-after studies			Other data	No numeric data
1.3 Uncontrolled before-and-after studies			Other data	No numeric data
2 Asthma			Other data	No numeric data
2.1 ITS studies			Other data	No numeric data

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Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2.2 Controlled before-and-after studies			Other data	No numeric data
2.3 Uncontrolled before-after studies			Other data	No numeric data
3 Lung function			Other data	No numeric data
3.3 Uncontrolled before-and-after studies			Other data	No numeric data

Analysis 2.1. Comparison 2 Respiratory health outcomes, Outcome 1 COPD.

		COPD	
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
ITS studies			
Croghan 2015	USA, Minnesota, Olmstead County Comprehensive 2007	In relation to COPD, the implementation of smoke-free legislation was not associated with a downward step change in ED visits P = 0.158 or change in trend, P = 0.313.	No smoking status reported
Humair 2014	Switzerland, Geneva Partial ban (with period of suspension) 2008	Hospitalizations for COPD significantly decreased over 4 periods of time, IRR 0.54 (95% CI 0.42 to 0.68)	No smoking status reported
Kent 2012	Ireland Comprehensive 2004	Admissions for pulmonary illness 439/100,000 population per annum to 396/100,000, 1 year post-ban unadjusted RR 0.91 (95% CI 0.83 to 0.99, P = 0.048) and adjusted for confounders RR 0.85 (95% CI 0.72 to 0.99, P = 0.04) Significant differences observed for asthma and pneumonia, but not for COPD in any age group	No smoking status reported
Controlled before-and-after studies			
Dusemund 2015	Switzerland, Canton of Graubünden Local ordinance: Partial 2008 Control: Rest of Switzerland (not including Graubünden or Ticino)	22.4% reduction in incidence of AE-COPD admissions, IRR 0.78 (95% CI 0.68 to 0.88, P < 0.001). Rest of Switzerland, reduction 7%, IRR 0.93 (95% CI 0.91 to 0.95, P < 0.001) Greater reduction in admissions observed in Intervention Canton, P = 0.008 compared to control	No smoking status reported
Gaudreau 2013	Canada, Prince Edward Island Comprehensive 2003 Control: New Brunswick Province	No significant differences reported for respiratory admissions	No smoking status reported
Hahn 2014	USA, Kentucky Comprehensive 2004, 2008 to 2011 Control: counties with smoking policy < 12 months or no ban	Adjusting for all characteristics, population and seasonal trend factors, risk ratio of COPD hospitalizations in communities with comprehensive smoking bans was 0.781 compared to communities with a weak or no policy Chi^2 = 6.65, P = 0.01; 95% CI 0.647 to 0.942 The risk ratio of hospitalizations for COPD in communities with established laws was 0.789 compared to communities with new or no laws Chi^2 = 9.91, P = 0.02; 95% CI 0.680 to 0.914 Protective factors for reduced COPD admissions were being male, aged 45 to 64 years and living in county with higher post-secondary education Overall the study identified those living in counties with comprehensive smoke-free laws were 22% less likely to	No smoking status reported

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COPD			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
		be hospitalized for COPD compared to those living in counties with weak or no laws. Counties that had smoking bans in place for > 12 months were 21% less likely to be hospitalized for COPD compared to communities with laws < 12 months or no laws The study found that smoke-free policies can improve health outcomes and can negate risk factors including lower socioeconomic status and living in rural tobacco-growing communities	
Head 2012	USA, Beaumont City, Texas Comprehensive 2006 Control: Tyler Texas and All Texas	COPD discharges for non-Hispanic black residents RR 1.04 (95% CI 0.85 to 1.27 (NS)) and non-Hispanic white residents RR 0.64 (95% CI 0.54 to 0.75) in Beaumont. NS in control areas	No smoking status reported
Naiman 2010	Canada, Toronto Comprehensive 1999, 2001, 2004 13 municipalities had bans Control cities: Durham Region, Thunder Bay (no bans)	33% reduction in admissions for respiratory conditions, (95% CI 32 to 34) observed after 2001 ban	Smoking status reported from national Canadian survey. No smoking status reported from main data set
Vander Weg 2012	USA State bans 1991 to 2008 Control: States with no bans	36 months post-legislation, states with bans had significantly lower COPD admission rates compared to no bans, 11% to 17%, P < 0.001 with significant decreasing trends over time as increase in bans in different settings	No smoking status reported
Uncontrolled before-and-after studies			
McGhee 2014	Hong Kong Partial 2007	Respiratory admissions and admission for lung cancer increased	No smoking status reported
Yildiz 2015	Turkey, Kocaeli City Comprehensive 2009	Bronchitis admissions reduced 39.8%, 44,141 to 26,558 post-ban Admissions for LRTI decreased (7048 to 6738, P < 0.01) post-legislation. Peak admission levels noted May 2010 Admissions for diagnoses of COPD and MI were unchanged (NS differences) post-legislation Admissions for allergic rhinitis: NS trend analysis observed. Admissions for asthma showed NS increase (6805 vs 7895)	Principal diagnostic codes used No smoking status reported

Analysis 2.2. Comparison 2 Respiratory health outcomes, Outcome 2 Asthma.

Asthma			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
ITS studies			
Croghan 2015	USA, Minnesota, Olmstead County Comprehensive 2007	Evidence supported a downward step change in ED visits for asthma, RR 0.814 (95% CI 0.722 to 0.966, P < 0.001) post-legislation Results for adults identified similar trend, RR 0.840 (95% CI 0.729 to 0.966, P = 0.015) post-legislation For children RR 0.751 (95% CI 0.595 to 0.947, P = 0.015) post-legislation	No smoking status reported
Humair 2014	Switzerland, Geneva Partial ban (with period of suspension) 2008	No statistically significant changes for asthma admissions	No smoking status reported
Kent 2012	Ireland Comprehensive 2004	Significant differences post-legislation in younger age groups for asthma admissions, RR 0.60 (95% CI 0.39 to 0.91, P = 0.016)	No smoking status included

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Study	Location/ Intervention	Outcomes	Smoking status
		Asthma	
Mackay 2010	Scotland Comprehensive 2006	Pre-legislation, admissions for asthma in aged 0 to 14 years increased, mean rate 5.2% year, (95% CI 3.9 to 6.6). Post-legislation, mean reduction in rate of asthma admissions 18.2% per year compared to March 26th 2006, (95% CI 14.7 to 21.8, P < 0.001) After adjusting for sex, age group, residence, or socioeconomic status, admissions for asthma increased pre-ban 4.4%/year, (95% CI 3.3 to 5.5). Post-legislation the rate of admissions decreased 15.1%/year, (95% CI 12.9 to 17.2) Reductions in admissions for asthma were observed in both age groups post-legislation. 55.1% of admissions occurred in preschool children. Pre-legislation, there was an increasing trend in admissions in this group (9.1%). Similar reductions post-legislation; NS difference observed between the age groups (No significant differences were observed between the groups after adjusting for age, sex, area of residence and socioeconomic group) Significant reduction in emergency admissions for children with asthma observed following smoke-free legislation	Nonsmokers as participants' children Smoking prevalence reported from other data source
Millett 2013	England Comprehensive 2007	50.1% of the 217,381 admissions were preschool-aged during study period Pre legislation the admission rate for children with asthma was increasing 2.2%/ year, adjusted RR 1.02 (95% CI 1.02 to 1.03). Post-legislation there was a statistically significant decrease in admission rates for childhood asthma: 8.9%, adjusted RR 0.91 (95% CI 0.89 to 0.93). Overall the legislation was associated with a 12.3% reduction in hospital admissions for childhood asthma in the 1st year Modelling analyses identified a potential reduction of 6802 admissions in the 1st 3 years following smoke-free legislation Multivariate analyses identified post legislation reductions in asthma admissions adjusting for age, gender, socioeconomic status, area of residence and in all English regions.	Nonsmokers as participants' children
Roberts 2012	USA, Rhode Island Comprehensive 2006/2007 2008/2009	There was an increase in hospitalizations for asthma between 2003: 11.3% (95%CI 10.6 to 12.1) and 2009: 13.5% (95% CI 12.8 to 14.3)	No smoking status reported
Sims 2013	England Comprehensive 2007	502,000 admissions recorded during study period. Adjusted for seasonality, variation in population and long-term trends Smoke-free legislation associated with immediate 4.9% (95% CI 0.6% to 9.0%) reduction in emergency admissions for asthma in adults. This would equate to approximately 1900 admissions prevented in each of the 1st 3 years post-legislation No regional differences were observed	All nonsmokers in study
		Controlled before-and-after studies	
Gaudreau 2013	Canada, Prince Edward Island Comprehensive ban 2003 Control: New Brunswick Province	No significant differences reported for asthma admissions in children aged 0 to 14 years or in adults	No smoking status reported
Head 2012	USA, Beaumont City, Texas Comprehensive	Discharges in Beaumont reduced for white non-Hispanic residents for asthma, RR 0.69 (95% CI 0.52 to 0.91. Black	No smoking status reported from data Reports state smoking prevalence from other data source

