



Health Effects from the Use of, and Exposure to, Tobacco and Non-Tobacco Waterpipes

Kiran Ghai, Analyst, Research and Policy, Environmental Health
Kathie Brown, Supervisor, Environmental Health

February 5, 2015

Table of Contents

<i>Key Messages</i>	2
<i>Executive Summary</i>	4
<i>1 Issue</i>	7
<i>2 Context</i>	8
<i>3 Conceptual Framework</i>	11
<i>4 Literature Review Question</i>	11
<i>5 Literature Search</i>	11
<i>6 Relevance Assessment</i>	12
<i>7 Results of the Search</i>	12
<i>8 Critical Appraisal</i>	13
<i>9 Description of Included Studies</i>	13
<i>10 Synthesis of Findings</i>	16
<i>11 Applicability and Transferability</i>	24
<i>12 Recommendations</i>	27
<i>References</i>	29
<i>Appendix A: Waterpipe Diagram</i>	33
<i>Appendix B: Conceptual Model</i>	34
<i>Appendix C: Medline Search Strategy</i>	35
<i>Appendix D: EMBASE Search Strategy</i>	37
<i>Appendix E: EBSCO Search Strategy</i>	38
<i>Appendix F: Grey Literature Search Strategy</i>	40
<i>Appendix G: Literature Search Flowchart</i>	43
<i>Appendix H: Data Extraction Tables</i>	44
<i>Appendix I: Data Synthesis</i>	56
<i>Appendix J: Applicability and Transferability Worksheet</i>	58

Key Messages

1. The evidence indicates that waterpipe tobacco smoking is possibly associated with lung cancer (a. diagnosis and b. mortality), pregnancy outcomes (a. low-birth weight and b. newborn pulmonary problems), periodontal disease (a. periodontal bone height loss, plaque index and gingivitis, deepening of sulci or pockets, vertical periodontal bone loss and b. dry socket), respiratory illness (perennial rhinitis including nasal congestion and wheezing) and lung function (FEV_1)¹.
2. The evidence indicates that waterpipe tobacco smoking is not significantly associated with bladder cancer (diagnosis), oesophageal cancer (oesophageal squamous cell carcinoma diagnosis), nasopharyngeal cancer (nasopharyngeal carcinoma), oral dysplasia (dysplasia of oral mucosa diagnosis), infertility (male factor infertility), infectious disease (hepatitis C infection), pregnancy outcomes (Apgar score <7, malformations, perinatal complications) and lung function (FVC, FEV_1/FVC)^{2,3}.
3. The two included systematic reviews were strong, but the quality of the individual studies included in the reviews ranged from low to very low. The exception is the data on the lung function outcome which was of moderate quality. Further high-quality research is required on the health effects of tobacco and non-tobacco waterpipes. Research evidence on the health effects from the use of, and exposure to, non-tobacco waterpipes is lacking.

¹ FEV_1 is a lung function measurement which stands for forced expiratory volume in one second.

² FVC and FEV_1/FVC are lung function measurements. FVC is forced vital capacity and FEV_1/FVC is the ratio of FEV_1 to FVC.

³ The authors reported a trend toward lower FVC and FEV_1/FVC , when in fact there was no effect.

4. According to a 2013 survey, a significant number (88,400) of Ontario students in grades 7 to 12 used a waterpipe, at least once in the past year. Canadian adult “ever use” of waterpipes is also increasing.

5. Four Ontario municipalities have banned indoor waterpipe smoking (including non-tobacco). Countries in the Middle East, where waterpipes have been traditionally used, have banned or severely restricted waterpipe use.

Executive Summary

The research question addressed is: What are the health effects for the general population of using and being exposed to tobacco and non-tobacco waterpipes?

Waterpipes and products smoked in waterpipes (tobacco and non-tobacco variety) can be purchased at retail outlets in Peel Region for personal use. On-site waterpipe smoking is currently offered at approximately 20 waterpipe establishments (restaurants and/or bars) in Peel.

The *Smoke-Free Ontario Act* (SFOA) prohibits tobacco waterpipe smoking in enclosed public places, including restaurant and bar patios. Peel Public Health has received complaints of poor indoor air quality and of tobacco waterpipes being smoked inside Peel waterpipe establishments. Tobacco inspectors face challenges enforcing the SFOA because it is difficult to determine if tobacco is being smoked in waterpipes.

While users are aware of the health hazards of waterpipe smoking, they perceive it as less harmful and less addictive than cigarette smoking (1). This review examines the health effects from the use of, and exposure to, tobacco and non-tobacco waterpipes.

The initial search was limited to English-language systematic reviews, meta-analyses and guidelines. This paper does not examine drug and alcohol use in waterpipes. One hundred and seven potentially relevant documents were found. All articles focused on the use of tobacco waterpipes and none of the papers addressed non-tobacco waterpipes. Eight articles were critically appraised. Two systematic reviews passed the detailed assessment and were included in the review. While the two included systematic reviews were strong, the quality of the individual

studies included in the reviews ranged from low to very low. The exception is the data on the lung function outcome which was of moderate quality.

The evidence indicates that waterpipe tobacco smoking is possibly associated with lung cancer (a. diagnosis and b. mortality), pregnancy outcomes (a. low-birth weight and b. newborn pulmonary problems), periodontal disease (a. periodontal bone height loss, plaque index and gingivitis, deepening of sulci or pockets, vertical periodontal bone loss and b. dry socket), respiratory illness (perennial rhinitis including nasal congestion and wheezing) and lung function (FEV_1)⁴.

The evidence indicates that waterpipe tobacco smoking is not significantly associated with bladder cancer (diagnosis), oesophageal cancer (oesophageal squamous cell carcinoma diagnosis), nasopharyngeal cancer (nasopharyngeal carcinoma), oral dysplasia (dysplasia of oral mucosa diagnosis), infertility (male factor infertility), infectious disease (hepatitis C infection), pregnancy outcomes (Apgar score <7, malformations, perinatal complications) and lung function (FVC, FEV_1/FVC)⁵.

Based on the evidence, it is recommended that Peel Public Health:

1. Develop a policy options paper on waterpipe use that outlines, evaluates and compares policy alternatives. Options may include the development of a by-law prohibiting non-tobacco waterpipe smoking in enclosed public places and workplaces, including restaurant and bar patios.

