The Health Impacts of Exposure to Outdoor Tobacco Smoke: A Rapid Review of the Evidence

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July 2011

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Key Messages

- The evidence linking exposure to outdoor tobacco smoke (OTS) and adverse health impacts is not available.
- Exposure levels to OTS can be as high as or higher than secondhand smoke (SHS) levels indoors. The levels of OTS exposure will vary with enclosure, ventilation and distance.
- Exposure to SHS indoors results in adverse cardiac and respiratory outcomes.
- Legislative bans on indoor spaces result in reduced exposure and improved health outcomes.
- Across Ontario, 53 municipalities have placed restrictions on smoking in certain outdoor spaces.

Executive Summary

Purpose

The purpose of this report is to review the research related to the potential health impacts associated with exposure to secondhand smoke in outdoor spaces. This report will inform decision-making related to the development and implementation of outdoor smoking restrictions in Peel Region.

Research Question

What are the health impacts associated with exposure to outdoor tobacco smoke (OTS) in public places?

Context

Legislative bans on indoor spaces reduce exposure to SHS, support those trying to quit smoking, and discourage others, especially youth, from starting to smoke. The focus of public debate has moved to the impacts of exposure to OTS. In 2008, 53% of all Ontarians reported being exposed to SHS at entrances to buildings. In 2009, 50% of adults in Ontario supported banning smoking on sidewalks and 59% supported bans in parks and on beaches.

Fifty-three municipalities across Ontario have enacted further legislation to restrict smoking outdoors (e.g. Collingwood, Woodstock). The legislative restrictions vary to include settings such as playgrounds, beaches and municipally-owned property including transit stops. The three hospitals in Peel Region have also developed their own smoke-free grounds policies that are more restrictive than the 2006 *Smoke Free Ontario Act* (SFOA).

Synthesis of Key Findings

Two recent, high quality systematic reviews were used (Callinan, 2010 and IOM, 2010) for this review.

The overall findings include:

- Introduction of legislated smoking bans in indoor spaces leads to reduction in exposure to secondhand smoke with the greatest reduction seen in hospitality workers. Legislative bans resulted in decreased cotinine levels in non-smokers.
- There is some evidence for improvement in cardiac, respiratory, eye, nose, throat outcomes, the strongest being a reduction in admissions for myocardial infarction, for bans in indoor spaces.
- Studies of both smokers and non-smokers in bars and restaurants showed a reduction in respiratory symptoms following a ban.

Full Report

1 Issue

In November 2009, Mississauga's Environmental Advisory Committee presented a report to Mississauga City Council on the issue of prohibiting smoking in proximity to outdoor playgrounds and municipally-owned buildings and facilities. In February 2010, Mississauga City Council adopted the Environmental Advisory Committee's recommendation to "…consider implementing a region-wide prohibition of smoking in proximity to outdoor playgrounds and municipally-owned buildings and facilities" and referred the matter to Peel Public Health for consideration as a regional by-law. A multi-jurisdictional policy working group was established in December 2010 including representatives from the Cities of Mississauga and Brampton and the Town of Caledon.

This report focuses on the potential health impacts associated with exposure to secondhand smoke in outdoor spaces to inform the by-law development process. This report does not address the behavioural (cessation support) and social benefits (denormalization and prevention) of reducing smoking in outdoor spaces.

2 Context

In 2007-2008, slightly more than fifteen per cent (15.5%) of Peel residents 12 years of age and older were current (daily and occasional) smokers, compared to 19**%** across Ontario(1).

In 2008, a telephone survey found that about half of all Ontarians (53%) reported being exposed to secondhand smoke (SHS) at entrances to buildings in the previous month. A 2009 Ontario Tobacco Research Unit (OTRU) survey found about 47% of adults in Ontario supported banning smoking on sidewalks and more than half of all adults (59%) agreed that smoking should be banned in parks and on beaches.(2)

Outdoor tobacco smoke (OTS) is garnering increased attention for the possible health risks from exposure and for its role in continuing to promote smoking as a socially accepted behaviour. The 2006 *Smoke Free Ontario Act* (SFOA) currently prohibits smoking within enclosed workplaces and public places in Ontario. Fifty-three municipalities across Ontario have enacted further legislation to restrict smoking outdoors (e.g. Collingwood, Woodstock). The legislative restrictions vary to include settings such as playgrounds, beaches, and municipally-owned property including transit stops. The three hospitals in Peel Region have also developed their own smoke-free grounds policies that are more restrictive than SFOA. There are other workplaces in Peel Region that have implemented outdoor smoke-free policies.

The impact of exposure to OTS will depend on several factors including the concentration of smokers and smoke, proximity to the source of smoke, wind direction and wind speed (3). Tobacco smoke does not accumulate outdoors as it does in indoor spaces. OTS will dissipate after smoking ceases and it can infiltrate into indoor spaces depending on proximity to a door, windows, air intakes and the air current in and around the building.

Exposure to indoor SHS in both children and adults has been associated with cancer, ulcers, heart disease, middle ear infections, and asthma. The health impacts of exposure to OTS are the subject of this review. A conceptual model for the impact of OTS smoke was developed by Peel Public Health staff (Appendix 1).

3 Literature Review

3.1 PICO question

The question for this rapid review is "What are the health impacts associated with exposure to OTS in public places?"

The PICO question format:

Population – general population exposed to OTS

Exposure – exposure to OTS

Comparison – general population not exposed to OTS

Outcome – health effects – cardiovascular disease, respiratory disease, all cancers; special consideration to the dose response relationship and the factors that may impact that relationship such as distance and dispersion

3.2 Search Strategy

The search strategy was developed based on the PICO question and in consultation with a Peel Public Health librarian and the knowledge broker[a].

3.2.1 Databases Searched

The databases searched were Medline, The Cochrane Collaboration, Public Health Plus, Health Evidence, CINAHL and PyscINFO. A grey literature search of the websites of the Canadian National Collaborating Centres, the United States Centers for Disease Control, and the World Health Organization was conducted (Appendix 2: Search Strategy).

3.2.2 Inclusion/Exclusion Criteria

The initial search found no relevant syntheses and summaries related to health impacts associated with exposure to OTS.

The search was revised and the keywords were changed to capture SHS more broadly. Included were guidelines, syntheses, systematic reviews, and meta-analyses. In this case, single studies or other types of reviews were excluded. There was no date limit applied except for one database (CINAHL) which was searched from January 1, 2000 to present.

In order to ensure that no single studies related to OTS were missed, an additional search that included single studies was completed. No relevant reports were found.

[a] A knowledge broker provides a link between research producers and end users by developing a mutual of goals and cultures, collaborates with end users to identify issues and problems for which solutions are required, and facilitates the identification, access, assessment, interpretation, and translation of research evidence into local policy and practice. (Dobbins, M., Robeson, P., Ciliska, D., Hanna, S., Cameron, R., O'Mara, L., DeCorby, K., Mercer, S. (2009). A description of knowledge broker role implemented as part of a randomized controlled trial evaluating three knowledge translation strategies. *Implementation Science*, 4(23))

3.2.3 Results of Search Process

Based on the databases, search terms and inclusion/exclusion criteria outlined previously, the search returned thirteen syntheses and one summary. Two duplicates were removed (Appendix 3: Overview of search process diagram).

3.2.4 Relevancy Assessment

One member of the team reviewed the abstracts of the twelve studies. Four studies were determined to be relevant (4-7) to the PICO question. Two were selected for critical appraisal because they were recent and the highest level of evidence (Appendix 4 – Relevancy Assessment). The two articles that were generally relevant but were not included in this rapid review because of a) datedness and b) questionable statistical methods to combine data for meta-analysis that the Cochrane review deemed to heterogeneous to make for a valid quantitative analysis.

3.3 Critical Appraisal

3.3.1 Callinan *et al* (2010)

This systematic review focused on assessing various exposure, behaviour, health and environmental outcomes associated with implementing legislative smoking bans in various international jurisdictions. The systematic review was critically appraised by three team members using the Health Evidence Quality Assessment Tool. The team unanimously found that the study was of strong quality.

3.3.2 Institute of Medicine (2010)

This systematic review was conducted by the *Committee on Secondhand Smoke Exposure and Acute Coronary Events* convened by Institute of Medicine of the U.S. National Academies. The Committee examined the relationship between SHS exposure and acute coronary events. One team member critically appraised this review using the Health Evidence Quality Assessment Tool. The assessment resulted in a strong quality assessment.

3.4 Synthesis

3.4.1 Callinan et al (2010)

Callinan reviewed a total of 50 studies. The studies measured the prevalence of smoking before and after bans in various indoor settings and health outcomes such as hospital admissions for cardiac events. **None of the studies related to health impacts of OTS exposure.**

Thirty-one of the 50 studies examined exposure to SHS, nineteen of which used biomarkers. Twenty-five of the 50 studies reported on the health outcomes resulting from exposure to SHS.

Study designs included:

- uncontrolled studies before and after a smoking ban in working populations (n=24)
- repeated cross-sectional measures in general populations (n=18)
- quasi-experimental studies with an intervention and control area (n=13).