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Asthma			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
	2006 Control: Tyler Texas and All Texas	non-Hispanic residents RR 1.00 (95% CI 0.84 to 1.21)	
Herman 2011	USA, Arizona Counties with bans Comprehensive 2007 Control: counties with no bans	Statistically significant reduction in hospital admissions comparing ban counties with no-ban counties Asthma: 249 cases, 22% reduction, P < 0.001	No smoking status reported
Landers 2014	USA States: Comprehensive bans Arizona May 2007, Colorado July 2006, Florida July 2003, Hawaii November 2006, Iowa July 2008, Maryland February 2008, New Jersey April 2006, New York July 2003, Rhode Island May 2005, Utah May 2006, Vermont September 2005, Washington December 2005 Control States: Arkansas, Kentucky, Michigan, South Carolina, Wisconsin	Bivariate analyses identified adult asthma discharge rates associated with being non-white 0.26, P < 0.001, living in poverty, 0.19, P < 0.001 and rate of primary care physicians in county 0.16, P < 0.001 Child asthma discharges associated with living in poverty 0.33, P < 0.001, smoking prevalence 0.24, P < 0.001 and state cigarette tax -0.18, P < 0.001 Multivariate adjusted models observed significant reduction in relationship between implementation of county laws and reduction in working-age adult asthma discharges β = -2.44, P < 0.05 and child asthma discharges β = -1.32, P < 0.05 No significant effect of state laws on working-adult or child asthma beyond effect of county laws. No effect of state laws on appendicitis discharge rates Local county laws had impact on asthma discharges	Smoking status self reported
Uncontrolled before-after studies			
Yildiz 2015	Turkey, Kocaeli City Comprehensive 2009	Admissions for asthma showed NS increase (6805 vs 7895)	No smoking status reported

Analysis 2.3. Comparison 2 Respiratory health outcomes, Outcome 3 Lung function.

Lung function			
Study	**Location/ Intervention**	**Outcomes**	**Smoking status**
Uncontrolled before-and-after studies			
Durham 2011	Switzerland, Canton of Vaud Local ordinance Partial 2009	ETS exposure declined significantly after introduction of new smoke free law. Smokers had lung age 5.6 years older than chronological age. 61.0% reported smoking at baseline. 54.6% at follow up. Pre law: non-smokers inhaled equivalent of 1.4 to 7.4 cigarettes / day. Post law significantly reduced p<0.05. (Figure not given). Lung function: improved in women +3.07%, p=0.05; non-smokers +3.91%, p=0.04; and in older participants +4.22%, p=0.004.	Lung function and smoke exposure validated Self-report health status
Goodman 2007	Ireland Comprehensive March 2004	Total ETS exposure to SHS was 46.9 hours pre ban and 4.2 hours post ban, a decrease of 90%. Exposure to SHS outside of work: Mean 6.4 hrs pre-law V 3.7 hrs at 1 yr post-law (% change) -42%; p ≤ 0.01. FVC parameters increased significantly in never smokers, it declined in current smokers. FEV1 did not change significantly in any group; increased in non smokers. Significant reduction in carboxyhaemoglobin by 5% in the never-smoker group, but no significant reduction in ex-smokers and current smokers. 79%	Self reported exposure to SHS was validated by carboxyhaemoglobin, exhaled CO and salivary cotinine

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Study	Location/ Intervention	Lung function Outcomes	Smoking status
		reduction in exhaled CO for never and ex smokers but no significant change in current smokers. Exhaled CO Median (interquartile range) ppm: 4.0 (IQR, 3-5) pre law vs 2.0 (IQR, 2-3) follow up, p <0.001. Median exhaled breath CO and salivary cotinine decreased by 79% and 81% respectively in never and ex smokers. Saliva cotinine Median (IQR) ng/ml: 5.1 (IQR 3.4-7.6) pre law V 0.6 (IQR 0.3-1.3) follow up, p <0.001.	
Larsson 2008	Sweden Comprehensive June 2005	No change in median cigarettes per day: 17 cig/day to 15 cig/day at 12 month follow-up, p for trend= 0.788, NS. No significant reduction for cigarette consumption for either gaming (casino or bingo hall) or for other hospitality employees. Small number of smokers at baseline. No change in smoking status from baseline to 12 months follow up. Small number of smokers at baseline that responded at follow-up, n= 14. Significant reduction in the percentage of employees reporting exposure to SHS for 75% of more of their time at work. 59/91 (65%) pre ban V 1/71(1%) at follow up, p<0.001. Greater duration of SHS exposure amongst gaming employees than other hospitality employees at baseline (p value for trend= 0.029) but duration of SHS exposure was similar in both at follow up. No statistical changes in spirometry / lung function or cigarettes consumed at one year follow up.	Biochemical validation of Active and SHS exposure and urinary cotinine
Rajkumar 2014	Switzerland, Basel City, Basel County and Zurich Partial 2010	27.2% of participants (n=92) were ex smokers, the remainder being non smokers. 14.1% reported diagnosis of asthma, 62% were female respondents (n=57). SHS bio chemically measured using Monitor of Nicotine (MoNIC) passive sampling badges. Exposure to SHS decreased during the study. Of the 78 participants exposed to SHS at baseline, 55 were not exposed at follow up and their SHS exposure decreased from 2.6,95% CI 1.7 to 3.4 CE/d to 0.2, 95% CI: 0.1 to 0.2 CE/d. Lung function analyses were completed on all 62 participants. At baseline, lung function testing identified lower results compared to population range, difference marked for women forced expiratory volume (FEV). After the smoking ban, an adjusted odds ratio for cough was 0.59, 95% CI 0.36 to 0.93, and for chronic bronchitis 0.75, 95% CI 0.55 to 1.02 compared to baseline. Post ban, self reported cough decreased. Below average lung function pre legislation indicates chronic damage from long term smoke exposure. Second hand smoke exposure in 55 non smoking hospitality employed participants was 2.56, 95% CI 1.70 to 3.44 cigarette equivalents per day pre ban and was 0.16, 95% CI 0.13 to 0.20 at follow up (Rajkumar 2014).	SHS exposure bio chemically measured in air quality measurements Non smokers in study - self reported

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Comparison 3. Perinatal health outcomes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Effect on perinatal health			Other data	No numeric data
1.1 ITS studies			Other data	No numeric data
1.2 Controlled before-and-after studies			Other data	No numeric data
1.3 Uncontrolled before-and-after studies			Other data	No numeric data

Analysis 3.1. Comparison 3 Perinatal health outcomes, Outcome 1 Effect on perinatal health.

Effect on perinatal health		
Study	**Location/ Intervention**	**Outcomes**
	ITS studies	
Amaral 2009	USA, California Local smoke free ordinances 1988 to 1994. State workplace ban Partial 1995	44181 births during study period Local workplace ordinances decreased the fraction of very low birth weight births in cities with local ordinances by 0.04 percentage points The implementation of local smoking ordinances was associated with a decrease in birth weight of 1.83 grams and increased gestation by 0.03 days The statewide ordinance was associated with a reduction in birth weight of 6.58 grams, P < 0.001 reducing to non-significant changes of -2.45 grams and -3.12 grams after adjusting for different cities and ban trajectories Subgroup analyses identified that white mothers had an increase in gestation of 0.19 days, P < 0.001 after local ordinances and a significant decrease in very low birth weights by 0.06 percentage points, P < 0.001. Education level of mothers was not associated with significant differences in birth outcomes if local ordinance was in place. The statewide ordinance was significantly associated with lower birth weight and decreased gestation for lower-educated mothers. Mothers with high school degree education were significantly associated with increased birth weight by 10 grams and decreased fraction of very low birth weight by 0.2 percentage points The statewide smoking ordinance, after adjusting for race and ethnicity, was associated with a significant reduction in birth weight of 7.2 grams, P < 0.05 for Hispanic mothers Results suggest that state work place smoking bans had a statistically significant but small negative effect on birth weight. Local ordinances did not have a similar effect
Cox 2013	Belgium Comprehensive 2010	606,877 singleton births delivered at 24 to 44 weeks gestation 448,520 births spontaneous deliveries Reductions in risk of preterm births reduced at each phase of smoking ban legislation After 2010 comprehensive ban, there was step change in the risk of spontaneous preterm delivery; slope change -2.65% (95% CI -5.11 to -0.13; P = 0.04) Similar reductions noted for all births, change -3.5% (95% CI -6.35 to -0.57; P = 0.02) No significant effect of smoking ban on risk of low birth weight or small-for-gestational-age in population or on average birth weight (adjusted modelling)
Kabir 2013	Ireland Comprehensive 2004	Maternal smoking rates from 2000 to 2008 were higher in mothers who had SGA or vSGA. Data available from