⁴ FEV_1 is a lung function measurement which stands for forced expiratory volume in one second.

⁵ FVC, and FEV_1/FVC are lung function measurements. FVC is forced vital capacity and FEV_1/FVC is the ratio of FEV_1 to FVC.

2. Conduct a literature search and analysis on the best available research evidence (single studies) on the health effects of non-tobacco waterpipe use.
3. Educate the public on the negative health effects of using a tobacco waterpipe.
4. Regularly monitor emerging research on the health effects of the use of, and exposure to, tobacco and non-tobacco waterpipes.
5. Advocate for and/or partner with key stakeholders to conduct high-quality research on the health effects of the use of, and exposure to, tobacco and non-tobacco waterpipes.
6. Express written support for Bill 45⁶, specifically the proposed amendments to the SFOA, to the Minister of Health and Long-Term Care.
7. Advocate to the Minister of Health and Long-Term Care to provide an accurate, timely, cost-effective and efficient process for health units to submit waterpipe products for laboratory analysis of tobacco content.
8. Advocate to the Minister of Health and Long-Term Care to amend the SFOA to prohibit the smoking of tobacco-like products, e.g., non-tobacco waterpipes, in all areas where the smoking of tobacco products is prohibited.
9. Advocate to the federal Minister of Health to include tobacco waterpipe products under the federal *Tobacco Act* in order to set minimum requirements for packaging and labelling.

⁶ Bill 45 is an omnibus Government of Ontario bill aimed at enhancing public health by enacting the *Healthy Menu Choices Act, 2014*, the *Electronic Cigarettes Act, 2014*, and by amending the *Smoke-Free Ontario Act*.

1 Issue

Waterpipes and products smoked in waterpipes (tobacco and non-tobacco variety) can be purchased at more than 100 retail outlets in Peel Region for personal use. On-site waterpipe smoking is currently offered at approximately 20 waterpipe establishments (restaurants and/or bars) in Peel. Based on inquiries to Peel Public Health, the number of waterpipe establishments is expected to increase.

The *Smoke-Free Ontario Act* (SFOA) prohibits the smoking of tobacco waterpipes in enclosed public places, including restaurant and bar patios. Peel Public Health has received complaints of poor indoor air quality and of tobacco waterpipes being smoked inside waterpipe establishments, despite the SFOA restrictions. Tobacco inspectors face challenges enforcing the SFOA because it is difficult to determine if tobacco is being smoked in waterpipes. Other enforcement agencies including licensing, fire and police have contacted Peel Public Health with concerns and/or questions related to the use of waterpipes in enclosed public places.

While users are aware of the health hazards of waterpipe smoking, they perceive it as less harmful and less addictive than cigarette smoking (1). This review examines the health effects from the use of, and exposure to, tobacco and non-tobacco waterpipes. The findings from this review will inform policy recommendations on waterpipe use in Peel.

2 Context

There are five main components of a waterpipe⁷; head, body, water bowl, hose and mouthpiece (see Appendix A for waterpipe diagram). The head is filled with a mixture of tobacco and/or other plant material, molasses and flavours. Charcoal is placed above, usually separated by aluminum foil, to heat the mixture. The waterpipe's body rests in the bowl filled with water. The head has holes allowing smoke to pass into the body of the pipe, where it bubbles up through the water in the bowl before being inhaled. The user inhales the smoke through the mouthpiece attached to the hose (2, 3, 4).

Mo'assel is the most common product used in waterpipes, consisting of approximately 30% tobacco and a 70% mixture of molasses, honey, glucose syrup, glycerol and essences (3). Information on the contents of non-tobacco products could not be found in the literature. Flavoured tobacco and non-tobacco products make smoking a waterpipe more attractive to youth, young adults and occasional or non-smokers (5). This paper does not examine drug and alcohol use in waterpipes.

There is no data currently available on waterpipe use by Peel residents. Canadian adult "ever use" of waterpipes increased from 4% in 2006 to 8% in 2011 (6). The 2013 Ontario Student Drug Use and Health Survey reported that 9.7% (88,400) of students in grades 7 to 12 used a waterpipe, at least once in the past year. In addition, male students (11.5%) were more likely to use waterpipes than female students (7.9%) and waterpipe use significantly increased with grade, peaking at 18.8% in grade 12 (7).

⁷ Depending on the country of origin, a waterpipe can be referred to by various names, including hookah, shisha, sheesha, narghile, goza, arghil, boory and hubble bubble (1, 4, 7). The term waterpipe will be used in this paper.

In 2012, researchers tested the air quality inside 12 Toronto waterpipe establishments. Results indicated that the air quality levels were hazardous to human health based on real-time measurement of fine particulate matter (PM_{2.5}) and ambient carbon monoxide. Levels of air nicotine were comparable to levels of air nicotine found in bars where cigarette smoking was permitted⁸, suggesting that tobacco was being smoked illegally (8).

Indoor air quality is a concern for both patrons and employees of waterpipe establishments. Legislation regarding worker safety and air quality is covered under Section 127 of the *Occupational Health and Safety Act*, Regulation 851, Part III Industrial Establishments, which states that “an industrial establishment shall be adequately ventilated by either natural or mechanical means such that the atmosphere does not endanger the health and safety of workers” (9). There are no specific requirements under the *Fire Prevention and Protection Act/Fire Code* pertaining to indoor waterpipe smoking.

The federal and provincial governments can strengthen controls on the use, packaging and/or sale of waterpipes and products used in waterpipes. On November 24, 2014, the Ontario government introduced Bill 45 – *Making Healthier Choices Act, 2014*. One of the proposed SFOA amendments contained in the Bill would broaden the inspection powers of tobacco inspectors to enable them to seize products believed to contain tobacco for laboratory testing (10). If passed this new seizure power will assist tobacco inspectors in being able to identify the type of product being smoked in a waterpipe. The Government of Ontario has not taken any action to prohibit the smoking of non-tobacco herbal products in enclosed public places. Alberta and Nova Scotia have both passed bills to prohibit the smoking of non-tobacco waterpipes in enclosed places (11, 12). Municipalities can pass by-laws to address the health, safety and well-

⁸ Recent European study that reported median air-nicotine levels in cigarette smoking venues.

being of persons. To date, four Ontario municipalities (City of Barrie, Orillia, Peterborough and the Town of Bradford West Gwillimbury) have banned tobacco and non-tobacco waterpipe smoking in enclosed public places. Other Ontario municipalities including Niagara Falls, Ottawa, St. Thomas and the Town of Englehart have prohibited tobacco and non-tobacco waterpipe smoking on outdoor municipal property (13).