Some of the 50 papers had more than one design component. The studies are not in mutually exclusive categories and some studies are in more than one category(8). Meta-analysis was not

possible because of heterogeneity of study design, participants, outcomes and nature of intervention. Study details are provided in the data extraction table (Appendix 5).

In this review, 40 studies addressed a comprehensive ban prohibiting smoking in indoor workplaces including bars and restaurants. Ten studies dealt with a partial ban allowing designated smoking areas in indoor workplaces, including bars and restaurants. The studies covered 13 countries with legislative bans. Blinding was not possible and participant selection varied from random selection to convenience sampling. The included studies had a follow-up period of at least six months for those examining smoking behaviour and less than six months for those measuring exposure to SHS. Table 1 provides an overview of the evidence assessing health impacts associated with SHS exposure indoors after a legislative ban.

Table 1: Overview of health impacts evidence after smoking ban indoors (n=50)

Health Impact	**Evidence**
Coronary Syndrome, Acute myocardial infarction (AMI), worsening coronary disease	10 of 12 studies show a decrease in hospital admissions for AMI following a ban
Respiratory Symptoms	10 of 12 studies showed decreases after a ban: cough, wheezing, shortness of breath 3 studies showed reduced impact using pulmonary function measures
Eye, nose, throat symptoms	10 studies showed clear reduction of symptoms in smokers and non-smokers
Cancer*	Not included

*****SHS is classified as a human carcinogen by International Agency for Research on Cancer (IARC). Cancer was not included as a health outcome in the two reviews. This was likely due to the fact that legislative bans have not been in place long enough to see an impact on cancer rates.

3.4.1.1 Acute Coronary Syndrome (ACS)

Twelve studies reported on hospital admission rates and death due to acute myocardial infarction (AMI) or coronary heart disease following a ban. The study locations were the United States, Italy, Scotland and Canada with 10 of the studies involving comprehensive bans.

Ten of the twelve studies consistently reported a decrease in hospital admissions for AMI following a smoking ban. Four of the ten studies had control groups and three of the four had comprehensive bans in place.

In two of the controlled studies:

- **non-smokers** were found to have a three-fold decline in admission rates for AMI (comprehensive ban)
- 47% decline in the **general population** in admissions rates for smoking related diseases (partial ban).

In uncontrolled studies:

- An 8-21% decline in AMI rates was found following either partial or comprehensive bans
- A study of the comprehensive ban in Scotland that stratified by smoking status found a greater overall reduction in AMI in never (21%) and former smokers (19%) compared to smokers (14%).

Two additional studies showed a decrease in death due to coronary heart disease. The findings included:

- 33,000 fewer deaths over an eight year period (comprehensive ban)
- Decline from 22 deaths (>0.9 ng/mL cotinine) to 10 deaths (<0.1 ng/mL cotinine), in non-smokers admitted for ACS followed for 30 days, (comprehensive ban).

3.4.1.2 Respiratory symptoms and lung function

Both smokers and non-smokers had improved respiratory health following a legislative ban. Of the 12 studies examining respiratory symptom outcomes, eleven had comprehensive bans in place. In all of the 12 studies the respiratory symptom outcomes were self-reported. **Ten of twelve reported a significant reduction in respiratory symptoms; two of ten had control groups.** All studies were in hospitality or bar work settings and some of the studies only examined the outcome in non-smokers (n=3).

The ten studies reporting an improvement examined changes in all respiratory symptoms combined and/or individual symptoms. Most of the studies found overall improvement of respiratory symptoms irrespective of smoking status though not all studies stratified by smoking status. **In studies where significant differences were found, the percent reduction of respiratory symptoms ranged from 12-42%. Two controlled studies of non-smokers found a 16% and 38.1% reduction, respectively.**

Statistically significant reductions in individual respiratory symptoms were observed in many of the studies. **Generally, those studies that stratified by smoking status found greater reductions in individual respiratory symptoms in non-smokers.** The range of percentage

reduction for the individual respiratory symptoms across the ten studies (two controlled and eight uncontrolled) is:

- morning cough – 4.4% to 30% (13% in one controlled study)
- daytime cough – 2.3% to 38%
- phlegm production – 3.5% to 42% (14% in one controlled study)
- wheeze – 5.3% to 15%
- shortness of breath – 1.2% to 11%.

Five of the twelve studies and an additional study[b] included pulmonary function tests. All six studies had comprehensive bans in place and were observational studies without controls. All studies measured respiratory function in the same individual before and after the ban. Two of six studies showed a significant increase in forced expiratory volume (FEV1), three of six studies showed an increase in forced vital capacity (FVC), and two of six studies showed a reduction in forced expiratory flow (FEF). FEV1, FVC and FEF are objective physiological measures of lung function and are appropriately weighted more prominently.

3.4.1.3 Eye, nose and throat symptoms

Ten studies, one of them controlled, included eye, nose and throat symptoms. **There was a clear reduction in eye, nose and throat symptoms in both smokers and non-smokers.** Non-smokers had particular improvements in eye, nose and throat symptoms. Five studies in smokers showed reduction in symptoms with eye symptom improvement the most common finding.

[b] The additional study was part of the 50 studies included in the review.

3.4.1.4 Other Outcomes

3.4.1.4.1 Exposure to SHS

Across all studies, the number of participants reporting a decline in exposure to SHS ranged from 22% to 85%. In addition, the amount of self-reported time exposed to SHS was reduced by 71% to 100%. **In twelve of the studies reduced exposure was independently supported by a reduction in saliva cotinine ranging from 39% to 89%.**

There was greater reduction in exposure to SHS in hospitality workers compared to the general population. One study in Toronto found a 95% reduction in total hours exposed to SHS (work plus other) by non-smoking employees following a legislative ban. The Toronto hospitality workers were compared to Windsor hospitality workers where there was no legislative ban in place.

3.4.1.4.2 Environmental Levels

There were eight studies that included environmental measures of air quality. **All studies showed a significant reduction in levels of markers of poor air quality due to tobacco smoke such as nicotine, dust, benzene and particulate matter ($PM_{2.5}$ and PM_{10})[c].** Of the eight studies, one measured $PM_{2.5}$ using personal aerosol monitors. The review did not provide measurement details for the other studies.

Three of the studies report the potential for adverse effects associated with implementing smoking bans in indoor spaces. These include the potential for smoke from outdoor areas drifting into indoor spaces.

[c] $PM_{2.5}$ and PM_{10} – refers to particulate matter less than 2.5 and 10 microns in diameter, respectively.

3.4.2 Institute of Medicine (2010)

This expert committee report examined coronary impacts of exposure to SHS in indoor spaces. The review included the same studies that were in the Callinan Cochrane review and came to the same general conclusions.

- Concurred with the 2006 Surgeon General Report that the **evidence sufficiently establishes a causal relationship between exposure to SHS and increased risks of coronary heart disease death and illness** in men and women.
- Sufficient evidence exists to infer a **causal relationship between exposure to SHS and acute coronary events (AMI).** The Committee could not estimate the length of exposure required to increase the risk of AMI because most the epidemiologic studies do not include the duration of exposure before smoking bans. Data from experimental studies indicate that cardiovascular effects are seen after very brief exposure (less than one hour).
- Sufficient evidence exists to conclude that there is **a causal relationship between smoking bans (indoors) and decreases in acute coronary events**.

4 Applicability and Transferability

A facilitated discussion took place on June 9, 2011 with Peel Public Health staff involved in the Living Tobacco Free program priority part of the 10-year strategic plan. The group discussed the various factors associated with the feasibility of applying this research evidence to smoking restrictions outdoors in Peel Region.

There is general support across Ontario for restrictions to smoking in outdoor spaces. Fifty-three Ontario municipalities have implemented restrictions. However, there is little information on knowledge, behaviour and attitudes specific to Peel Region residents. Peel Region hospitals have implemented smoke-free hospital grounds, which exceed the current legislative requirements under SFOA. Other workplaces in Peel Region have also developed policies or inquired about doing so. In previous discussions, a complete ban on smoking outdoors at the Regional Headquarters was not supported by Peel Regional Police.

Staff established an inter-agency committee of three local municipalities to examine the various options for OTS restrictions. The City of Mississauga and the Town of Caledon have expressed support in principle.

Approximately 170,000 Peel residents smoke (15.5% of the population). SHS exposure indoors results in health impacts in smokers and non-smokers. The evidence consistently indicates that health outcomes improve when legislative bans restricting exposure to SHS indoors are implemented.

Evidence linking OTS exposure to adverse health impacts is not available. However, an OTS exposure study of common outdoor settings found(3):

- **In some situations, levels outdoors can be as high as or higher than SHS levels indoors.** Monitoring surveys and controlled experiments in public outdoor locations and a private residential patio using various real-time particles ($PM_{2.5}$) sensing instruments

found that the average respirable suspended particulate levels outdoors ranged from 33 to 60 µg/m^3 with some downwind levels peaking at 582 µg/m^3. By comparison, indoor levels peaked at 50 µg/m^3 in the living room (400m^3) and 200 ug/m^3 in the bedroom (44 m^3).

- **OTS levels at distances less that 0.5 m were roughly equal to or greater than the average indoor living room levels (peaking = 1500 µg/m^3; average = 252 µg/m^3).** OTS was still detectable at three to four metres from the tobacco source on patios.
- Outdoor enclosures (e.g. fence or wall) can result in higher OTS levels, up to two-fold higher OTS levels (52 µg/m^3) than those without enclosures (21 µg/m^3).