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Study	Location/ Intervention	Outcomes
	Effect on perinatal health	
		1 maternity hospital 2000 to 2008 data. Not linked to national registry data Reduced monthly rates of SGA and vSGA reductions were observed post-legislation (adjusted modelling); 4.7% to 4.3% (vSGA) and 6.9% to 6.6% (SGA). Effects continued in the post-ban period: vSGA -0.6%, P < 0.0001 and SGA -0.02%, P < 0.0001 Significant reduction in low birth weights observed indicates evidence of smoke-free legislation
Mackay 2012	Scotland Comprehensive 2006	Post-legislation there was a significant reduction in current smoking rates, 25.4% to 18.8%, P < 0.001; and an increase in never-smokers 57.3% to 58.4%, P < 0.001 Univariate modelling identified decrease 11.07% 95% CI 6.79 to 15.15, P < 0.001) in overall preterm deliveries and a decrease 10.26% (95% CI 4.04 to 16.07, P < 0.002) in spontaneous preterm labour. Significant for current and never-smokers (model used date 1st January 2006, not 26th March) Prior to legislation multivariate analyses observed significant decreases (after adjusting for confounders) in SGA -4.52% (95% CI -8.28 to -0.60, P = 0.024); vSGA -7.95 (95% CI -15.87 to -7.35, P = 0.048), overall preterm delivery -11.72% (95% CI -15.87 to -7.35, P < 0.001), and for spontaneous preterm labour -11.35% (95% CI -17.20 to -5.09, P = 0.001). Significant reductions for current and nonsmokers Analyses using later start date identified increase in preterm delivery rates 3.83 (95% CI 1.42 to 6.30, P = 0.002), following adjustment for pre-eclampsia data
	Controlled before-and-after studies	
Bharadwaj 2012	Norway Intervention: Mothers who work in bars and restaurants Control: All other mothers on register Comprehensive 2004	Post-legislation mothers in the treatment group significantly reduced their risk of < 1500 grams birth by 1.9 percentage points (P < 0.05) and < 2000 grams birth by 2.5 percentage points (P < 0.05) and a significant reduction of 2.5 percentage points in being born preterm. There was no effect on < 1000g, APGAR score or if birth defect or male birth Approximately 20% of mothers in treatment group reported smoking at start of pregnancy; 64% were not smoking at start of pregnancy. No details reported for remainder. Following the smoking ban, mothers in the treatment group were 15.4% more likely to quit smoking during pregnancy (P < 0.05). The impact of quitting smoking at start of pregnancy increased birth weights on average by 162.5 grams, P < 0.05 There was no effect on birth weight for mothers who were nonsmokers at start of pregnancy. Mothers with missing data for smoking status also had increased birth weights of 105.5 grams and may suggest underreporting of smoking status Further analyses did not identity changes in birth weight associated with self-reported income Occupational status during pregnancy changed for the treatment group. A number of mothers changed employment from bars and restaurants. Analyses of these changes did not identify significant differences to the results The impact of fathers' smoking status on birth weight identified a decrease of 77.09 grams in the treatment group (significant at 10% level) Further analyses on the impact of birth weight on later life success predicted that at age 28 years, a 100 gram increase in birth weight could increase adult income by 1.8%. For the sample in the study, their birth weight increase of 164 grams would translate into a 2.7% increase in salary This study identified that mothers working in bars and restaurants after smoke-free legislation was introduced were 15% more like to quit smoking and this impacted on increased birth weights and on lower incidences of preterm births
Page 2012	USA, Colorado Intervention: Pueblo	Significant differences observed at baseline between the intervention city and the comparison in relation to

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Effect on perinatal health		
Study	**Location/ Intervention**	**Outcomes**
	Control: El Paso Comprehensive 2003	mother's mean age. race, ethnicity, education, alcohol consumption, marital status and anaemia Significant differences existed in relation to previous pregnancy and medical history. Mothers from Pueblo were more likely to be Hispanic, have lower education and report previous pregnancy complications Results identified significantly more mothers were smoking in the control City 8.66% pre-ban compared to 11.89% post-ban, P < 0.0001 The percentage of smokers in Pueblo was 16.64% at baseline and 15.07% post-ban, P < 0.0786, NS No significant differences were noted post-ban in intervention city in relation to LBW. In control city, there was an increase in births < 3000 grams, 29.78% to 32.02%, P < 0.0001 Unadjusted rates of preterm babies did not change over time in Pueblo but increased in the control city, 7.93% to 9.23%, P < 0.001 Multivariable logistic regression modelling, adjusted for medical conditions, and birth characteristics found no significant association among location, ban and LBW Unadjusted models for preterm births identified a 21% (23% adjusted) reduction in odds of preterm birth associated with smoking ban, P < 0.05, in Pueblo When compared to control city, the smoking ban in Pueblo was associated with a 38% reduction in odds of maternal smoking, OR 0.620 (95% CI 0.529 to 0.727, P < 0.05)
Uncontrolled before-and-after studies		
Kabir 2009	Ireland Comprehensive 2004	1 year post-smoking legislation, a 25% decrease in risk of preterm births was observed; OR 0.75 (95% CI 0.59 to 0.96) There was a 43% increased risk of LBW; OR 1.43 (95% CI 1.10 to 1.85) after adjusting for all potential confounders A 12% reduction in maternal smoking rates (23.4% to 20.6%) was observed post-ban There was an increase in smoking cessation prior to pregnancy in 2005, P = 0.047 Significant decline in preterm births and maternal smoking. Increase in LBW birth risks may reflect secular trend

Comparison 4. Mortality outcomes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Effect on mortality rates			Other data	No numeric data
1.1 ITS studies			Other data	No numeric data
1.2 Controlled before-and-after studies			Other data	No numeric data
1.3 Uncontrolled before-and-after studies			Other data	No numeric data

Analysis 4.1. Comparison 4 Mortality outcomes, Outcome 1 Effect on mortality rates.

Effect on mortality rates		
Study	**Location and Ban**	**Study Design/ Outcomes**
ITS studies		
Aguero 2013	Spain, Girona	AMI admissions and mortality. AMI case fatality n = 891