In 2007, the City of Vancouver enacted a health by-law banning all indoor smoking or burning of any substance in commercial establishments. The by-law initially excluded waterpipe establishments, but was amended in 2008 to include them. The revised by-law was challenged in court and the case focused on what degree waterpipes and second-hand smoke from waterpipes constitutes a public health threat and whether the by-law infringes on the *Canadian Charter of Rights and Freedoms*. The decision in this case was to uphold the by-law (14, 15, 16).

Countries where waterpipe smoking is a traditional cultural practice are also taking action on waterpipes:

- Jordan will not renew licenses for coffee shops that serve waterpipes
- Lebanon and Syria have banned indoor smoking (including waterpipes) in restaurants and cafes
- Saudi Arabia has banned smoking (including waterpipes) in all enclosed places, and
- Turkey will not permit smoking (including waterpipes) in cafes, bars or restaurants (17).

3 Conceptual Framework

The conceptual model frames the research question and outlines the factors associated with increased waterpipe use. The conceptual model was developed with input from Region of Peel tobacco inspectors. The conceptual model is presented in Appendix B.

4 Literature Review Question

The research question addressed in this review is: What are the health effects for the general population of using and being exposed to tobacco and non-tobacco waterpipes?

PECO	
Population	Anyone smoking a waterpipe or being exposed to second-hand waterpipe smoke
Exposure	Use of, and exposure to, tobacco and non-tobacco waterpipes
Comparisons	n/a
Outcome	Health effects

5 Literature Search

A search was conducted in October 2013 using Medline, EMBASE and EBSCO databases. No date limits were put on the initial search. Due to the large number of search results, the criterion for date limits was updated twice. The search was limited to English-language systematic reviews, meta-analyses and guidelines. Grey literature sites were searched along with the reference lists of relevant systematic reviews. The full search strategy can be found in Appendices C to F.

6 Relevance Assessment

Two reviewers independently reviewed the titles and abstracts of all search results for relevance. Discrepancies were addressed through discussion and mutual agreement and/or discussions with a third party. Articles selected for critical appraisal had to meet the following criteria: (1) include anyone who smoked a waterpipe or was exposed to second-hand smoke from a waterpipe, (2) was a systematic review, meta-analyses or guideline, (3) was written in English, and (4) was published in the last ten years. Articles excluded from critical appraisal included duplicate articles and studies assessing drugs and alcohol in waterpipes.

7 Results of the Search

The search identified 107 potentially relevant documents. All articles focused on tobacco waterpipe smoking. Six articles were excluded as duplicates, leaving 101 articles for initial relevancy assessment. Based on title and abstract review, 20 articles passed initial relevancy assessment.

The criterion for full text review was changed to articles published in the last five years, which eliminated three articles. 17 articles were further assessed for relevancy based on the full text. Nine articles were eliminated because they: a) were not a systematic review, meta-analyses or guideline, b) did not address waterpipes or c) did not have a clear PECO question or methods. The remaining eight articles were critically appraised. The search results flowchart is presented in Appendix G.

8 Critical Appraisal

Two reviewers independently assessed the quality of eight articles using the Health Evidence Quality Assessment Tool. Discrepancies were addressed through discussion and mutual agreement and/or discussions with a third reviewer. Results from the assessment revealed that two systematic reviews were strong (Akl, et al. 10/10 and Raad et al. 9/10). The remaining six systematic reviews were weak with five papers scoring 0/10 and one paper scoring 2/10. Based on the quality assessment scores, only the two strong articles were included in this review.

9 Description of Included Studies

While the two included systematic reviews were strong, the quality of the individual studies included in the reviews ranged from low to very low. The exception was the studies assessing the lung function outcome which were of moderate quality. Limitations in study methodologies for lung function included:

- not distinguishing passive smokers from non-smokers for exposure to waterpipe or cigarette smoking
- not reporting the use of a standardized exposure assessment tool
- only one study mentioned handling of confounding factors
- only one study reported blinding of the outcome adjudicator, and
- only one study reported percentages of participation and complete data (1,18).

Limitations in study methodologies for the other health outcomes included factors such as no standardized measurement tool to account for variables in waterpipe smoking such as the quantity and type of tobacco smoked, use of other substances, frequency and length of waterpipe

smoking sessions and number of years smoked. No study reported using a standardized measurement tool for other forms of tobacco smoking. The type of tobacco used in waterpipes in India and China is typically unprocessed and heated directly by coal, as opposed to the more widespread use of processed tobacco and indirect heat. There was inappropriate handling of confounding, no study reported tests for interactions between waterpipe and cigarette smoking and only two studies reported blinding of outcome adjudicator. In 12 of the 23 studies, controls were selected from the same study base as cases (1, 18). Data extraction tables for the two systematic reviews can be found in Appendix H .

Akl, E.A., Gaddam, S., Gunukula, S.K., Honeine, R., Jaoude, P.A. and J. Irani. (2010) The Effects of Waterpipe Tobacco Smoking on Health Outcomes: A Systematic Review.

The paper included 23 studies and systematically reviewed the medical literature for the effects of waterpipe tobacco smoking on ten health outcomes including lung cancer, bladder cancer, oesophageal cancer, nasopharyngeal cancer, oral dysplasia, pregnancy outcomes, periodontal disease, respiratory illness, infertility and infectious disease. Case-control, retrospective cohort, cross sectional and cohort studies were included from China, India, Tunisia, Egypt, Iran, Algeria, Tunisia, Morocco, Yemen, Beirut, Lebanon and Saudi Arabia. Exposure varied and often included multiple sources such as waterpipe, cigarette, bidi, nass chewing, opium, snuff, cannabis and hashish. Thirteen of the 23 studies did not report exposure levels.

Raad, D., Gaddam, S., Schunemann, H.J., Irani, J., Jaoude, P.A., Honeine, R. and E.A. Akl. (2011). Effects of Water-Pipe Smoking on Lung Function.