In addition, a more recent study measuring OTS ($PM_{2.5}$) levels within nine m of the entrances of public buildings observed that(9):

- Average $PM_{2.5}$ levels with one to four and five or more lit cigarettes was 15.2 µg/m^3 and 22.8 µg/m^3 respectively
- Peak levels of $PM_{2.5}$ with one to four lit cigarettes was as high as 496 µg/m^3
- Average $PM_{2.5}$ levels with more than five lit cigarettes was two and a half times greater than the average background level (22.8 µg/m^3 compared to of 9.3 µg/m^3) when the lit cigarettes were three m away

The discussion of the applicability and transferability noted that comprehensive enforcement, adequate signage and the availability of cessation support were identified as extremely important components of any successful policy that restricts smoking outdoors. Additional considerations for Peel Region are:

- Ethnic diversity - health status report indicators conclude that many new immigrants are not smoking.
- Hookahs and other pipes – should they be captured in smoking restrictions outdoors
- Business considerations - Rothman, Benson and Hedges operates within the City of Brampton. There are 60 employees at the Brampton location(10).

5 Recommendations

It is recommended that Peel Public Health:

- Recommend that Regional Council support the development of a regional by-law that restricts smoking in certain outdoor spaces.
- Advocate that provincial agencies and academic institutions research the health, social and environmental impacts of OTS restrictions.
- Continue to monitor the literature related to OTS exposure and adverse health impacts.

6 References

(1) Statistics Canada. Canadian Community Health Survey 2000/2001-2007/2008.

(2) Ontario Tobacco Research Unit. Indicators of smoke-free Ontario progress. Monitoring and Evaluation Series 2010.

(3) Klepeis NE, Ott WR, Switzer P. Real-time measurement of outdoor tobacco smoke particles. Journal of the Air & Waste Management Association. 2007;57(5):522-534.

(4) Callinan JE, Clarke A, Doherty K, Kelleher C. Legislative smoking bans for reducing secondhand smoke exposure, smoking prevalence and tobacco consumption. Cochrane Database of Systematic Reviews 2010;4:005992.

(5) Institute of Medicine. Secondhand smoke exposure and cardiovascular effects: Making sense of the evidence. 2010.

(6) Meyers DG, Neuberger JS, He J. Cardiovascular effect of bans on smoking in public places: a systematic review and meta-analysis. J Am Coll Cardiol 2009 Sep 29;54(14):1249-1255.

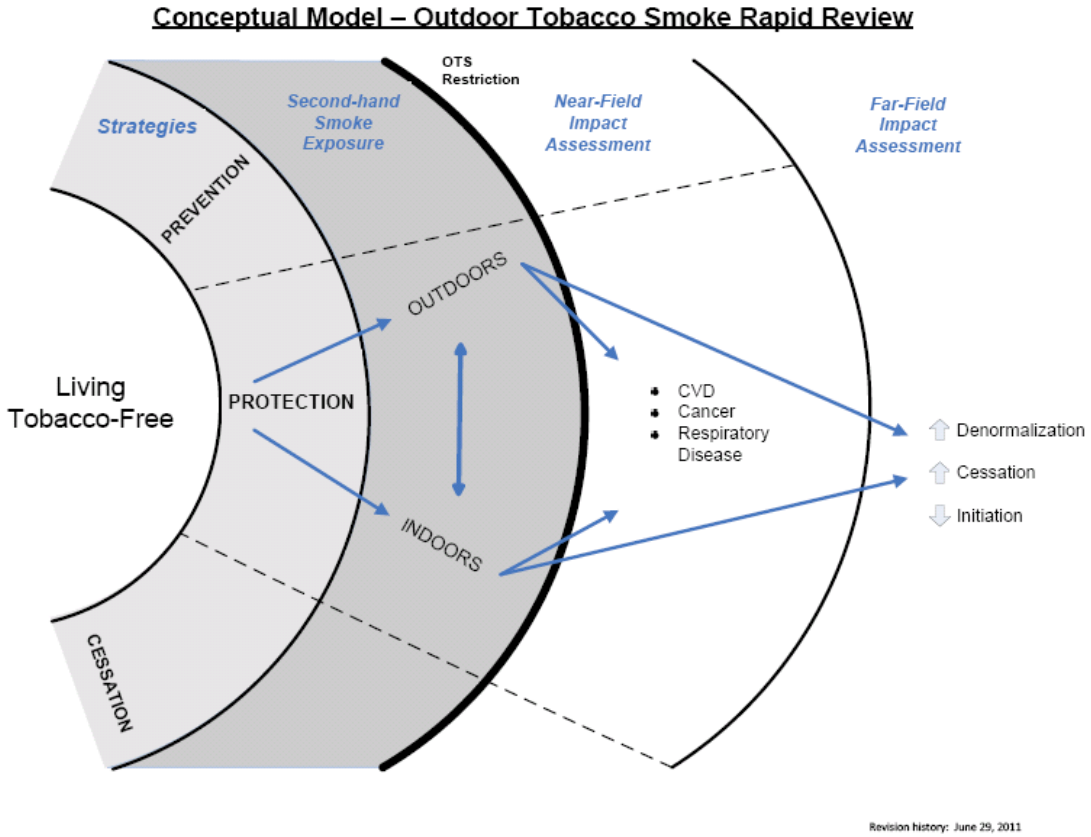
(7) Taylor R, Cumming R, Woodward A, Black M. Passive smoking and lung cancer: a cumulative meta-analysis. Australian & New Zealand Journal of Public Health 2001 Jun;25(3):203-211.

(8) Callinan JE. personal communication. 2011.

(9) Kaufman P, Zhang B, Bondy SJ, Klepeis N, Ferrence R. Not just “a few wisps”: real-time measurement of tobacco smoke at entrances to office buildings. Tobacco Control 2011;20:212-218.

(10) City of Brampton. 2009 Employer Survey. 2009.

Appendix 1: Conceptual Model – Outdoor Tobacco Smoke Rapid Review



Appendix 2: Searching the Evidence: A Tool for Practitioners

Welcome to the Library Searches tool!

The Library Searches tool and accompanying glossary will guide you through several steps for conducting a literature search. It will help you find the best evidence available on your topic in an effective and efficient manner.

Contents of the tool cover three areas: i) Determining the Question Type, ii) Developing a Searchable Question, and iii) Documenting the Search Strategy. Contents of the glossary include descriptions, definitions and examples of searchable questions (e.g., PICO) and forms and levels of evidence. The tool also provides tips for developing search terms, and guidance on how to revise and save your search.

It is encouraged to consult with a Peel librarian at the beginning of your searching process as they can provide expertise in such areas as developing a searchable question and choosing appropriate search terms. Also, take note of the checkpoints with your manager/supervisor and librarian throughout the search process.

Notes inserted in "red" are specific to this search
Last revision: February 22, 2011
Completed by: Rebecca Strange and Franca Ursitti

Searching the Evidence: A Tool for Practitioners

(Updated March5th, 2010)

Determine the Question Type

☐ Intervention (or Treatment, Prevention, Therapy)
☒ Harm (or Causation, Etiology)
☐ Prognosis
☐ Diagnosis (or Assessment)
☐ Economics (Cost-efficiency, Cost-effectiveness, and Cost-benefit studies)
☐ Meaning (Qualitative Research)
☐ Organizational Behaviour (Qualitative)
☐ Theory

Not sure what these types of questions are? Go to page 9 in glossary for definitions and examples of each question type.

☐ Obtaining statistics from data sources (Community Needs Assessment)

STOP → **Note: this is probably not a literature search. Consult with your manager/supervisor to identify relevant websites and data sources**

Develop a Searchable Question

Go to pages 10-14 in glossary for examples of PICO questions.

Briefly describe the public health scenario leading to the searchable question (Tell story):

local municipalities have received a number of complaints from residents regarding smo
public places including city buildings where vulnerable persons are present (e.g. commu
centres, parks, arenas)
some jurisdictions have passed local by-laws restricting smoking at outdoor public places

Identify terms to fit into your PICO Question

P – Population/Problem	**general population *(the team has an interest in children and pregnant women)***
I – Intervention or Exposure	**Outdoor tobacco smoke**
C – Comparison/Control	**No exposure**
O – Outcome of Interest	**Cardiovascular disease, respiratory disease, cancer including lung**

What are the effects of exposure to outdoor tobacco smoke, a component of secondhand smoke, on cardiovascular disease, respiratory disease, and lung cancer in the general population compared to no exposure.