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Study	Effect on mortality rates Location and Ban	Study Design/ Outcomes
	Partial 2006	Post-ban decrease observed in AMI mortality rates, RR 0.82 (95% CI 0.71 to 0.94, P < 0.05) AMI mortality age < 65 years NS. ≥ 65 years RR 0.82 (95% CI 0.74 to 0.91, P < 0.05) (AHA/ESC definition) Subgroup analysis: women AMI mortality rates, RR 0.72 (95% CI 0.52 to 0.97, P < 0.05) men: AMI mortality rates, RR 0.85 (95% CI 0.72 to 0.99, P < 0.05) (AHA/ESC definition)
Cox 2014	Belgium, Flanders Partial 2007	Flemish Agency for Care and Health registry data on AMI deaths for people aged ≥ 30 years during 2000 to 2009. 38,992 AMI deaths recorded Decreased AMI mortality rates January 2006. Highest in women ≤ 60 years, -33.8% (95% CI -49.6 to -13.0) compared with effect for men -13.1% (95% CI -24.3 to -0.3) Estimates for aged ≥ 60 years -9.0% (95% CI -14.1 to – 3.7) for men, and -7.9% (95% CI -13.5 to -2.0) for women. Additional effect post-2007 legislation for men aged ≥ 60 years with annual slope change -3.8% (95% CI -6.5 to -1.0) From January 2006 to December 2009, the model predicts 1715 fewer AMI deaths with smoke-free legislation. Step change in mortality after 1st ban.
De Korte-De Boer 2012	Netherlands, Limberg General work place ban 2004 Included hospitality sector 2008 Comprehensive 2008	Weekly incidence data on sudden cardiac arrest from ambulance registry South Limberg. 2305 sudden cardiac arrest cases recorded during study period (2002 to 2010), mean incidence 5.3 (SD 2.3) Adjusted Poisson model identified small increase in sudden cardiac death pre-ban and reduced post-ban 2004 -0.24% cases/week, P = 0.043. Equivalent to 6.8% reduction 1 year post-ban, 22 cases. No further decrease noted after 2nd ban. This may be due to poor enforcement of 2008 legislation
Jan 2014	Panama Comprehensive 2008	Mortality regression models (January 2001 to April 2008) on changes in deaths from MI identified 0.5% annual percentage change, P < 0.05. The trend was 0.47% up to June 2010, with a trend change of -0.3% July 2010 to December 2012. The change was not statistically significant
Stallings-Smith 2013	Ireland Comprehensive 2004	Impact on mortality rates. During study period 215,878 non-trauma deaths recorded in population ≥ 35 years (2000 to 2007) Following smoke-free legislation, there was a 13% immediate decrease in all-cause mortality, RR 0.87 (95% CI 0.76 to 0.99) There was a 26% reduction in deaths from ischaemic heart disease, RR 0.74 (95% CI 0.63 to 0.88), a 32% reduction in deaths from stroke, RR 0.68 (95% CI 0.54 to 0.85), and a 38% reduction in COPD deaths, RR 0.62 (95% CI 0.46 to 0.83) after smoke-free legislation Post-ban reductions for IHD, stroke and COPD were observed in ages ≥ 65 years COPD mortality was reduced in women, RR 0.47 (95% CI 0.32 to 0.70) 15% decrease in non-smoking-related mortality, RR 0.85 (95% CI 0.75 to 0.97). There was a 5% increase in mortality each post-ban year. No post-ban annual trend reductions were detected for any smoking-related causes of death Unadjusted estimates of 3726 smoking-related deaths (95% CI 2305 to 4629) were probably prevented as a result of smoke-free legislation, primarily due to reduced passive smoke exposure Follow-up paper mortality rates and socioeconomic status (2000 to 2010) Stallings-Smith 2014 identified smoking ban reduced inequalities in smoking-related mortality. 2 factors emerged explaining 81% of the variance: Structural factors were characterised with high loadings on education, occupation, foreign nationality and family composition Material aspects loaded in the 2nd factor included: unemployment, housing tenure and car access

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Study	Location and Ban	Study Design/ Outcomes
		Effect on mortality rates
		No post-ban annual trend effects were detected for any cause of death in the period 2000 to 2007 Post-ban mortality effects of structural socioeconomic indicators identified a reduction in smoking-related inequalities For IHD and COPD mortality rates, reductions were strongest in the most deprived tertile; decreases in stroke mortality were observed across all socioeconomic groups (Stallings-Smith 2014)
		Controlled before-and-after studies
Dove 2010	USA, Massachusetts Control 290 cities and towns with no bans Comprehensive 2004	AMI deaths recorded on national registry Post-legislation statistically significant reduction in AMI mortality rates 7.4% (95% CI 3.3 to 11.4, P < 0.001); 270 fewer deaths Significant reduction in AMI mortality rates aged ≥ 75 years compared to younger, -9.1% (95% CI -13.9 to -4.1, P < 0.001). Higher reduction detected in women compared to men, -9.7% (95% CI -15.1 to -3.9, P < 0.001) No significant results in control groups State ban reduction -1.6% in 1st year and increased to -18.6%, P < 0.001, in 2nd year following legislation
Rodu 2012	USA, state bans California 1 January 1995 Utah 1 January 1995 South Dakota 1 July 2002 Delaware* 27 November 2002 Florida 1 July 2003 New York * 24 July 2003 * Comprehensive bans Remaining states no bans	Secondary analysis of AMI mortality rates aged > 45 years California: The AMI mortality rate declined pre-ban 1992 to 1993 from 225/100,000 to 204/100,000, annual reduction of 3%. Post-ban the AMI rate declined 2%, P = 0.16 Utah: 3 years pre-ban, the AMI mortality rate decreased from 200 to 180/100,000; 3.3% annual reduction. In 1995, post-ban, the rate declined 7.7%, P = 0.43 Between 1991 and 1994, no significant difference was noted in other 48 States without smoking bans at that time. South Dakota: In the 3 years pre-ban, AMI mortality rates dropped 253 to 198/100,000, 7.2% annual reduction. In the year post-ban, the rate increase 8.9% to 216/100,000, P = 0.007 Delaware: Pre-ban the AMI mortality rate decreased 199 to 160/100,000, 6.6% annual decline. Post-ban the rate decreased 8.1%, P = 0.89 Between 1999 and 2002 the AMI rate declined for the other 46 States without a ban. In 2003 the rate of AMI decline was 7.2%, significantly greater than expected, P < 0.0002. Florida: Pre-ban the AMI mortality rate declined 169 to 132/100,000, 6.4% annual decline. Post-ban the rate significantly reduced 8.8%, P = 0.04 New York: Pre-ban AMI mortality rates reduced 187 to 160/100,000, 4.9% annual reduction. Post-ban the rate significantly declined 12%, P < 0.0002 Statewide smoking bans had little or no immediate effect on AMI death rates
		Uncontrolled before-and-after studies
Hurt 2012	USA, Minnesota, Olmsted County 2002, 2007 Comprehensive 2007	Incidence of sudden cardiac death (SCD) declined pre-ordinance 1 and post-ordinance 2 by 17%, P = 0.13, 109.1 to 92.0/100,000 population; RR 0.83 (95% CI 0.65 to 1.06) NS
McGhee 2014	Hong Kong Partial 2007	Hospital admission and mortality rates: Ischaemic heart disease, acute myocardial infarction, cerebrovascular disease, cardiovascular disease, respiratory disease, lung cancer, all natural causes, injury poisonings and external causes, cancer excluding lung cancer. Mortality rates for lung cancer diagnosis significantly reduced 5.65% (95% CI -9.73 to -1.39, P < 0.05) The authors suggest this is not attributable to the smoking ban, but to improved treatment and other factors as follow-up post-legislation is 12 months
Pell 2009	Scotland Comprehensive March 2006	Cohort study. Mortality rates in ACS admissions amongst nonsmokers All-cause mortality increased from 10 in those with mean cotinine ≤ 0.1 ng.ml to 22 in those with cotinine > 0.9 ng/ml, P < 0.001

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Effect on mortality rates		
Study	Location and Ban	Study Design/ Outcomes
		All-cause mortality (after adjusting for age and gender) associated with cotinine > 0.9 ng/ml, OR 4.80 (95% CI 1.95 to 11.83, P = 0.003 Current smokers excluded from the primary analyses (n = 1831), 53 (3%) died and 78 (4%) died or were readmitted for myocardial infarction within 30 days of the index admission. The early risk of death in smokers was comparable to that among never-smokers; however, the difference was no longer statistically significant when adjusted for differences in age
Villalbi 2011	Spain Partial 2005/2006	Secondary analysis of AMI mortality rates. 2004 to 2007 study period Reduction in AMI deaths observed 2004: Rate 119.99/100,000 population (95% CI 117.98 to 122.01) vs 2007: 102.28 (95% CI 100.49 to 104.07) Adjusted AMI mortality rates in 2004 and 2005 are similar, but in 2006 there is a 9% decline for men and 8.7% decline for women, especially aged > 64 years. In 2007 there is a statistically significant decline for men (-4.8%), but not for women Post-ban the annual age-standardized AMI mortality risk was significantly reduced in the years after legislation compared to 2003/2004 rates Men: 2006: RR 0.90 (95% CI 0.88 to 0.93, P < 0.001). 2007: RR 0.86 (95% CI 0.83 to 0.88, P < 0.001) Women: 2006: RR 0.90 (95% CI 0.87 to 0.92, P < 0.001). 2007: RR 0.86 (95% CI 0.84 to 0.89, P < 0.001) The smoking ban was associated with a reduction in AMI mortality

Comparison 5. Smoking and passive smoking outcomes

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Active smoking outcomes			Other data	No numeric data
1.1 ITS studies			Other data	No numeric data
1.2 Controlled before-and-after studies			Other data	No numeric data
1.3 Before-and-after studies (no control)			Other data	No numeric data
2 Passive smoking outcomes			Other data	No numeric data

Analysis 5.1. Comparison 5 Smoking and passive smoking outcomes, Outcome 1 Active smoking outcomes.