The paper included six cross-sectional studies and systematically reviewed the effects of waterpipe tobacco smoking on lung function. The paper also compared the effects of waterpipe smoking and cigarette smoking on lung function. The studies were conducted in Turkey, Kuwait, Saudi Arabia and Syria. Waterpipe smokers, cigarette smokers, non-smokers and passive smokers were included in the study. Exposure type included waterpipes and cigarettes. This rapid review only reviewed the results of waterpipe tobacco smoking on lung function.

10 Synthesis of Findings

Health Outcomes Possibly Associated with Waterpipe Tobacco Smoking

The evidence indicates that **waterpipe tobacco smoking is possibly associated with** lung cancer (a. diagnosis and b. mortality), pregnancy outcomes (a. low-birth weight and b. newborn pulmonary problems), periodontal disease (a. periodontal bone height loss, plaque index and gingivitis, deepening of sulci or pockets, vertical periodontal bone loss and b. dry socket), respiratory illness (perennial rhinitis including nasal congestion and wheezing) and lung function (FEV₁)⁹.

Lung Cancer (Diagnosis)

Five case-control studies from China, India and Tunisia assessed lung cancer (diagnosis). The majority of populations studied were males aged 35 to 80. The pooled odds ratio (OR) for association of waterpipe tobacco smoking with lung cancer diagnosis was 2.12 (95% confidence interval (CI) 1.32 - 3.42). A sensitivity analysis was conducted for the one study with no major methodological limitations and the OR was 3.0 (95% CI 1.2 - 7.6). Two studies reported a statistically significant dose-response relationship for the total amount of exposure and duration of exposure (OR 3.4, 95% CI (1.3 - 8.1) by quarter of pipe-years; statistically significant increasing trend with increased duration of use).

Limitations in study methodologies included:

⁹ FEV₁ is a lung function measurement which stands for forced expiratory volume in one second.

- four of five studies did not appropriately deal with confounding factors
- tobacco typically used in China and India is unprocessed and burned directly by charcoal
- blinding of outcome adjudicator not reported
- none of the studies used a standardized measurement tool, and
- participation rate was not reported (1).

Lung Cancer (Mortality)

One retrospective cohort study from China assessed lung cancer (mortality) in males. The calculated crude relative risk (RR) for association with lung cancer mortality was 4.39 (95% CI 3.82 - 5.04). The study limitations included:

- no adjustment of confounding
- tobacco typically used in China and India is unprocessed and burned directly by charcoal
- no standardized exposure measurement, and
- participation rate not reported (1).

Pregnancy Outcome (Low-Birth Weight)

Two retrospective cohort studies and one case-control from Lebanon and Iran assessed low-birth weight. The pooled OR for association of waterpipe tobacco smoking with low-birth weight was 2.12 (95% CI 1.08 - 4.18). The study limitations included no standardized exposure measurement, no adjustment for confounding and no participation rate was reported (1).

Pregnancy Outcome (Newborn Pulmonary Problems)¹⁰

One retrospective cohort study from Lebanon assessed newborn pulmonary problems. The mean age of the pregnant women ranged from 27.6 to 29.1. The pooled OR for association of waterpipe tobacco smoking with newborn pulmonary problems was 3.65 (95% CI 1.52 - 8.75). The study limitations included no standardized exposure measurement, no adjustment for confounding, no participation rate and no blinding of outcome adjudicator was reported (1).

Periodontal Disease (Dry Socket)

One cohort study assessed dry socket in Egyptian male waterpipe smokers, cigarette smokers and non-smokers. The reported RR with dry socket was 3.7 (P=0.001). There was a statistically significant dose relationship for total amount of exposure. Study limitations included:

- no matching or adjustment of confounding factors
- no standardized exposure measurement
- participation rate not reported
- no blinding of outcome adjudicator, and
- only healthy patients not taking medications were included in the study (1).

Periodontal Disease (Periodontal Bone Height Loss, Plaque Index and Gingivitis, Deepening of Sulci or Pockets, Vertical Periodontal Bone Loss)

Four cross-sectional studies from Saudi Arabia evaluated periodontal disease using different outcome measurements (periodontal disease was measured as: periodontal bone height loss,

¹⁰ The author did not include newborn pulmonary problems in the list of health outcomes that are possibly associated with waterpipe tobacco smoking. As the results show a significant association, we have chosen to include newborn pulmonary problems in this list and the final results.

plaque index and gingivitis, deepening of sulci or pockets, vertical periodontal bone loss).

Studies consistently showed a statistically significant association between waterpipe tobacco smoking and periodontal disease (OR range of 3 to 5). Results were not pooled, as the data were obtained from the same (or in a subgroup of the same) group of participants. Three studies adjusted for confounding (age and dental care habit) and two studies reported blinding of outcome adjudicator. Two studies found a statistically significant dose relationship in terms of total amount of exposure (1).

Respiratory Illness (Perennial Rhinitis including Nasal Congestion and Wheezing)

One cross-sectional study assessed respiratory illness, defined as perennial rhinitis including nasal congestion and wheezing in primary school students aged 10 to 15 years old from Beirut.

The OR compared with no exposure at home was:

- 2.3 (95% CI 1.1 - 5.1) for waterpipe-only exposure
- 2.5 (95% CI 1.6 - 3.8) for waterpipe and/or cigarette exposure.

Study limitations included no matching or adjusting for confounding, no standardized exposure measurement, no blinding of outcome adjudicator and participation rate was not reported (1).

Lung Function (FEV₁)

Six cross-sectional studies from Turkey, Kuwait, Saudi Arabia and Syria assessed lung function.

Compared with no smoking, waterpipe smoking was associated with lower FEV₁ (Standard Mean Difference (SMD) = -0.43; 95% CI -0.58 to -0.29; equivalent to a 4.04% lower FEV₁ or

a moderate effect size¹¹). In a sensitivity analysis excluding passive smokers, the results remained significant for FEV₁. The association between waterpipe smoking and reduction of FEV₁ is statistically significant and of clinical relevance. The minimal important difference for FEV₁ is in the range of 100 to 140 mL. The mean difference in the study was approximately 4%, which is around 170 mL for a 40-year-old white man of 180 cm height. For study limitations, see Description of Included Studies section (18).