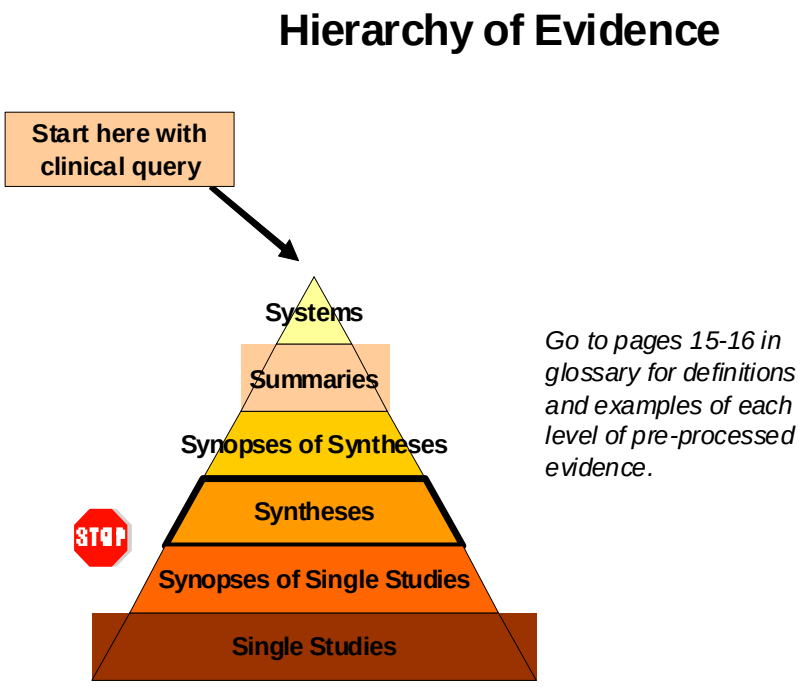
PICO Question:

Searching the Hierarchy of Evidence

What level(s) of evidence will you search?
Note: You can choose more than one level of evidence for each search.

☐ Systems *(No systems exist for public health.)*
☐ Summaries
☒ Synopses of Syntheses
☒ Syntheses

STOP *(Consult your Manager if you are unable to retrieve citations from the above sources and to determine if a search for single studies is appropriate to your question.)*
☐ Synopses of Single Studies
☐ Single Studies



Go to pages 15-16 in glossary for definitions and examples of each level of pre-processed evidence.

Haynes, 2007

Searching the Grey Literature

STOP **Consult with Manager/Supervisor & Librarian**:
Is searching the grey literature appropriate to your research question? Will the grey literature add value above and beyond the evidence available from the hierarchy above?
Sources of Grey Literature (Examples)
☐ National and provincial policies
☐ Ministry of Health directives and guidelines
☒ Documents from reputable websites which outline strong research methods (e.g. World Health Organization and the National Institute for Health and Clinical Excellence)
☐ Guidelines from provincial advisory committees (e.g., NACI - National Advisory Committee on Immunization)
☐ Industry technical reports, papers and guidelines from international sources
☐ Product Monographs

Does the grey literature conflict with the peer-reviewed research? - No

If yes, STOP **Consult with Manager/Supervisor & Librarian** to determine how to proceed.

Searching Practice Reviews

Consult with Manager/Supervisor & Librarian:
Is searching practice reviews appropriate to your research question? Will practice reviews add value above and beyond the hierarchy of evidence and/or the grey literature?

☐ Board of Health and Best Practice Reports
☐ Reports from other health departments (e.g., available on website)
☐ Reports from non-governmental, charitable or advocacy organizations (e.g., Heart and Stroke Foundation)
☐ Other:

Searching Information from Key Informants/Field Experts

Consult with Manager/Supervisor & Librarian:
Is searching information from key informants appropriate to your research question? Will information from key informants/field experts add value above and beyond the hierarchy of evidence and/or the grey literature?

☐ Expert opinions and communication with key experts
☐ Handouts and/or proceedings from conferences
☐ Personal information from stakeholders in the field (e.g., phone conversation regarding a program or strategy)
☐ Unpublished information or documents not widely shared by a health unit or organization
☐ Other:

3. Document the Search Strategy

Name: Outdoor Tobacco
Date(s) of Search: October 28, 2010, November 1, 2010 and February 4, 2011

Database Search Strategy Worksheet

What are the health impacts associated with exposure to outdoor tobacco smoke in public places?

What is the PICO Question? (*Copy from page 1 (step 2) of tool*)

Step 1: List Your Search Terms/Identify MeSH headings

	Population	**Intervention or Exposure**	**Comparisons**	**Outcomes**
Your terms *(pull key words from pg.1 PICO*	General population	outdoor tobacco smoke, a component of	No exposure	cardiovascular disease, respiratory

Go to pages 18 - 19 in glossary for example and guidance on search terms (e.g., Boolean Logic and search symbols).

table)		secondhand smoke		disease, and lung cancer
MeSH headings *Consult the thesaurus of each specific database for specific terms used by specific databases (e.g., in MEDLINE these terms are MeSH headings, other databases use other terms)*		Tobacco Smoke Pollution (MESH) AND Public place$ (TW) OR Outdoor$ (TW) AND Tobacco Smoke Pollution (MESH) OR Outdoor tobacco smoke (TW) or OTS concentrate$ (TW)		Lung Neoplasms-MESH (exploded) or Cardiovascular Disease MESH (exploded) or Respiratory Tract Diseases (MESH) (exploded) OR Cardiovasc$.tw. Or respir$.tw. or heart.tw. or lung$.tw. or cancer$.tw. or asthma.tw. or bronchi$.tw.

Source: Health-evidence.ca. (2009, November 25). *Developing an Efficient Search Strategy*. Retrieved 02/20/10 http://www.healthevidence.ca/public/tools/16/Developing_an_Efficient_Search_Strategy.doc.

Step 2: List the Inclusion and Exclusion Criteria for the Search

Identifying the inclusion and exclusion criteria for your search will help to refine your search and retrieve the most relevant articles; the limits you are able to place on your search will differ depending on the database used. *(The list below is not exhaustive.)*

Inclusion Criteria	Exclusion Criteria
☒ Language: all ☒ Country/Location: all ☒ Publication Date: no limit ☒ Age group: all ☒ Cultural group: all ☐ Publication type: ☒ Study type: guidelines, overviews, policy briefs, syntheses ☐ Review articles: ☒ Other: first round: "outdoor tobacco smoke" second round: broadened to "SHS" third round: limited it to "public place"	☐ Language: no ☐ Country/Location: no ☐ Publication Date: no ☐ Age group: no ☐ Cultural group: no ☐ Publication type: ☐ Study type: single studies ☐ Review articles ☐ Other:

Go to pages 20-22 in glossary for descriptions of sample databases.

Step 3: Follow the Hierarchy of Evidence & Identify the Appropriate Databases for your Search

Evidence Hierarchy	Identify Sources/Databases Searched
i) Summaries	Are summaries available? ☐ Yes ☐ No Source(s):
ii) Synopses of Syntheses	Are synopses of syntheses available? ☐ Yes ☒ No Source(s):
iii) Syntheses	Are syntheses available? ☒ Yes ☐ No Source(s): ☒ MEDLINE/PubMed ☒ The Cochrane Library (Cochrane Database of Systematic Reviews) ☒ Other: CINAHL, PyscINFO, National Collaborating Centre for Environmental Health, National Collaborating Centre for Methods and Tools (Public Health Plus), Health Evidence.ca **Note:** The preferred Medline interface is Ovid. Medline (Ovid) and The Cochrane Library should be your two primary databases for searching systematic reviews. If relevant systematic reviews are not retrieved through these two databases initially, you may consider searching in: Other bibliographic databases (e.g, CINAHL and PyscINFO) Discipline Specific Websites (e.g., TOXNET & National Collaborating Centre for Environmental Health) STOP → Consult with Library: if searching for literature in a sector or discipline specific website that you are unfamiliar with **Note:** As you move from bibliographic databases to discipline specific websites, the time spent searching increases, and the likelihood of finding quality studies decreases.

STOP ***Consult with your Manager/Supervisor & Librarian*** *if unable to retrieve citations from the above sources to determine if a search for single studies is appropriate to your question.*	
iv) Synopses of Single Studies	Are synopses of single studies available? ☐ Yes ☐ No Source(s):
v) Single Studies	Are single studies available? ☐ Yes ☐ No Source(s):
vi) Other: Grey Literature, Practice Reviews & Information from Key Informants/Field Experts	Is relevant and value-added evidence available from these sources? ☒ Yes ☐ No Source(s): ☒http://www.ncceh.ca/ National Collaborating Centre for Environmental Health. Environmental Tobacco Smoke in Indoor and Outdoor Public Places, 2006. http://www.phsa.ca/NR/rdonlyres/2EF46210-203B-4FBA-B219-9C29985273A6/0/EnvironmentalTobaccoSmokeinIndoorandOutdoorPublicPlaces2006.pdf ☒ www.nice.org.uk/ National Institute for Health and Clinical Excellence . Report of the Smoke Free Stadia Project, University of Liverpool, March 2010 http://www.gmpublichealthpracticeunit.nhs.uk/wp-content/uploads/2009/12/Report-of-the-smoke-free-stadia-project.pdf ☒ http://www.thecommunityguide.org/index.html CDC Community Guide. The Institute of Medicine (IOM) report, "Secondhand–Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence." October 2009. http://www.cdc.gov/tobacco/basic_information/health_effects/heart_disease/iom_report/ ☒ http://www.ncceh.ca/ National Collaborating Centre for Environmental Health. Summary of Conclusions of Eight Major Reviews Concerning Exposure to Second-Hand Tobacco Smoke, February 2008. http://www.ncceh.ca/sites/default/files/Second-

	hand_Tobacco_Smoke_Feb_2008_0.pdf

Step 4: Citations Retrieved – Assessing the Pool of Potential Evidence

How many citations were retrieved?