Active smoking outcomes			
Study	Location and ban	Smoking outcome	Results
ITS studies			
Bajoga 2011	21 jurisdictions: 13 US states, 4 Canadian provinces, 4 countries Republic of Ireland (ROI), Scotland, New Zealand, Northern Ireland Comprehensive 2009	Smoking prevalence surveys Smoking status: self-reported	In 18 jurisdictions, with exception of ROI, Delaware and New Mexico, there was a statistically significant decline in smoking prevalence prior to legislation Immediate change noted in smoking prevalence and level of smoking in Washington -2.56 (95% CI -0.80 to -4.33); and in ROI -1.18 (95% CI -0.37 to -1.98) Significant changes in trend post-ban (compared to pre-legislation) noted for 6 jurisdictions:

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Active smoking outcomes			
Study	**Location and ban**	**Smoking outcome**	**Results**
			Delaware: -1.12 (95% CI -0.82 to -1.39) Maine: -0.50 (95% CI -0.14 to -0.85) New Jersey: -0.84 (95% CI -0.08 to –1.60) New Mexico: -1.37 (95% CI -0.23 to -2.52) Ohio: -1.43 (95% CI -0.33 to -2.54) Rhode Island: -0.72 (95% CI -0.10 to -1.33) The decline of smoking prevalence increased in these 6 jurisdictions in further post-legislation period. No change in smoking prevalence rates identified in 13 of 21 jurisdictions
Federico 2012	Italy Comprehensive 2005	Smoking prevalence, quit attempts Smoking status: self-reported	Linear regression analyses Smoking prevalence decreased post-ban Men : 37.8% (1999) to 34.4% (2010) Women: 21.5% (1999) to 21.2% (2010) Number of cigarettes smoked decreased over time and increased quit rates were observed Smoking prevalence in men decreased, β = 2.6%, P = 0.002, and cessation rates increased, β = 3.3%, P = 0.006 after the ban. The rates returned to pre-ban level subsequently Among women the immediate change and change in smoking prevalence associated with the ban were not statistically significant. Long-term trends in reducing smoking prevalence favoured highly educated, β = -0.3% A reduction in smoking prevalence among lower-educated women was observed, β = 1.6% decrease, P = 0.120 (NS), however significant increases in quit ratios were observed, 4.5%, P < 0.001 for low-educated women. Trends reversed over time. For younger-aged 20 to 24 years, smoking ban associated with reduced prevalence for lower-educated men, β = 1.3%, P = 0.088 (NS) Overall the impact of ban on smoking and inequalities was short term
Gualano 2014	Italy Comprehensive January 2005	Smoking prevalence surveys Smoking status: self-reported	Annual surveys 2001 to 2013 of > 3000 adults nationally representative sample Decrease in smoking prevalence 28.9% 2001 to 20.6% in 2013 Expected annual percentage change (EPAC) -2.6%, P < 0.001 Reduction in number of cigarette smoked, decrease, from 16.4/day to 12.7/day, EPAC -2.1%, P < 0.001 Decrease prevalence for men EPAC -2.9%,P < 0.001, women -2.5%, P < 0.001 Smoking intensity reduction greater in men: 18.8/day to 13.5 cigs/day 2013, EPAC -2.5, P < 0.001 Reduction in tobacco consumption in men aged 15 to 24 years, P = 0.02, and aged 25 to 44 years, P = 0.01 Women reduction in intensity 12.2 cigs/day reduced to 11.5 cigs/day. EPAC -1.0, P = 0.03 Significant reduction in tobacco consumption in women aged 15 to 24 years, P = 0.02; aged 25 to 44 years, P = 0.002, and aged 65 years and older, P = 0.02 Increase in consumption observed among women aged 45 to 64 years (NS) Data show significant reduction in tobacco consumption, but no join point

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Active smoking outcomes			
Study	**Location and ban**	**Smoking outcome**	**Results**
			related to introduction of smoke-free law
Jones 2015	England, 2007 Scotland, 2006 Comprehensive	Smoking prevalence, tobacco consumption Smoking status: self-reported	For waves 1 to 18 of the surveys: 12,771 pooled smoker observations in Scotland (mean 0.779), in England number of smokers pooled 50,438 (mean 0.709) Smoking prevalence Scotland (2-way fixed-effect model) Men: n = 22,210; 0.00925 (0.43) Women: n = 24,752; 0.0197 (1.05) Prevalence of active smoking: little effect on overall prevalence in Scotland Smoking intensity in Scotland: No significant differences post-ban in number of cigarettes smoked Scotland:(England as control) Small variation in smoking prevalence over time. Declining trends in smoking Intensity of smoking: estimates are not significant. Insufficient evidence to conclude smoking ban results in decrease in cigarette consumption Linear fixed trends identified in Scotland – decreased consumption in men 55 years and older by 0.28 half-packs/1.4 cigarettes, P < 0.01 (10% level significance) Estimates show increase in prevalence and intensity among male 'moderate smokers' (10 to 19 cigs/day)/0.325 half-packs/1.6 cigarettes/day, P < 0.05 England (Scotland as control): Impact of policy at 1 year: reduction in consumption men aged 18 to 34 years 0.432 half-packs/2.16 cigs, P < 0.05 England (Scotland as control) Women aged 55 years and older: reduction in consumption -0.083 half-packs/1.3 cigs (NS) Increased consumption in age 35 to 54 years by 0.2625 half-packs/1.31 cigs/day, P < 0.05 Inconclusive findings reported. Smoking bans are not effective in reducing smoking consumption
Klein 2014	USA, Ohio Comprehensive 2007	Preconceptual smoking prevalence in low-income women Smoking status: self-reported	Mothers (pregnant and post-partum) who gave birth March 2002 to December 2009 Spline regression analyses used. n = 483,911 Pre-smoking ban current smokers 43.3% Post-smoking ban, current smokers 39.9% Lower odds of preconceptual smoking associated with being non-white, higher educational attainment, > 50% federal poverty level, aged less than 20 years or older than 30 years and having more than one child and living in city location (compared to ref groups). Living in rural location was associated with higher odds of preconceptual smoking among low-income women compared with women living in suburban location: OR 1.05 95% CI 1.02 to 1.08) April 2001 to May 2007(pre-ban), no statistical difference in preconceptual smoking levels in low-income women Statistically significant differences post-legislation OR 0.98 (95% CI 0.98 to 0.99) For every 6 months after policy, the odds of preconception smoking de-

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Study	Location and ban	Smoking outcome	Results
		Active smoking outcomes	
			creased 11% after accounting for social demographic differences
Mackay 2011	Scotland Comprehensive 2006	Smoking prevalence and quit attempts Smoking status: self-reported	Prevalence of smoking fell 8.0% from 31.3% in period January to March 1999 to 23.7% July to September 2010. Steep decline in quarter preceding legislation. Effect October to December 2005 (prior to legislation) smoking prevalence fell 1.7% (95% CI -2.38 to -1.02, P < 0.001). 1.7% absolute reduction in smoking prevalence. This effect was not sustained. Quit attempts: NRT prescribing was significantly higher prior to legislation. Following the smoking ban, prescribing costs fell by 26% per month (95% CI 17% to 35%, P < 0.001). 12 months post-smoking ban, the prescription costs were not significantly different to 2003 to 2005 period Quit attempts increased prior to legislation and resultant fall in smoking prevalence. The effects were not sustained
		Controlled before-and-after studies	
Bharadwaj 2012	Norway Comprehensive 2004	Smoking prevalence and pregnancy outcomes Smoking status: self-reported	Approximately 20% of mothers in treatment group (working in bars and restaurants) reported smoking at start of pregnancy, 64% were not smoking at start of pregnancy. No details reported for remainder. Following the smoking ban, mothers in the treatment group were 15.4% more likely to quit smoking during pregnancy (P < 0.05) than women working in other settings This study identified that mothers working in bars and restaurants after smoke-free legislation was introduced were 15% more like to quit smoking and this impacted on increased birth weights and on lower incidences of preterm births
Ferrante 2012	Argentina, Santa Fe Comprehensive August 2006 Control: Buenos Aires City: partial October 2006	Smoking prevalence Smoking status reported from national prevalence data, surveys in 2005 & 2009	Non-significant decreases in smoking prevalence in both cities over period 2005: Santa Fe 27.3% (95% CI 24.3 to 30.5), Buenos Aires: 27.4% (95% CI 24.4 to 30.6), (difference between cities NS, P = 0.95) 2009: Santa Fe 26.6% (95% CI 25.5 to 27.8), Buenos Aires: 26.1% (95% CI 22.8 to 29.7), (difference between cities NS, P = 0.84) More quit attempts in Sante Fe in year prior to 2009 survey than in control, 53.2% (95% CI 42.5 to 63.6) vs 44.4% (95% CI 34.3 to 55.0, P = 0.045). No change in proportion of daily smokers or cigarettes consumed in either area between 2005 and 2009
Hahn 2008	USA, Kentucky,Fayette County Comprehensive April 2004 Control: 30 counties with no smoking ban (and remaining 112 counties)	Smoking prevalence Smoking status: self-reported	Fayette County: pre-law 25.7% (95% CI 21.2 to 30.1); post-law 17.5% (95% CI 11.8 to 23.1) = 31.9% reduction Control area: pre-law 28.4% (95% CI 26.8 to 30.0); post-law 27.6% (95% CI 25.2 to 30.0) = 2.8% reduction. Significant reduction in smoking prevalence pre-law to post-law periods and between intervention and control areas (Wald Chi^2 = 5.5, P = 0.02) after controlling for seasonality, time trends, demographic characteristics