Health Outcomes Not Significantly Associated with Waterpipe Tobacco Smoking

The evidence indicates that **waterpipe tobacco smoking is not significantly associated with** bladder cancer (diagnosis), oesophageal cancer (oesophageal squamous cell carcinoma diagnosis), nasopharyngeal cancer (nasopharyngeal carcinoma), oral dysplasia (dysplasia of oral mucosa diagnosis), infertility (male factor infertility), infectious disease (hepatitis C infection) and pregnancy outcomes (Apgar score <7, malformations, perinatal complications). There was no effect on FVC or on FEV₁/FVC^{12,13}. Detailed data synthesis tables can be found in Appendix I.

Bladder Cancer (Diagnosis)

One case-control study from Egypt assessed bladder cancer (diagnosis) in males aged 31 to 74, admitted with invasive bladder cancer. Waterpipe smoking was not significantly associated with bladder cancer. The study reported a potential protective association between waterpipe tobacco

¹¹ Cohen's Criteria general definitions for interpreting effect size estimates states that 0.5, as a rule of thumb, is a moderate effect size (19).

¹² FVC and FEV₁/FVC are lung function measurements. FVC is forced vital capacity and FEV₁/FVC is the ratio of FEV₁ to FVC.

¹³ The authors reported a trend toward lower FVC and FEV₁/FVC, when in fact there was no effect.

smoking and bladder cancer diagnosis OR 0.8 (95% CI 0.2 - 4.0). The study adjusted for age, education, type of housing, history of schistosomiasis, high-risk occupations and tobacco smoking. Participation rate was >95% and blinding of outcome adjudicator not reported. Study limitations included no standardized exposure measurement (1).

Oesophageal Cancer (Oesophageal Squamous Cell Carcinoma Diagnosis)

One case-control study from Iran assessed oesophageal cancer (oesophageal squamous cell carcinoma diagnosis). The median exposure level was 32 waterpipe-years. The OR for the association of waterpipe smoking with oesophageal cancer diagnosis was 1.85 (95% CI 0.95 - 3.58). The OR for waterpipe smoking only with oesophageal cancer diagnosis was 1.69 (95% CI 0.76 - 3.77). The study reported a statistically significant dose response relationship for intensity of use (P=0.03), but not for duration, total amount, or age started. The study used standardized exposure measurement and matched for age, sex, residence and adjusted for education, ethnicity, other types of tobacco use and total intake of fruits and vegetables. The participation rate and blinding of outcome adjudicator was not reported (1).

Nasopharyngeal Cancer (Nasopharyngeal Carcinoma)

One case-control study from Algeria, Morocco and Tunisia assessed nasopharyngeal cancer (nasopharyngeal carcinoma). The study reported an OR for association between waterpipe tobacco smoking and nasopharyngeal cancer of 0.49 (95% CI 0.20 - 1.23). The study matched for hospital, age, sex, household type (urban/rural) and adjusted for age, but not other types of smoking. No standardized exposure measurement was used and participation rate was >90% (1).

Oral Dysplasia (Dysplasia of Oral Mucosa Diagnosis)

One cross-sectional study from Yemen assessed oral dysplasia (dysplasia of oral mucosa diagnosis) in 33 Yemeni volunteers (27 men and 6 women) aged 22 to 58 (mean age was 38.5).

The study reported an OR for association of waterpipe tobacco smoking with dysplasia of the oral mucosa on the chewing side to be 8.33 (95% CI 0.78 - 9.47). The study recruited exclusively individuals who chewed takhzeen al-qat, a green-leaved plant with a stimulant effect. Study limitations included:

- no matching or adjustment of confounding
- volunteer recruitment of study participants
- no standardized exposure measurement, and
- analysis was stratified by chewing side (1).

Infertility (Male Factor Infertility)

One case-control study from Egypt assessed infertility (male factor) among lower to lower middle class males aged 15 to 45 who had been diagnosed with male factor infertility. The OR compared with never smoking was 2.5 (95% CI 1.0 - 6.3). The study matched for age, socio-economic class and adjusted for cigarette smoking, tea drinking, marital duration, husband's age and education. The participation rate was >98%, no standardized exposure measurement was used and blinding of outcome adjudicator was not reported (1).

Infectious Disease (Hepatitis C Infection)

Three cross-sectional studies from Egypt assessed infectious disease (hepatitis C infection) among male village inhabitants. The pooled OR for association of group waterpipe tobacco and hepatitis C was 0.98 (95% CI 0.80 – 1.21). The study did not use a standardized exposure measurement and blinding of outcome adjudicator was not reported. The study identified two reports of outbreak investigations that suggested an association between tuberculosis and sharing tobacco and marijuana waterpipes (1).

Pregnancy Outcomes (Apgar score <7, Malformations, Perinatal Complications)

One retrospective cohort study from Lebanon assessed pregnancy outcomes (Apgar score <7, malformations, perinatal complications). The mean age of the pregnant women ranged from 27.6 to 29.1. The associations were not significant for Apgar scores at one and five minutes, malformations or perinatal complications. The study limitations include no standardized exposure measurement, no adjustment for confounding, no participation rate and no blinding of outcome adjudicator was reported (1).

Lung Function (FVC, FEV₁ /FVC)

Six cross-sectional studies from Turkey, Kuwait, Saudi Arabia and Syria assessed lung function. Compared with no smoking, the SMD for FVC was -0.15; 95% CI -0.34 to 0.04; equivalent to a 1.38% reduction in FVC% for waterpipe users. The pooled SMD in the sensitivity analysis was -0.19 (95% CI -0.40 – 0.01). The SMD for FEV₁/FVC was -0.46; 95% CI -0.93 to 0.01; equivalent to a 3.08% lower FEV₁/FVC in waterpipe smokers compared to non-smokers. The

pooled mean difference in the sensitivity analysis was -0.51 (95% CI -1.06 - 0.05) (18). For study limitations, see Description of Included Studies section.

11 Applicability and Transferability

A meeting was held on July 28, 2014 to discuss the applicability and transferability of the research. Lori Greco facilitated the session and staff from the Office of the Medical Officer of Health, Environmental Health and Chronic Disease and Injury Prevention divisions attended. Highlights from the discussion are provided below; refer to Appendix J for further details.