1. First search round with inclusion criteria being "outdoor tobacco smoke" – 0 citations retrieved
2. Second search round removing "outdoor tobacco smoke" and broadening to "secondhand smoke" - 77 citations retrieved
3. Third search round – limiting search by adding "public places" search term - 14 citations retrieved – two duplicates

Consider the number of articles retrieved in your search. A large number retrieved may require you to refine the search strategy further (e.g., place further limits on the search). A small number of articles retrieved may require expanding your search strategy.

Depending on your topic, the number of studies required to answer your PICO will differ, and will also depend on the types of studies retrieved. For example, a search that retrieves three relevant systematic reviews of strong methodology may be adequate for your topic at hand.

Can you proceed to the critical appraisal stage with the pool of citations the search strategy has generated?

☒ Yes – Complete the "Overview of Search Process" [insert link here] *(pg. 24 of glossary) – first round of medline search resulted in too many citations. The search was narrowed further by adding the "public place" search term*

☐ No - too many citations
Action: (a) reduce keywords, (b) put more limits on the inclusion/exclusion criteria and/or (c) limit to particular databases

☐ No - too few citations
Action: (a) expand keywords, (b) remove some of the limits on inclusion/exclusion criteria, (c) search additional databases

Step 5: Saving your Search

Go to pages 22-23 in glossary for information on how to save your search

Have you imported your references into Refworks?
☒ Yes
☐ No

Have you saved your search?

☒ Yes - Where is it saved? (location/filename)? on file with the librarian but also included in the textbox below

☐ No

Note: You can alternatively cut and paste the search details in the textbox below *(see details on saving your search on pages 22-23 in glossary)*:

Database: Ovid MEDLINE(R) <1950 to October Week 4 2010>
Search Strategy:
---

1 outdoor tobacco smoke.tw. (1)
2 Tobacco Smoke Pollution/ (8297)
3 OTS concentrat$.tw. (1)
4 outdoor$.tw. (8954)
5 2 and 4 (190)
6 exp Cardiovascular Diseases/ (1611583)
7 exp Respiratory Tract Diseases/ (913523)
8 exp Lung Neoplasms/ (144725)
9 6 or 7 or 8 (2420145)
10 1 or 3 (1)
11 5 or 10 (190)
12 9 and 11 (65)
13 meta-analysis.mp,pt. (43855)
14 (search or systematic review or medline).tw. (140912)
15 cochrane database of systematic reviews.jn. (7454)
16 13 or 14 or 15 (168036)
17 12 and 16 (1)
18 public place$.tw. (960)
19 cardiovasc$.tw. (199037)
20 respir$.tw. (286897)
21 heart.tw. (494572)
22 lung$.tw. (370266)
23 cancer$.tw. (791434)
24 asthma.tw. (88443)
25 bronchi$.tw. (94619)
26 2 and 18 (277)
27 11 or 26 (454)
28 19 or 20 or 21 or 22 or 23 or 24 or 25 (1971839)
29 9 or 28 (3605775)
30 16 and 27 and 29 (6)

Database: PsycINFO <1987 to February Week 1 2011>
Search Strategy:
---
1 exp tobacco smoking/ (15514)
2 outdoor.tw. (1756)
3 1 and 2 (44)
4 secondhand smoke.tw. (257)
5 2 and 4 (13)
6 public place$.tw. (488)
7 1 and 6 (96)
8 ots.tw. (145)
9 1 and 8 (1)
10 3 or 5 or 7 or 9 (135)
11 exp cardiovascular disorders/ (26674)
12 exp respiratory tract disorders/ or exp apnea/ or exp bronchial disorders/ or exp dyspnea/ or exp lung disorders/ or exp pharyngeal disorders/ (7041)
13 respir$.tw. (7312)
14 cardiovasc$.tw. (12480)
15 heart.tw. (24405)
16 cancer$.tw. (25965)
17 exp neoplasms/ or exp nervous system neoplasms/ (22517)
18 asthma.tw. (3525)
19 bronchi$.tw. (475)
20 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 (89143)
21 10 and 20 (13)
22 meta-analysis.mp,pt. (9501)
23 (search or systematic review or medline).tw. (34559)
24 cochrane database of systematic reviews.jn. (0)
25 22 or 23 or 24 (42531)
26 review.tw. (167939)
27 21 and 25 (0)
28 21 and 26 (1)

CINAHL Search Stategy

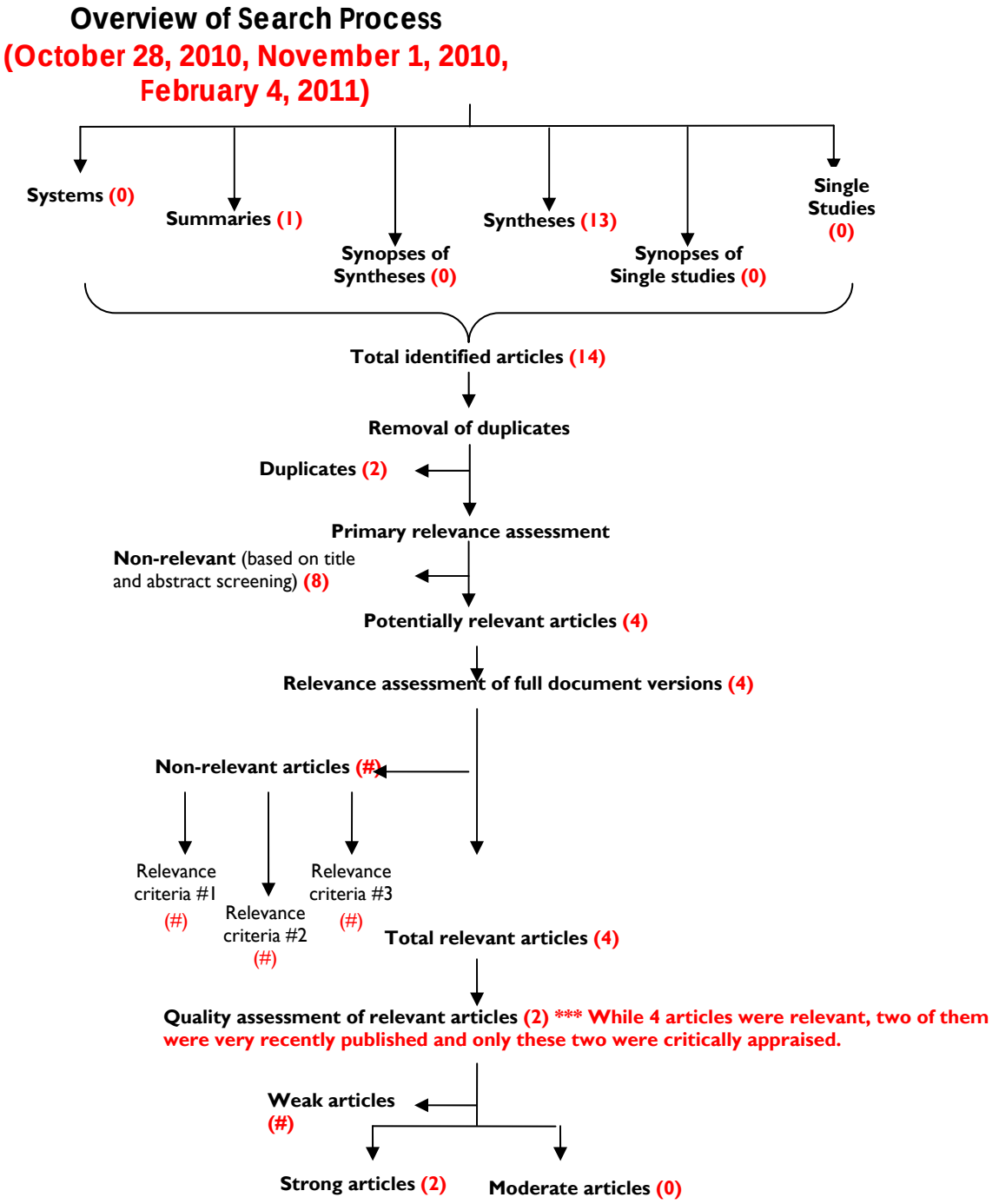
S29	s26 AND s20 AND s4	Limiters - Published Date from: 20000101-20111231; Research Article; Exclude MEDLINE records; Evidence-Based Practice Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	3	Edit S29
S28	s26 AND s20 AND s4	Limiters - Published Date from: 20000101-20111231 Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	153	Edit S28
S27	s26 AND s20 AND s4	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	155	Edit S27
S26	(S21 or S22 or S23 or S24 or S25)	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	131311	Edit S26
S25	JN cochrane database of systematic reviews	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	4310	Edit S25
S24	MW meta-analysis	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	10083	Edit S24
S23	TX medline	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL	25549	Edit S23

			with Full Text		
S22	TX systematic review	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	42023	Edit S22
S21	TX search*	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	102500	Edit S21
S20	S5 or S6 or S7 or S8 or S9 or S10 or S11 or S12 or S13 or S14 or S15 or S16 or S17 or S18 or S19	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	473609	Edit S20
S19	MW neoplasm*	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	113399	Edit S19
S18	TX neoplasm*	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	116405	Edit S18
S17	TX bronchi*	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	10296	Edit S17
S16	TX asthma	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	34074	Edit S16
S15	TX cancer	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen -	173368	Edit S15