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Study	Location and ban	Smoking outcome	Results
		Active smoking outcomes	
Page 2012	USA, Pueblo City, Colorado Comprehensive 2003 Control: El Paso County, Colorado	Maternal smoking LBW and preterm births Smoking status: self-reported	Significant differences observed at baseline between the intervention city and the comparison in relation to mother's mean age. race, ethnicity, education, alcohol consumption, marital status and anaemia Significant differences existed in relation to previous pregnancy and medical history. Mothers from Pueblo were more likely to be Hispanic, have lower education and report previous pregnancy complications Results identified a significant increase in mother's smoking in the control city (8.66% pre-ban compared to 11.89% post-ban, P < 0.0001) The percentage of mothers smoking in Pueblo was unchanged (16.64% at baseline and 15.07% post-ban, P = 0.0786, NS) When compared to control city, the smoking ban in Pueblo was associated with a 38% reduction in odds of maternal smoking: OR 0.620 (95% CI 0.529 to 0.727, P < 0.05)
		Before-and-after studies (no control)	
Cesaroni 2008	Italy, Rome Comprehensive 2005	Smoking prevalence Smoking status: self reported from national survey data	Prevalence: Men: 34.9% pre-law period (2002 - 2003) to 30.5% post-law period (2005). Women: 20.6% pre-law to 20.4% post-law Cigarette sales decreased 2005 -5.5% Data from the post-law was compared with data in the previous year, the effect of the law was statistically significant for men but not women and was greater for residents living in lower socioeconomic areas than those from higher socioeconomic areas
Cox 2014	Belgium, Flanders Partial 2007	Smoking prevalence reported from national data	Reports a decrease in Belgian smoking prevalence (2004 - 2008) from Belgian Health Survey Active smokers stable from 1997 to 2004. but decreased significantly 2004 to 2008 for men and women. Prevalence of smoking in women reduced from 22% in 1997 to 17.9% in 2008 Prevalence of heavy smoking in population decreased (more than 20 cigs/day) from 7.7% to 4.9%
Gallus 2007	Italy Comprehensive January 2005	Smoking prevalence and tobacco consumption Smoking status: self-reported	2001/2 vs 2003/4: No significant difference in smoking prevalence 2005/6 vs 2003/4: Significant reduction (P < 0.05) in prevalence in total population, in men and in people aged 15 to 44 years Smoking prevalence: 2004: 26.2%; women 22.5%, men 30% 2005: 25.6%; women 22.2%, men 29.3% 2006: 24.3%; women 20.3%, men 28.6% Reduction in mean daily cigarette consumption: 15.4 in 2004 (men: 16.7; women: 13.7), to 14.6 in 2005 (men: 16.3; women: 12.4) and 13.9 cig/day in 2006 (men: 15.1; women: 12.4) Reduction in smokers consuming ≥ 15 cig/day from 15.2% in 2004 to 13.2% in 2005 to 11.7% in 2006
Hurt 2012	USA, Minnesota, Olmsted County 2002, 2007 Comprehensive 2007	Smoking prevalence Smoking status: self-reported.	Smoking prevalence at baseline for 25.1% (myocardial infarction; MI) and 15.7% (sudden cardiac death; SCD). No significant differences post-ban. BRFSS

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Active smoking outcomes			
Study	**Location and ban**	**Smoking outcome**	**Results**
		National data used for smoking prevalence.	data reported smoking decreased in 2000 from 19.8% to 14.9% in 2010 Significant differences noted pre-ordinance 1 and post-ordinance 2 for MI. Incidence of MI declined by 33%, P < 0.001 from 150.8 to 100.7/100,000 population, adjusted RR 0.6 (95% CI 0.53 to 0.83) Incidence of SCD declined pre-ordinance 1 and post-ordinance 2 by 17%, P = 0.13, 109.1 to 92.0/100,000 population, RR 0.83 (95% CI 0.65 to 1.06, NS) During period of study, prevalence of smoking declined and prevalence of hypertension, diabetes mellitus, hypercholesterolaemia and obesity remained constant or increased Decrease in incidence of MI not explained by factors other than reduced smoking prevalence
Kabir 2009	Ireland Comprehensive 2004	Perinatal outcomes Maternal smoking and quit rates Smoking status: self-reported	1 year post-smoking legislation, a 25% decrease in risk of preterm births was observed; OR 0.75 (95% CI 0.59 to 0.96) There was a 43% increased risk of LBW; OR 1.43 (95% CI 1.10 to 1.85) after adjusting for all potential confounders A 12% reduction in maternal smoking rates (23.4% to 20.6%) was observed post-ban There was an increase in smoking cessation prior to pregnancy in 2005, P = 0.047. Former smokers increased from 23.9% to 24.4% Significant decline in preterm births and maternal smoking. Increase in LBW birth risks may reflect secular trend
Larsson 2008	Sweden Comprehensive June 2005	ETS exposure, smoking prevalence Active smoking and SHS exposure measured cotinine levels	No change in median cigarettes per day: 17 cig/day to 15 cig/day at 12 month follow-up, P for trend = 0.788, NS. No significant reduction for cigarette consumption for either gaming (casino or bingo hall) or for other hospitality employees. Small number of smokers at baseline No change in smoking status from baseline to 12 months follow-up. Small number of smokers at baseline that responded at follow-up, n = 14 Significant reduction in the percentage of employees reporting exposure to SHS for 75% of more of their time at work. 59/91 (65%) pre-ban vs 1/71(1%) at follow-up, P < 0.001 Greater duration of SHS exposure amongst gaming employees than other hospitality employees at baseline (P value for trend = 0.029) but duration of SHS exposure was similar in both at follow-up No statistical changes in spirometry/lung function or cigarettes consumed at 1 year follow-up
Lee 2011	England Comprehensive July 2007	Smoking prevalence Smoking status: self-reported	Response rates 61% to 73% over the period of the surveys 2003 to 2008 Current smokers decreased 25% in 2003 to 21% in 2008, Adjusted odds ratio (AOR) 0.96/year (95% CI 0.95 to 0.98, P < 0.01) Mean number cigarettes consumed decreased 14.1 to 13.1, -0.28 ± 0.06, P < 0.01 The implementation of smoke-free legislation was not associated with a statistically significant change in the trend in smoking prevalence: AOR 1.02 (95% CI 0.94 to 1.11, P = 0.596); or number