Applicability (feasibility)

Political Acceptability or Leverage

- Living Tobacco-Free is a priority under the Public Health Strategic Plan and is expected to be a Term of Council Priority in 2015.
- To date, Regional Council has been supportive of smoke-free policy development. There is a need to maintain momentum on smoking issues with the new Regional Council that was elected in the fall of 2014.
- There is broad public support for smoke-free restaurants and patios.
- More than half the smokers in Peel Region are trying to quit. Smoking cessation research indicates that smoke-free environments help individuals to quit smoking.

Social Acceptability

- Given Peel's diverse population, certain ethno-cultural groups may not support action on waterpipes. However, in countries where waterpipes have been traditionally used such as Syria, Lebanon and Jordan, bans/by-laws have been introduced on waterpipe use.
- There is no age restriction on the purchase of non-tobacco waterpipe products or waterpipe apparatus.
- There is no minimum age requirement to enter a waterpipe establishment. Peel Public Health has received complaints of children dining in waterpipe establishments.
- An education campaign on the health risks of waterpipe use would be accepted by the public. The campaign could include messaging on how the current legislation applies to waterpipe establishments and to remind the public to make complaints regarding waterpipe establishments to Peel Public Health. Complaints expressing dissatisfaction with the status quo can be an impetus for policy development.
- There is public support for smoke-free dining establishments and work places.

Available Essential Resources (personnel and financial)

- There are 14 FTEs dedicated to tobacco control within Peel Public Health.
- To ensure there are enough resources, tobacco activities need to be prioritized.
- A possible outcome is to increase inspections of waterpipe establishments to monitor for compliance with the SFOA. Where warranted, Peel Public Health could conduct joint inspections with other enforcement agencies such as municipal licensing and the Ministry of Revenue.

- There is a need to partner with other organizations/stakeholders on various policy options (e.g. advocacy, OTRU and testing of products, etc.).

Organizational Expertise and Capacity

- Circulate the rapid review to other health units, municipalities and other organizations affected or interested in waterpipes.
- There is a need to advocate for amendments to the SFOA to strengthen TEOs ability to enforce the legislation.
- The waterpipe issue needs to be linked to other tobacco priorities such as multi-unit dwellings (MUDs) and patios.

Transferability (generalizability)

Magnitude of Health Issue in Local Setting

- The extent of the waterpipe issue in Peel is unknown.
- The geographical settings in the research are very different than Peel.
- Waterpipes are a small issue among the other tobacco priorities.

Magnitude of the “Reach” and Cost Effectiveness of the Intervention

- An education campaign can complement a by-law and/or other policy options.

Target Population Characteristics

- Study populations are not comparable to Peel’s population. Studies primarily focused on areas of the Middle East where waterpipe smoking is part of the culture.
- Majority of studies focused on male waterpipe smokers.
- Exposure in studies is not comparable to Peel.

12 Recommendations

1. Develop a policy options paper on waterpipe use that outlines, evaluates and compares policy alternatives. Options may include the development of a by-law prohibiting non-tobacco waterpipe smoking in enclosed public places and workplaces, including restaurant and bar patios.
2. Conduct a literature search and analysis on the best available research evidence (single studies) on the health effects of non-tobacco waterpipe use.
3. Educate the public on the negative health effects of using a tobacco waterpipe.
4. Regularly monitor emerging research on the health effects of the use of, and exposure to, tobacco and non-tobacco waterpipes.
5. Advocate for and/or partner with key stakeholders to conduct high-quality research on the health effects of the use of, and exposure to, tobacco and non-tobacco waterpipes.
6. Express written support for Bill 45¹⁴, specifically the proposed amendments to the SFOA, to the Minister of Health and Long-Term Care.

¹⁴ Bill 45 is an omnibus Government of Ontario bill aimed at enhancing public health by enacting the *Healthy Menu Choices Act, 2014*, and the *Electronic Cigarettes Act, 2014*, and by amending the *Smoke-Free Ontario Act*.

7. Advocate to the Minister of Health and Long-Term Care to provide an accurate, timely, cost-effective and efficient process for health units to submit waterpipe products for laboratory analysis of tobacco content.
8. Advocate to the Minister of Health and Long-Term Care to amend the SFOA to prohibit the smoking of tobacco-like products, e.g., non-tobacco waterpipes, in all areas where the smoking of tobacco products is prohibited.
9. Advocate to the federal Minister of Health to include tobacco waterpipe products under the federal Tobacco Act in order to set minimum requirements for packaging and labelling.

References

- (1) Akl, E.A., Jawad, M., Lam, W.Y., Co, C.N., Obeid, R. and Irani, J. (2013). Motives, beliefs and attitudes towards waterpipe smoking: a systematic review. *Harm Reduction Journal*. 10:12. Doi: 10.1186/1477-7517-10-12.
- (2) Akl, E. A., Gaddam, S., Gunukula, S. K., Honeine, R., Jaoude, P. A. and Irani, J. (2010). The effects of waterpipe tobacco smoking on health outcomes: A systematic review. *International Journal of Epidemiology*, 39(3), 834-857.
- (3) Chaouachi, K. (2009). Hookah (Shisha, Narghile) smoking and environmental tobacco smoke (ETS). A critical review of the relevant literature and the public health consequences. *International Journal of Environmental Research and Public Health*, 6, 798-843. doi:10.3390/ijerph6020798.
- (4) Jawad, M., McEwen, A., McNeill, A. and Shahab, L. (2013). To what extent should waterpipe tobacco smoking become a public health priority? *Addiction*, 108(11), 1873-1884. doi:10.1111/add.12265.
- (5) Ontario Tobacco Research Unit. (2013). Prohibitions/Restrictions on Flavoured Tobacco Products: Monitoring Update, *OTRU Update 2013*. <http://otru.org/wp-content/uploads/2013/10/flavours2013.pdf>.
- (6) Health Canada. (2012). *Canadian Tobacco Use Monitoring Study: Summary of Annual Results for 2012*. http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/ctums-esutc_2012/ann_summary-sommaire-eng.php.