			Advanced Search Database - CINAHL with Full Text		
S14	TX heart	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	174212	Edit S14
S13	TX cardiovasc*	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	95367	Edit S13
S12	TX respir*	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	90219	Edit S12
S11	MJ lung	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	12759	Edit S11
S10	MW pharyngeal	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	1116	Edit S10
S9	MW dyspnea	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	2840	Edit S9
S8	MW bronchial	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	1120	Edit S8

S7	MW apnea	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	4437	Edit S7
S6	MW respiratory	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	27183	Edit S6
S5	MW cardiovascular	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	31686	Edit S5
S4	S1 or S2 or S3	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	832	Edit S4
S3	MW smoking and TX public place	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	49	Edit S3
S2	MW smoking and TX secondhand smoke	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	724	Edit S2
S1	MJ smoking and TX outdoor	Search modes - Boolean/Phrase	Interface - EBSCOhost Search Screen - Advanced Search Database - CINAHL with Full Text	121	

Appendix 3: Overview of Search Process



Appendix 4: Relevancy Assessment

OTS lit search - relevancy review based on abstract info

Last revised - February 23, 2011

Reference #	Reference including title	Type of study	Population	Exposure	Outcome assessed	Key findings	Proceed to CA? (Y/N)
1	Björkstén B. 1999. The environmental influence on childhood asthma. *Allergy* 54, no. Suppl 49:17-23.	review	Children	environmental influences on childhood asthma and allergy - focus on indoor environment. SHS but one risk factor discussed	environmental factors that may increase the incidence of sensitization to allergens	many factors examined; SHS part of the non-specific environmental factors	N - the outcome is sensitization to allergens; only a overview of the factors; no quantitative assessment of exposure level and health outcome

2	Callinan, J. E., A. Clarke, K. Doherty, and C. Kelleher. 2010. Legislative smoking bans for reducing secondhand smoke exposure, smoking prevalence and tobacco consumption. *Cochrane Database of Systematic Reviews* 4, 005992.	Cochrane systematic review - included 50 studies	general public; occupational exposure	31 studies reported exposure to SHS; 19 studies measured SHS using biomarkers	25 studies reported health indicators as an outcome; self-reported respiratory and sensory symptoms measured in 12 studies and lung function measured in 5 studies	consistent evidence that smoking bans reduced exposure to SHS in workplaces, restaurants, pubs and in public places; failed to detect reduced exposure in cars; consistent evidence of a reduction in hospital admissions for cardiac events and other health indicators after the ban	Y - Priority #1
3	Green, E., C. Courage, and L. Rushton. 2003. Reducing domestic exposure to environmental tobacco smoke: a review of attitudes and behaviours. *Journal of the Royal Society for the Promotion of Health* 123, no. 1:46-51.	review	children	indoor environments	attitudes and behaviours towards SHS with focus on child health and indoor environment	The focus is on attitudes and behaviours towards environmental tobacco smoke. Not assessing health outcomes associated with exposure to SHS	N

4	Meyers, D. G., J. S. Neuberger, and J. He. 2009. Cardiovascular effect of bans on smoking in public places: a systematic review and meta-analysis. *Journal of the American College of Cardiology* 54, no. 14:1249-1255.	systematic review and meta-analysis	general public	exposure to SHS in public places	risk of hospital admission for acute MI after smoking ban in place;	11 reports from 10 study locations; AMI risk decreased by 17% overall, with the greatest effect among younger individuals and nonsmokers	Y - Priority #3; 11 of the 57 references in this report is included in the Cochrane review; the difference between this review and priority #1 and #2 is that it is a quantitative review that tried to account for the heterogeneity limitation.
5	Taylor, R., R. Cumming, A. Woodward, and M. Black. 2001. Passive smoking and lung cancer: a cumulative meta-analysis. *Australian & New Zealand Journal of Public Health* 25, no. 3:203-211.	meta-analysis	spousal meta-analysis - women never smoke but exposed to SHS from spouse compared to unexposed, never-smoking women		association between passive smoking and lung cancer	statistically significant increased RR across a number of international studies	Y - 1 of 130 references included in the Cochrane review as an additional reference; Priority #4

6	Environmental Tobacco Smoke in Indoor and Outdoor Public Places, 2006. BC Provincial Health Services Authority http://www.phsa.ca/NR/rdonlyres/2EF46210-203B-4FBA-B219-9C29985273A6/0/EnvironmentalTobaccoSmokeinIndoorandOutdoorPublicPlaces2006.pdf	review	general public	exposure to SHS in indoor and outdoor public places	association between SHS and all cancer, cardiac disease, stroke, asthma and other respiratory disease and symptoms, other health conditions or endpoints		N - methods section sparse; no detailed description of the search strategy; objectives well described

7	National Collaborating Centre for Environmental Health. Summary of Conclusions of Eight Major Reviews Concerning Exposure to Secondhand Tobacco Smoke, February 2008. http://www.ncceh.ca/sites/default/files/Second-hand_Tobacco_Smoke_Feb_2008_0.pdf	summary of conclusions from eight major studies; based on study #8	general public	exposure to SHS in indoor and outdoor public places	causal and possible causal relationships between SHS exposure and developmental, respiratory, carcinogenic and cardiovascular effects	at least one study of the eight found a causal association with SIDS, fetal growth impact, pre-term delivery, acute lower respiratory tract infections in children, asthma exacerbation in children, asthma; at least one study found a possible causal association with spontaneous abortion, adverse impact on cognition and behaviour, intrauterine growth retardation, lymphomas in children, allergic sensitization, fertility or fecundity, cervical cancer, brain cancer in children, stroke	N - this document consists of only two tables. There is no methods section. However, because it is an update to reference #6, if ref #6 is deemed relevant, then this reference will be considered together with #8 on the assumption that the same methods used in #8 were used in this study

8	CDC Community Guide. The Institute of Medicine (IOM) report, "Secondhand–Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence." October 2009.http://www.cdc.gov/tobacco/basic_information/health_effects/heart_disease/iom_report/	review	general public - non smokers	indoor exposure to SHS	relationship between SHS exposure (incl. short-term exposure) and acute coronary events	exposure to SHS increases the risk of CHD by about 25-30%: dose-response demonstrated; decrease in relative risk of acute coronary events in non-smokers with a decrease in SHS occurring after a smoking ban	Y - Priority #2 - As per a comparison of the reference lists, the 11 studies included in this committee report were all included in the Callinan qualitative narrative review published in the Cochrane Collaboration in 2009. Callinan did not have additional studies for this particular health outcome.

9	National Institute for Health and Clinical Excellence. Report of the Smoke Free Stadia Project, University of Liverpool, March 2010 http://www.gmpublichealthpracticeunit.nhs.uk/wp-content/uploads/2009/12/Report-of-the-smoke-free-stadia-project.pdf	review	general public using sports stadia and outdoor public venues; environmental health practitioners		compliance with smoke-free legislation in sports stadia and outdoor public venues	focus was compliance with smoke-free legislation	N - no health outcomes assessed
10	Salvi, Sundeep S and Varnes, Peter J. 2009. Chronic obstructive pulmonary disease in non-smokers	review	non-smokers		COPD	looked at the associated of COPD with biomass fuel, occupational exposure to dusts and gases, history of pulmonary tuberculosis, chronic asthma, respiratory-tract infections during childhood, outdoor air pollution and poor socioeonomic status	N - broad review of factors influencing COPD with smoking being on of the considerations. SHS was not distinguished from other tobacco factors

11	Backinger,C.L.; McDonald,P.; Ossip-Klein, DJ; Colby,S.M.; Maule,C.O.; Fagan,P.; Husten,C.; Colwell,B. Improving the future of youth smoking cessation American Journal of Health Behavior 2003; Vol. 27; Page: S170	review	youth smokers		cessation	Objective was to provide recommendations that will build a better foundation for research on youth smoking cessation; Given the dearth of studies on youth smoking cessation, scientifically rigorous studies need to be conducted with attention to methodological issues, research gaps, and reporting of key research components.	N - cessation not an outcome of interest for this rapid review
12	Sadler,G.A review of adjunct exercise interventions to aid the smoking cessation efforts of women 2009. Physiotherapy Canada Vol 61, page 16.	review	women		cessation		N - cessation not an outcome of interest for this rapid review