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Active smoking outcomes			
Study	**Location and ban**	**Smoking outcome**	**Results**
			of cigarettes smoked per day 0.42, SE = 0.28, P = 0.142. After controlling for time and other trends, no significant differences reported post-ban Older respondents less likely to smoke compared to younger aged (18 to 34 years) AOR 0.55 (95% CI 0.52 to 0.58, P < 0.001) and women more likely to smoke, AOR 1.07 (95% CI 1.03 to 1.12, P < 0.001) Reduction in smoking at work from 15% pre-ban to 2% post-ban, AOR 0.12, P = 0.0005 Reduction in smoking in pubs or bars 36% to 3%, AOR 0.04, P = 0.0005 Decreased smoking in cafes/restaurants AOR 0.12, P < 0.0005 and inside homes AOR 0.67, P = 0.001 Smoking in cars decreased from 32% to 26%, AOR 0.73, P = 0.015, and smoking outside increased 45% to 63% post-ban, AOR 2.11, P = 0.0005 No hardening of current smokers noted. As prevalence decreased so did consumption per smoker
Lemstra 2008	Canada, Saskatoon Comprehensive 2004	Smoking prevalence Smoking status: self reported	Smoking prevalence decreased from 24.1% (95% CI 20.4 to 27.7) in 2003 to 18.2% (95% CI 15.7 to 20.9). Follow-up survey in 2005 reported 19.5% current smokers (95% CI 16.9 to 21.8). 77 of the 1255 respondents reported quitting smoking in the year following the ban Comparative data with Saskatchewan and all of Canada, identified statistically significant relative reductions in smoking prevalence in Saskatoon, P < 0.0001
Lippert 2012	Country: USA, Arizona 2007* Colorado 2006 District of Columbia 2007 Hawaii 2006* Illinois 2008* Iowa 2008* Louisiana 2007 Maryland 2008* Minnesota 2007 Nevada 2006 New Hampshire 2007 New Jersey 2006* New Mexico 2007 Ohio 2006* Pennsylvania 2008 Puerto Rico 2007* Utah 2006* Clean Indoor Air Act (varied implementation) * all Comprehensive bans. Remaining States: Partial bans.	Smoking prevalence Smoking status: self reported	1 year pre-/post- data. Average time post-ban 3.06 years 5 States (Colorado, Hawaii, Nevada, New Jersey, Ohio) 4-year interval 8 states/territory (Arizona, District of Columbia, Louisiana,Minnesota,New Hampshire, New Mexico, Puerto Rico, Utah) 3-year interval 4 States (Illinois, Iowa, Maryland, Pennsylvania) 2-year interval 86,531,447, 28.2% population represented in 17 states 14 States had significant decrease in prevalence of current smokers. Highest difference post-ban observed in New Hampshire, 3% change 6 states with the highest differences in current smoking status post-ban are listed below (State N): Colorado: (1106) 19.8% (95% CI 18.5 to 21.1) vs (1749) 17.0% (95% CI 15.9 to 18.1, P ≤ 0.0001) Iowa: (956) 19.8% (95% CI 18.4 to 21.2) vs (882) 17.1% (95% CI 15.7 to 18.5, P ≤ 0.0001) Maryland: (1450) 17.1% (95% CI 15.9 to 18.3) vs (1221) 15.1% (95% CI 13.9 to 16.3, P ≤ 0.0001) New Hampshire: (1079) 18.7% (95% CI 17.4 to 20.0) vs (836) 15.7% (95% CI 14.2 to 17.3, P ≤ 0.0001) New Jersey: (2384) 18.0% (95% CI 17.0 to 19.0) vs (1864) 15.8% (95% CI 14.7 to 16.9, P ≤ 0.0001) New Mexico: (1263) 20.1% (95% CI 18.7 to 21.5) vs 1483) 17.9% (95% CI 16.6 to 19.2, P ≤ 0.0001) 6 states had significant increase in number of former smokers.

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Active smoking outcomes			
Study	**Location and ban**	**Smoking outcome**	**Results**
			No state had increased prevalence of current smokers post-legislation (Utah unchanged)
Mackay 2012	Scotland Comprehensive 2006	ITS study of pregnancy outcomes Smoking status self-reported	Post-legislation there was a significant reduction in current smoking rates 25.4% to 18.8%, P < 0.001, and an increase in never-smokers 57.3% to 58.4%, P < 0.001

Analysis 5.2. Comparison 5 Smoking and passive smoking outcomes, Outcome 2 Passive smoking outcomes.

Passive smoking outcomes					
Study	**Country & ban**	**Outcome**	**Heading 3**	**Results**	**Heading 5**
Durham 2011	Switzerland, Canton of Vaud Local ordinance Partial 2009	SHS exposure	Smoking status: self-reported Lung function measures ETS exposure	1798 hospitality venues invited to participate. 2% response, n = 36 enrolled. 106 participants recruited from venues at baseline. 66 participants at follow-up (31st May to 26th September 2010) ETS exposure declined significantly after introduction of new smoke-free law Smokers had lung age 5.6 years older than chronological age Pre-law: nonsmokers inhaled equivalent of 1.4 to 7.4 cigarettes/day. Post-law significantly reduced P < 0.05 (figure not given) Lung function: improved in women + 3.07%, P = 0.05; nonsmokers + 3.91%, P =0.04; and in older participants + 4.22%, P = 0.004	Passive health outcomes
Goodman 2007	Ireland Comprehensive March 2004	Respiratory function, ETS exposure in hospitality workers	Self-reported exposure to SHS was validated by carboxyhaemoglobin, exhaled CO and salivary cotinine	Total ETS exposure to SHS was 46.9 hours pre-ban and 4.2 hours post-ban, a decrease of 90% Exposure to SHS outside of work: Mean 6.4 hours pre-law vs 3.7 hours at 1 year post-law (% change) -42%; P ≤ 0.01 FVC parameters increased significantly in never-smokers, it declined in current smokers. FEV1 did not change significantly in any group; increased in nonsmokers Significant reduction in carboxyhaemoglobin by 5% in the never-smoker group, but no significant reduction in ex-smokers and current smokers. 79% reduction in exhaled CO for never- and ex-smokers but no significant change in current smokers. Exhaled CO median (interquartile range) ppm: 4.0 (IQR, 3 -	Passive

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Passive smoking outcomes					
Study	**Country & ban**	**Outcome**	**Heading 3**	**Results**	**Heading 5**
				5) pre-law vs 2.0 (IQR, 2 - 3) follow-up, P < 0.001 Median exhaled breath CO and salivary cotinine decreased by 79% and 81% respectively in never- and ex-smokers. Saliva cotinine median (IQR) ng/ml: 5.1 (IQR 3.4 - 7.6) pre-law vs 0.6 (IQR 0.3 - 1.3) follow-up, P < 0.001	
Larsson 2008	Sweden Comprehensive June 2005	ETS exposure, smoking prevalence	Active smoking and SHS exposure measured cotinine levels	No change in median cigarettes per day: 17 cig/day to 15 cig/day at 12 month follow-up, P for trend = 0.788, NS. No significant reduction for cigarette consumption for either gaming (casino or bingo hall) or for other hospitality employees. Small number of smokers at baseline No change in smoking status from baseline to 12 months follow up. Small number of smokers at baseline that responded at follow-up, n= 14. Significant reduction in the percentage of employees reporting exposure to SHS for 75% or more of their time at work. 59/91 (65%) pre-ban vs 1/71(1%) at follow-up, P < 0.001. Greater duration of SHS exposure amongst gaming employees than other hospitality employees at baseline (P value for trend = 0.029) but duration of SHS exposure was similar in both at follow-up. No statistical changes in spirometry/lung function or cigarettes consumed at 1-year follow-up	Passive Health outcomes
Pell 2008	Scotland Comprehensive 2006	SHS exposure in non-smokers	Smoking status validated	Persons who never smoked reported decreased in SHS exposure and biochemically-verified, serum cotinine mean 0.68 to 0.56 ng/ml; P < 0.001 post-ban. SIgnificant reductions in both men and women, P < 0.001	Passive
Rajkumar 2014	Switzerland, Basel City, Basel County and Zurich Partial 2010	SHS exposure	SHS exposure validated	SHS biochemically measured using Monitor of Nicotine (MoNIC) passive sampling badges. Exposure to SHS decreased during the study. Of the 78 participants exposed to SHS at baseline, 55 were not exposed at follow-up. Secondhand smoke exposure in 55 nonsmoking hospitality employees was 2.56, (95% CI 1.70 to 3.44) cigarette equiv-	Passive

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		Passive smoking outcomes			
Study	Country & ban	Outcome	Heading 3	Results	Heading 5
				alents per day pre-ban and was 0.16 (95% CI 0.13 to 0.20) at follow-up	

APPENDICES

Appendix 1. Tobacco Addiction Group specialised register

Searched 5th March 2015. See the Tobacco Addiction group module in The Cochrane Library for details of databases and search strategies.