- (7) Boak, A., Hamilton, H.A., Adlaf, E.M. and Mann, R.E. (2013). Drug use among Ontario students, 1977-2013: Detailed OSDUHS findings (*CAMH Research Document Series No. 36*). Toronto, ON: Centre for Addiction and Mental Health.
- (8) Zhang, B., Haji, F., Kaufman, P., Muir, S. and Ferrence, R. (2013). Enter at your own risk: A multimethod study of air quality and biological measures in Canadian waterpipe cafes. *Tobacco Control*. doi: 10.1136/tobaccocontrol-2013-051180 [Epub ahead of print].
- (9) Ministry of Labour. (1990). *Occupational Health and Safety Act*. Regulation 851, Industrial Establishments, Part III Industrial Hygiene. http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900851_e.htm.
- (10) Ministry of Health and Long-Term Care. (2014). *Bill 45, Making Healthier Choices Act, 2014*. http://www.ontla.on.ca/web/bills/bills_detail.do?BillID=3080.
- (11) Email from Alberta Connects. (August 5, 2014). *Re: Waterpipe Smoking – Bill 33 An Act to Amend the Tobacco Reduction Act (ACR – 358001)*.
- (12) Nova Scotia Legislature. (November 20, 2014). *Bill No. 60: An Act to Amend Chapter 12 of the Acts of 2002, the Smoke-free Places Act, and Chapter 14 of the Acts of 1993, the Tobacco Access Act*.
- (13) Email from Ontario Tobacco Research Network (OTRU-NET). (April 10, 2014). *List of Canadian municipalities banning water pipe smoking in restaurants, cafes and bars*.
- (14) Email from Christina Tonella, Regional Manager, Tobacco Reduction at Vancouver Coastal Health. (August 8 and 13, 2014). *Question on Waterpipe (Hookah/Shisha) Smoking*.

- (15) City of Vancouver v. Abdolabbas Abdiannia. (August 11, 2014). Provincial Court British Columbia.
- (16) City of Vancouver. (May 13, 2014). *Health By-Law No. 9535*. <http://vancouver.ca/your-government/health-by-law.aspx>.
- (17) Perley, M., Ontario Campaign for Action on Tobacco. (March 24, 2014). *Deputation to the Toronto Board of Health - Addressing indoor waterpipe smoking*.
- (18) Raad, D., Gaddam, S., Schunemann, H. J., Irani, J., Abou Jaoude, P., Honeine, R. and Akl, E.A. (2011). Effects of water-pipe smoking on lung function: A systematic review and meta-analysis. *Chest*, 139(4), 764-774.
- (19) Schünemann, H.J., Oxman, A.D., Vist, G.E., Higgins, J. PT., Deeks, J.J., Glasziou, P. and Guyatt, G.H. on behalf of the Cochrane Applicability and Recommendations Methods Group. (2011). *Cochrane Handbook for Systematic Reviews of Interventions, version 5.10, Chapter 12: Interpreting results and drawing conclusions*. Accessed at <http://handbook.cochrane.org/> on July 7, 2014.

Appendices

Appendix A – Waterpipe Diagram

Appendix B – Conceptual Model

Appendix C – Medline Search Strategy

Appendix D – EMBASE Search Strategy

Appendix E – EBSCO Search Strategy

Appendix F – Grey Literature Search Strategy

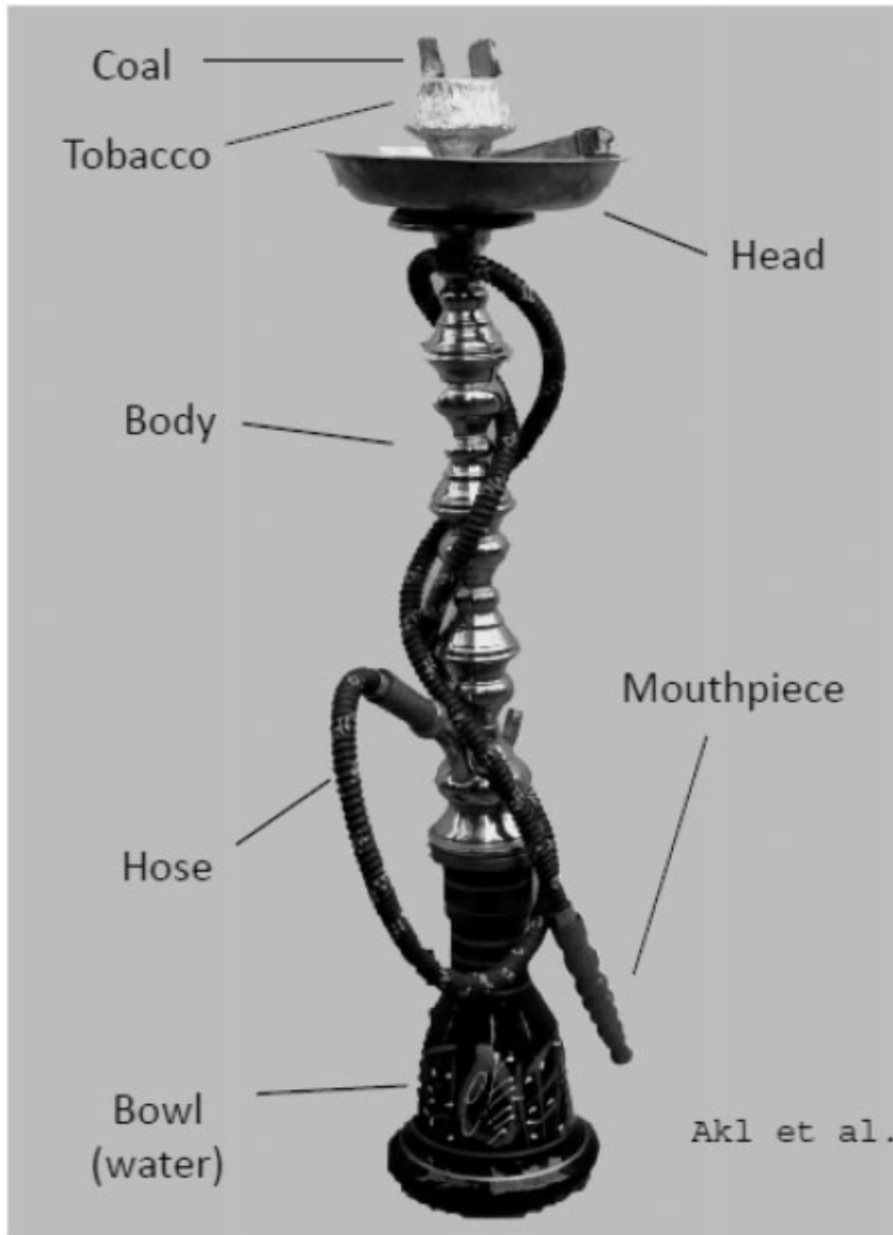
Appendix G – Literature Search Flowchart