Appendix 5: Data Extraction Table

Systematic Review #1	Legislative smoking bans for reducing secondhand smoke exposure, smoking prevalence and tobacco consumption. *Cochrane Database of Systematic Reviews* 4, 005992.
General Information & Quality Rating	
1. Author & date	Callinan, J. E., A. Clarke, K. Doherty, and C. Kelleher. 2010.
2. Country	Ireland
3. Health Evidence Quality Rating (Independently rated by 3 reviewers)	Overall rating: 10 (High quality)
4. Generalizability	Ontario has provincial and local legislative bans/restrictions in place; 13 different countries captured including US, Scotland, Ireland, Italy, Spain, Norway, New Zealand, Canada, Finland, England, Netherlands and Sweden
Details of Each Review	
Evidence used to develop this guideline	**Primary Objective:** A) to assess the extent to which legislation-based smoking bans or restrictions reduce exposure to SHS tobacco consumption and smoking prevalence **Secondary Objective:** B) to assess the extent to which legislation-based smoking bans or restrictions affect the health of those in areas which have a ban or restriction in place (morbidity and mortality) 50 studies in total ▪ 31 studies reported exposure to SHS, 19 of those studies measured SHS using biomarkers ▪ 25 studies reported health indicators as an outcome
Types of studies	Predominant type of study was uncontrolled before and after a smoking ban or restriction (n=24). Repeated cross-sectional study measures mainly in general populations (n=18) There were no RCTs where the ban was the primary intervention (can't blind the population or the investigators to the ban and do randomization). Some quasi-experimental studies had an intervention area and a control area (n=13) Legislation which prohibits smoking in indoor workplaces, including bars and restaurants, is categorized as comprehensive, even though it may allow exemptions in particular settings e.g. prisons (n=40). Legislation which allows designated smoking areas in indoor workplaces, including bars and restaurants, is categorized as a partial ban (n=10). - minimum 6 month followup after ban; some were less than 6 month followup when measuring exposure to secondhand smoke
Search period	as far back as could search (1806 to present)
Number of databases searched	6 Medline, EMBASE, CINAHL, PsycINFO, Cochrane Tobacco Addiction Group Specialized Register, Conference Paper Index

Inclusion/Exclusion Criteria	**Included studies** – reported legislative smoking bans and restrictions affecting populations at national, state or community level; a ban explicitly in the study; minimum of six months follow up for measures of smoking behaviours; RCT; quasi-experimental studies (i.e. non-randomized controlled studies); controlled before and after studies; interrupted-time series; uncontrolled pre and post-ban data **Excluded studies** – setting based bans such as workplaces where smoking has been partially or comprehensively restricted though not necessarily as a result of national or state-level legislation; excluded those studies which reported environmental measures of air quality (e.g. particulate matter (PM2.5), respirable particles, vapour phase nicotine) as their sole measure of exposure to SHS
Quality Appraisal	Methods of the Cochrane Collaboration
Details of Interventions Included in Review	
Description of interventions	Intervention providers: national, state or community governments by legislation or policy Intervention settings: smoking ban must operate at national, state or community level
Target Groups	▪ general public – smokers and non-smokers ▪ occupational exposure - hospitality workers ▪ populations at national, state or local level exposed to partial or comprehensive smoking bans
Outcome Measurements in the Review	
Primary Outcomes	Exposure to SHS – biological markers and self-report Prevalence of smoking – use, consumption, cessation rates (biochemical verification & self-report) Consumption of tobacco outcome Individual exposure to active smoking (n=1), population smoking prevalence &/or consumption (n=3) and cotinine (n-2) were also studied.
Secondary Outcomes	Hospital Admissions for Cardiac Events - Hospital admissions for acute coronary syndrome: 10 of 12 looked at admissions, two others on death and prognosis post acute coronary syndrome in non-smokers Respiratory Symptoms: twelve studies examining respiratory symptom outcomes, eleven with comprehensive bans in place, and two with control groups. Six of the twelve studies without control groups conducted pulmonary function tests - all had comprehensive bans in place. Sensory Symptoms: sensory symptoms measured in 10 studies, one had a control group
Results of Review	
Main results	**Introduction of legislative smoking bans leads to reduction in exposure to passive smoking with the greatest exposure reduction seen in hospitality workers. There is some evidence of an improvement in health outcomes with the strongest evidence being the reduction seen in admissions for acute coronary syndrome (heart attacks in hospital).** **Primary outcomes**

	▪ consistent evidence that smoking bans reduced exposure to SHS in workplaces, restaurants, pubs and in public places; reduction in amount of time exposure to SHS (71-100% reduction) or percentage of those exposed to SHS (22-85% reduction); biomarker studies (n=12) showed 39-89% reduction in saliva cotinine
	▪ greater reduction in exposure to SHS in hospitality workers compared to the general population; one study found significant reduction (>95%) in total hours exposed to SHS (work plus other) by non-smoking employees in Toronto
	▪ failed to detect reduced exposure in cars (n=5); percentage of children exposed remained unchanged (n=1)
	▪ In general, there was no change in either the prevalence or duration of reported exposure to SHS in the home as a results of implementing legislative bans (n=15). Some studies reported positive findings; significant reduction in homes allowing smoking, and the percentage of adults reporting smoke-free homes increased one year post ban. Others reported a decrease in smoking at work but not at home.
	▪ no consistent evidence of a reduction in smoking prevalence attributable to the ban. However, in studies reporting a decline in prevalence, total tobacco consumption was reduced.
	
	<u>Secondary outcomes</u>
	▪ **Acute Coronary Syndrome (ACS)**: Studies (n=12) reported hospital admission rates for acute myocardial infraction (AMI) or coronary heart disease following the onset of the ban. The study locations were the United States, Italy, Scotland and Canada with 10 of the studies involving comprehensive bans.
	▪ Consistent evidence (10 of 12 studies) showed a reduction in AMI hospital admissions. Four of the studies, all in the United States, had control groups and 3 of the 4 had comprehensive bans in place.
	▪ In two of the studies with control groups:
	  ▪ non-smokers were found to have a significant, 3-fold decline in AMI admission rates (Monroe County, Indiana – comprehensive ban)
	  ▪ 47% decline in admissions rates for smoking related diseases (Bowling Green, Ohio – partial ban)
	▪ For those studies without control groups:
	  ▪ significant decline in AMI rates in males and females under 60 yrs; RR 0.89 (CI 0.81-0.98) (Italy - partial)
	  ▪ significant decline in acute coronary events in 35-64 yrs; RR 0.89 (CI 0.85-0.93) and 65-74 yrs RR 0.92 (CI 0.88-0.97) (Italy – comprehensive ban)
	  ▪ 8% reduction in AMI hospital admissions (New York – comprehensive ban)
	  ▪ AMI rate decrease from 176/100,000 (CI 165.3 to 186.8) before the ban to 152.4/100000 (CI 135.3 to 169.3) after the ban; 13% decline in AMI after the ban (Saskatoon, Canada- comprehensive ban)
	  ▪ overall 17% decline in patients admitted for ACS; 14% in smokers, 19% in formers smokers and 21% in never smokers; A greater percent decline in current and non-smoking females (Scotland – comprehensive ban)
	▪ One of the twelve studies also showed a better prognosis after ACS among smokers and non-smokers (never and former smokers), with greater percentage improvements in non-smokers following a legislative ban. The review did not provide details for the measures that were used

	to assess prognosis. Two studies showed a decrease in **death** due to coronary heart disease. The findings included: ▪ 33000 fewer deaths over an 8 year period (California, United States – comprehensive) ▪ all cause mortality death decline in non-smokers from 22 with a cotinine level greater than 0.9 ng/mL to 10 with a cotinine level of less than 0.1 ng/mL. The same dose-response was seen for cardiovascular death (Scotland – comprehensive) ▪ **Respiratory**: A majority of studies (10 of 12) reported a significant reduction in respiratory symptoms irrespective of smoking status (i.e. non-smokers, smokers and past smoker), though not all studies stratified by smoking status. Two studies had control groups. All studies were in hospitality/bar worker settings and some of the studies only examined the outcome in non-smokers (n=3). ▪ Where significant differences were found, the overall percent reductions of respiratory symptoms ranged from 12%-42% (16% and 38.1% in each of the two studies in control groups, the latter with only a partial ban in place). ▪ Individual respiratory symptoms were also studied. Statistically significant reductions in individual respiratory symptoms were observed in many of the studies though not all studies reported significant reductions for each symptom. Two of these studies had control groups. The percent reduction varied for each symptom. The change in symptom before and after for the individual respiratory symptoms are: o morning cough – 4.4 to 30% (13% in one control group study) o daytime cough – 2.3 to 38% o phlegm production – 3.5 to 42% (14% in one control group study) o wheeze – 5.3 to 15% o shortness of breath – 1.2 to 11% o Generally, in those studies that stratified by smoking status the reductions in individual respiratory symptoms were greater for non-smokers. ▪ Mixed results with only 2 studies showing a significant increase in forced expiratory volume (FEV1), three studies an increase in forced vital capacity (FVC), and two studies showing a reduction in forced expiratory flow (FEF). These three physiological measures are objective indicators of lung function and are appropriately weighted more prominently. ▪ **Sensory**: overall reduction in symptoms in non-smokers and smokers (10 studies – one with a control group) with particular improvements in eye, nose, throat improvements in non-smokers. ▪ In smokers, five studies showed reduction in symptoms in smokers with eye symptom improvement the most common finding.
Comments/limitations	• Cotinine validated exposure studies appropriately given greater weight - recall bias not an issue when using biological markers of exposure • Setting based ban not included in the review – this would include workplaces, where smoking has been partially or comprehensively restricted, though not necessarily as a result of national or state-level legislation.