1 (ban* OR policy OR policies OR law* OR legislation OR regulation* OR restrict* OR prohibit* OR ordinance*):ti
2 (ban* OR policy OR policies OR law* OR legislation OR regulation* OR restrict* OR prohibit* OR ordinance*):ab
3 (ban* OR policy OR policies OR law* OR restrict* OR prohibit*):KY
4 (ban* OR policy OR policies OR law* OR restrict* OR prohibit*):MH
5 (ban* OR policy OR policies OR law* OR restrict* OR prohibit*):EMT
6 (ban* OR policy OR policies OR law* OR restrict* OR prohibit*):XKY
7 (Smoke-Free Policy):ti,ab,KY,MH,EMT,KW,XKY
8 (smoking regulation):ti,ab,KY,MH,EMT,KW,XKY
9 #1 OR #2 OR #3 OR #4 OR #5 OR #6 or #7 or #8

Appendix 2. MEDLINE search strategy

Ovid MEDLINE. Searched 26th February 2015 (to February week 4)

1 Smoke-Free Policy/
2 (smok* or tobacco).ti.
3 ban.ti. or (bans or banned or law or laws or policy or policies or prohibit* or restrict* or regulat* or legislat*).ti,ab.
4 2 and 3
5 1 or 4
6 Smoking Cessation/
7 "tobacco use"/ or "tobacco use cessation"/
8 Tobacco Smoke Pollution/
9 "Tobacco Smoke Pollution".ti,ab.
10 "environmental tobacco smoke".ti,ab.
11 ('second hand smoke' or 'secondhand smoke' or 'second-hand smoke').ti,ab.
12 (passive adj3 smok*).ti,ab.
13 (smok* adj3 involuntary).ti,ab.
14 smoking cessation.ti,ab.
15 (smok* adj3 (quit* or stop* or ceased or abstain* or abstin* or prevent*)).ti,ab.
16 tobacco consumption.ti,ab. (5284)
18 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17
19 5 and 18

Appendix 3. PubMed search strategy

Ovid MEDLINE In-Process & Other Non-Indexed Citations. Searched 26th February 2015 (to 25th February 2015).

1 (ban or bans or banned or law or laws or policy or policies or prohibit* or restrict* or regulat* or legislat* or ordinance*).ti.
2 (smoke-free or smokefree or smoke free).ti.
3 1 or 2
4 "Tobacco Smoke Pollution".ti,ab.
5 "environmental tobacco smoke".ti,ab.
6 ('second hand smoke' or 'secondhand smoke' or 'second-hand smoke').ti,ab.
7 (passive adj3 smok*).ti,ab.
8 (smok* adj3 involuntary).ti,ab.
9 smoking cessation.ti,ab.
10 (smok* adj3 (quit* or stop* or ceased or abstain* or abstin* or prevent*)).ti,ab.
11 tobacco consumption.ti,ab.
12 (smok* adj3 prevalence).ti,ab.

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13 (smoke-free or smokefree or smoke free).ti,ab.
14 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13
15 3 and 14
16 ("2013" or "2014" or "2015").yr.
17 15 and 16

Appendix 4. EMBASE search strategy

Ovid EMBASE. Searched 26th February 2015 (to 2015 week 08)

1 smoking regulation/
2 smoking ban/
3 (smok* or tobacco).ti.
4 ban.ti. or (bans or banned or law or laws or policy or policies or prohibit* or restrict* or regulat* or legislat*).ti,ab.
5 3 and 4
6 1 or 2 or 5
7 smoking cessation/
8 smoking/
9 passive smoking/
10 indoor air pollution/
11 cigarette smoke/
12 "Tobacco Smoke Pollution".ti,ab.
13 "environmental tobacco smoke".ti,ab.
14 ('second hand smoke' or 'secondhand smoke' or 'second-hand smoke').ti,ab.
15 (passive adj3 smok*).ti,ab.
16 (smok* adj3 involuntary).ti,ab.
17 smoking cessation.ti,ab.
18 (smok* adj3 (quit* or stop* or ceased or abstain* or abstin* or prevent*)).ti,ab.
19 tobacco consumption.ti,ab.
20 (smok* adj3 prevalence).ti,ab.
21 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20
22 6 and 21
25 journal conference abstract.pt.
26 24 not 25

Appendix 5. PsycINFO search strategy

Searched 22nd February 2013

1 (smok* or tobacco).ti.
2 ban.ti. or (bans or banned or law or laws or policy or policies or prohibit* or restrict* or regulat* or legislat*).ti,ab.
3 1 and 2
4 exp Smoking Cessation/
5 exp Passive Smoking/
6 exp Tobacco Smoking/
7 "Tobacco Smoke Pollution".ti,ab.
8 "environmental tobacco smoke".ti,ab.
9 ('second hand smoke' or 'secondhand smoke' or 'second-hand smoke').ti,ab.
10 (passive adj3 smok*).ti,ab.
11 (smok* adj3 involuntary).ti,ab.
12 smoking cessation.ti,ab.
13 (smok* adj3 (quit* or stop* or ceased or abstain* or abstin* or prevent*)).ti,ab.
14 tobacco consumption.ti,ab.
15 (smok* adj3 prevalence).ti,ab.
16 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
17 3 and 16

Appendix 6. CINAHL search strategy

Searched 6th March 2013

1 (smok* OR tobacco:ti2 ((ban:ti or bans or banned or law or laws or policy or policies or prohibit* or restrict* or regulat* or legislat*: tiab

3 1 AND 2

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4 ('Smoking cessation'/ LJ /PC exp

5 'Smoking'/LJ /PC exp

6 'Passive smoking'/LJ

7 'tobacco smoke pollution':tiab

8 “environmental tobacco smoke”:tiab

9 'second hand smoke' or 'secondhand smoke' or 'second-hand smoke':tiab

10 (passive and smok*) :tiab

11 (smok* and involuntary:tiab

12 “smoking cessation” :tiab

13 (smok*) and (quit* or stop* or ceased or abstain* or abstin* or prevent*)):tiab

14 “tobacco consumption”:tiab

15 (smok*) AND (prevalence): tiab

16 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15

17 3 AND 16

WHAT'S NEW

Date	Event	Description
17 November 2015	New citation required but conclusions have not changed	Review reports stronger evidence of benefit of bans on health outcomes but no qualitative change to conclusions. New first author and additional authors.
21 September 2015	New search has been performed	Changes to protocol; studies only evaluating effects on exposure to secondhand smoke no longer included. Twelve studies retained from previous version, 65 new studies added.

CONTRIBUTIONS OF AUTHORS

JC searched literature 2009 to 2012 and screened titles and abstracts
KF screened results from literature searches 2009 to 2015
JC, AC and KD screened results from literature searches 2012 to 2014
KF selected studies for inclusion and were checked by CK
KF and JMcH screened studies from revised inclusion criteria and were checked by CK
KF extracted the data and was checked by SvanB
KF and CK wrote the text of the review in this update

DECLARATIONS OF INTEREST

All authors declare no known conflicts of interest.

SOURCES OF SUPPORT

Internal sources

- UCD School of Nursing, Midwifery and Health Systems, Ireland.
- UCD School of Public Health and Population Science, University College Dublin, Ireland.

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External sources

- Health Research Board, Ireland.

  Dr Kate Frazer was awarded a Cochrane training fellowship CTF/2013/5
- UCD School of Public Health, Physiotherapy and Population Science, Ireland.

  Mr Jack McHugh, Summer Student Scholarship (8 weeks)

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

For this update we restricted inclusion of studies which reported passive smoke exposure to those which also reported health outcomes. We excluded studies which included outcome data with only cotinine measures, due to the established and unequivocal evidence that passive smoke exposure is controlled by legislative bans (Callinan 2010).

We have changed the objectives to reflect this, and to make the primary objective the effect on health outcomes, and the secondary objective the effect on smoking behaviour.

We have revised the title of this update from *Legislative bans for reducing smoking prevalence and tobacco consumption* to *Legislative smoking bans for reducing harms from secondhand smoke exposure, smoking prevalence and tobacco consumption.*

We have limited smoking prevalence studies to those where general population smoking prevalence outcomes are reported.

We have completed 'Risk of bias' assessments for the 12 studies reported in the original review and for all new studies included in this update.

We have included a 'Summary of findings' table in this update.

INDEX TERMS

Medical Subject Headings (MeSH)

*Smoking Prevention; Acute Coronary Syndrome [epidemiology]; Asthma [epidemiology]; Cohort Studies; Controlled Before-After Studies; Interrupted Time Series Analysis; Myocardial Infarction [epidemiology]; Prevalence; Pulmonary Disease, Chronic Obstructive [epidemiology]; Smoking [*epidemiology] [*legislation & jurisprudence]; Tobacco Smoke Pollution [*legislation & jurisprudence] [*prevention & control]; Tobacco Use Disorder [mortality] [*prevention & control]

MeSH check words

Humans

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