	• Meta-analysis was not possible due to the heterogeneity in design, participants, outcomes and nature of intervention. Summary and descriptive statistics have provided. Authors report threats to validity and other limitations in the description of the studies • Prevalence reported primarily as a confounder/co-variable to passive smoking measure. • There were studies that included environmental measures of air quality (n=8). All studies showed a significant reduction in levels of markers of poor air quality such as nicotine, dust, benzene and particulate matter. • Other adverse or otherwise negative effects of implementing smoking bans (n=3), reported that there was a potential for smoke from outdoor areas to drift into indoor areas. • Authors' statement on implications for research: There is also a need for research into extent to which exposure to SHS in non-smoking areas is a result of smoke coming from the outdoor smoking areas.

Systematic Review #2	**IOM (Institute of Medicine). *Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence*. Washington, D.C.: The National Academies Press.**
General Information & Quality Rating	
1. Author & date	Institute of Medicine of the National Academies, Committee on Secondhand Smoke Exposure and Acute Coronary Events. Board on Population Health and Public Health Practice (2010)
2. Country	United States
3. Health Evidence Quality Rating (Rated by 1 reviewer)	Overall rating: 9 (High quality)
4. Generalizability	Ontario has provincial and local legislative bans/restrictions in place; countries in North American and Europe captured in review including: Unites States, Italy, Canada, Scotland
Details of Each Review	
Evidence used to develop this guideline	**Primary:** **The committee's charge was the evaluation of three sets of relationships:** **a) assess the association between SHS exposure and cardiovascular disease, focusing on coronary heart disease and not stroke** **b) assess the association between SHS exposure and acute coronary events** **c) assess the association between smoking bans and acute coronary events** Eight specific questions were posed to the committee: 1. What is the current scientific consensus on the relationship between exposure to secondhand smoke and cardiovascular disease? What is the pathophysiology? What is the strength of the relationship? 2. Is there sufficient evidence to support the plausibility of a causal relation between secondhand smoke exposure and acute coronary events such as acute myocardial infarction and unstable angina? If yes, what is the pathophysiology? And what is the strength of the relationship? 3. Is it biologically plausible that a relatively brief (eg. under 1 hour) secondhand smoke exposure incident could precipitate an acute coronary event? If yes, what is known or suspected about how this risk may vary based upon absence or presence (and extent) of pre-existing coronary artery disease)? 4. What is the strength of the evidence for a causal relationship between

	indoor smoking bans and decreased risk of acute myocardial infarction? 5. What is a reasonable latency period between a decrease in risk of an acute myocardial infarction for an individual? What is a reasonable latency period between a decrease in population secondhand smoke exposure and a measurable decrease in acute myocardial infarction rates for a population? 6. What are the strengths and weaknesses of published population-based studies on the risk of acute myocardial infarction following the institution of comprehensive indoor smoking bans? In light of published studies" strengths and weaknesses, how much confidence is warranted in reported effect size estimates? 7. What factors would be expected to influence the effect size? For example, population age distribution, baseline levels of secondhand smoke protection among non-smokers, and levels of secondhand smoke protection provided by the smoke-free law? 8. What are the most critical research gaps that should be addressed to improve our understanding of the impact of indoor air policies on acute coronary events? What studies should be performed to address t2hese gaps? 11 studies played a key role in the evaluation of smoking bans and were the focus of the committee's deliberations.
Types of studies	These studies were all observational in nature and they assessed the effects of smoking bans on acute coronary events. They are not designed to answer questions about all three of the associations that were part of the committee's charge. Most of them did not measure individual exposures to secondhand smoke or the smoking status of individuals. They were designed to evaluate the association between bans and heart attack rates not the effects of secondhand smoke exposure. Two studies, that in Scotland and in Monroe County, Indiana, had data on smoking status and conducted analyses only in nonsmokers. These two studies were designed to assess the association between secondhand smoke exposure and heart attacks. The committee crossed checked to the Bradford-Hill criteria lend support to the interpretation.
Search period	1997- present
Date of most recent search	2009 (assumed "present" to mean 2009)
Number of databases searched	7 - Medline, Clinical Trials.gov, EMBASE, CRISP, , New York Academy of Sciences GreyLit, NACCHO **(**NATIONAL ABORIGINAL COMMUNITY CONTROLLED HEALTH ORGANISATION), WorldCat
Quality Appraisal	Methods of the CDC Community Guide
Details of Interventions Included in Review	
Description of interventions	Intervention providers: national, state or community governments by legislation or policy Intervention settings: smoking ban must operate at national, state or community level
Target Groups	▪ general public – smokers and non-smokers ▪ occupational exposure - hospitality workers ▪ populations at national, state or local level exposed to partial or comprehensive smoking bans

Outcome Measurements in the Review	
Primary Outcomes	1. Secondhand smoke exposure and coronary heart disease: change in risk of coronary heart disease associated with exposure to SHS 2. Secondhand smoke exposure and acute coronary events: two studies reviewed analyzed changes in the hospitalization rate for acute coronary events after the implementation of smoking bans. One reported only events in non-smokers (Monroe County, IN) and the other analyzed smokers and non-smokers separately (Scotland) 3. Smoking bans and acute coronary events
Results of Review	
Main results	**Outcome #1** ▪ **The committee concurred with the scientific consensus in the 2006 US Surgeon General report that "the evidence is sufficient to infer a causal relationship between exposure to secondhand smoke and increased risks of coronary heart disease morbidity and mortality among men and women."** ▪ Consistent evidence that the risk of coronary heart disease increases by 25-30%, with higher estimates in a few studies with better quantitative assessment of exposure. Epidemiological and animal studies demonstrate a dose-response relationship – increased risk even at lowest exposure levels, a steep initial rise in risk followed by a gradual increase with increasing exposure. ▪ Chamber studies and animal studies of the constituents of SHS and the pathophysiology of coronary heart disease make the relationship biologically plausible **Outcome #2** ▪ **The combination of the evidence from the epidemiologic studies and information from the experimental studies and studies of PM is sufficient to support an inference of a causal relationship between exposure to SHS and acute coronary events. Although data from experimental studies have indicated that cardiovascular effects are seen after very brief exposure (less than 1 hour), the data from most the epidemiologic studies do not include the duration of exposure before smoking bans, to the committee could not estimate the length of exposure required to increase the risk of acute MI**. ▪ both studies provided direct evidence related to SHS exposure and acute coronary events. ▪ both studies showed a reduction in relative risk of acute coronary events in nonsmokers with the decrease in SHS exposure that occurred after implementation of smoking bans ▪ effect seen after implementation of smoking bans is consistent with data from the INTERHEART study, a case-control study of more that 15,000 first cases of non-fatal acute myocardial infarction in 262 centre in 52 countries with adjusted odds ratio of: o 1.24 (1.17-1.32) those least exposed (1-7 hrs of exposure/week) o 1.62 (1.45-1.81) in those most exposed (at least 22 hours of exposure per week) ▪ Other 9 epidemiologic studies provide indirect evidence of an association between SHS exposure and AMI. Not possible to separate the effect of reducing SHS exposure from the effect of reducing active smoking

	(individual smoking status information not available) or SHS exposure concentrations. Monitoring studies of airborne tracers and biomarkers have demonstrated that exposure to SHS is dramatically reduced after the implementation of smoking bans. ▪ Experimental data have demonstrated that an association between SHS exposure and acute coronary events is biologically plausible - studies in humans, animals and cell cultures have demonstrated short-term effects of SHS, its components or both on the cardiovascular system ▪ There is sufficient evidence from such studies to infer that acute exposure to SHS at concentrations relevant to population exposures induces endothelial dysfunction, increase thrombosis and potentially affects plaque stability adversely. **Outcome #3** ▪ **On the basis of its review of the available experimental and epidemiological literature, including relevant literature on air pollution and PM, the committee concludes that there is a causal relationship between smoking bans and decreases in acute coronary events.** ▪ All 11 key epidemiological studies support an association between smoking bans and a decrease in the incidence of acute coronary events. They are overall consistent – all studies showed decreases in the rate of heart attacks after implementation of smoking ban ranging from 6-47%. ▪ The consistency in the direction of the change gave the committee confidence that smoking bans decrease the rate of heart attacks.
Comments/Limitations	**Outcome #1** ▪ The committee found that the evidence to determine the magnitude of the association (the number of cases of disease that are attributable to secondhand smoke exposure) is not strong, therefore the committee did not estimate that size of the effect or the attributable risk. **Outcome #2** ▪ Because of difference between the studies (population, population size and in analysis) the studies did not provide sufficient evidence of the magnitude of the decrease in relative risk ▪ None of the studies had information on how long or how often individuals were exposed before or after implementation of smoking bans. Therefore, the committee could not determine whether acute exposures were triggering acute coronary events, chronic exposure were causing chronic damage that eventually resulted in acute coronary event or a combination of chronic damage and an acute-exposure trigger led to the increased risk of acute coronary events. **Outcome #3** ▪ Contextual factors associated with a ban are difficult to separate from the impact of the ban itself and could vary from ban to ban. Therefore, the committee noted that their conclusion on the effects of bans refer to the combined effects of different types of legislation and those contextual factors. ▪ The committee was unable to determine the magnitude of effect on the basis of the 11 studies because of variability among and uncertainties within them