Appendix H – Data Extraction Tables

Appendix I – Data Synthesis

Appendix J – Applicability and Transferability

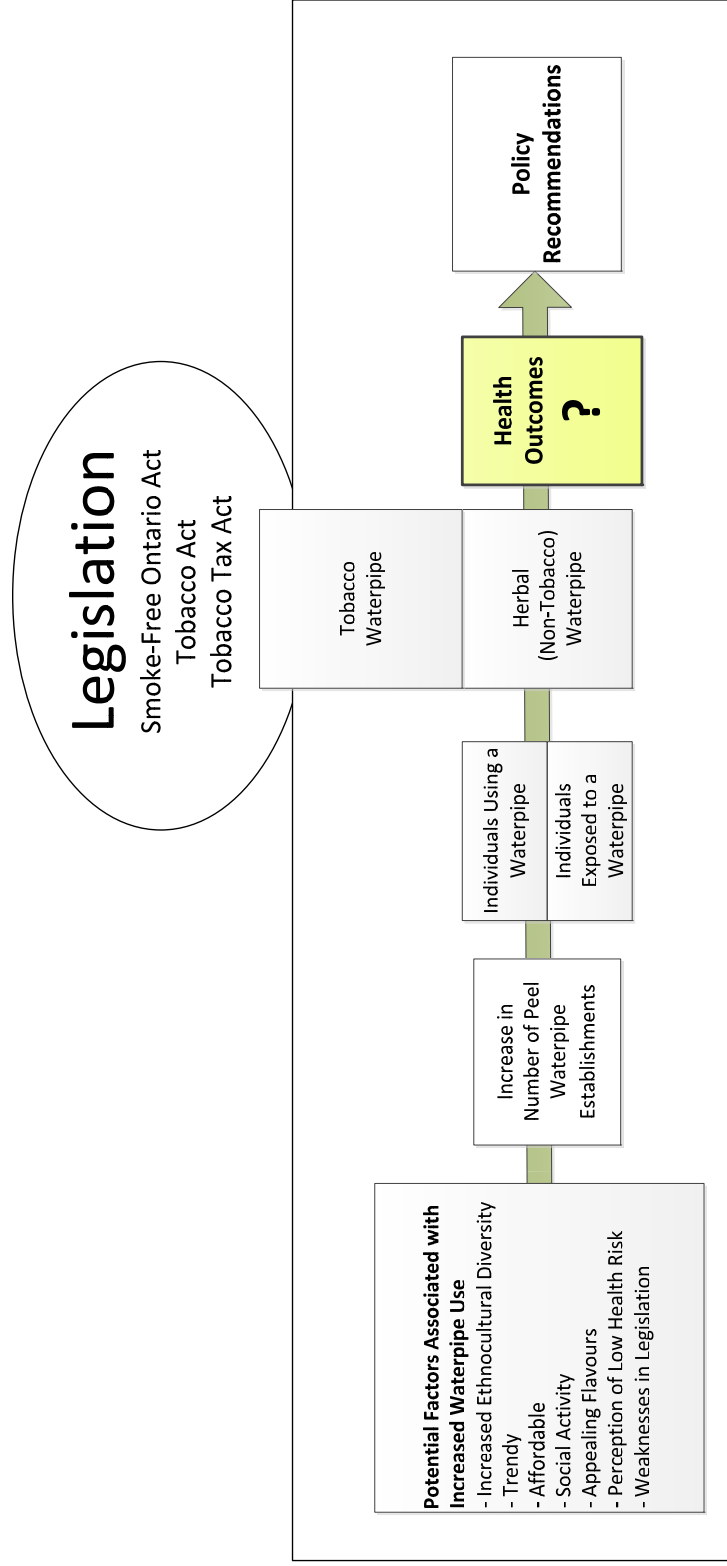
Appendix A: Waterpipe Diagram



- (2) Akl, E. A., Gaddam, S., Gunukula, S. K., Honeine, R., Jaoude, P. A., & Irani, J. (2010). The effects of waterpipe tobacco smoking on health outcomes: A systematic review. *International Journal of Epidemiology*, 39(3), 834-857.

Appendix B: Conceptual Model

What are the health effects from the use of, and exposure to, tobacco and non-tobacco waterpipes?



¹ TEO – Tobacco Enforcement Officer

Appendix C: Medline Search Strategy

Database: EBM Reviews - Cochrane Database of Systematic Reviews <2005 to September 2013>, EBM Reviews - ACP Journal Club <1991 to October 2013>, EBM Reviews - Database of Abstracts of Reviews of Effects <3rd Quarter 2013>, EBM Reviews - Cochrane Central Register of Controlled Trials <September 2013>, EBM Reviews - Cochrane Methodology Register <3rd Quarter 2012>, EBM Reviews - Health Technology Assessment <3rd Quarter 2013>, EBM Reviews - NHS Economic Evaluation Database <3rd Quarter 2013>, Global Health <1973 to 2013 Week 42>, Ovid MEDLINE(R) <1946 to October Week 4 2013>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <October 30, 2013>

Search Strategy:

-
- 1 exp Smoking/ae [Adverse Effects] (36472)
 - 2 (arguileh or narghil or narghile or arghil or arghileh or argil).ti,ab. (152)
 - 3 (waterpipe or water-pipe or "waterpipe").ti,ab. (704)
 - 4 (hookah or hukka or guza or goza).ti,ab. (302)
 - 5 (shisha or sheesha).ti,ab. (179)
 - 6 (tumbak or jurak or ajami).ti,ab. (21)
 - 7 1 and 3 (124)
 - 8 (moassel or mo'assel or muessel or mu'essel or maasel).ti,ab. (9)
 - 9 "hubble bubble".ti,ab. (32)
 - 10 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 (1057)
 - 11 meta-analysis.mp,pt. (115719)

- 12 systematic review.tw. (85747)
- 13 cochrane database of systematic reviews.jn. (26571)
- 14 11 or 12 or 13 (174061)
- 15 exp guideline/ (42965)
- 16 (practice guideline or guideline).pt. (25288)
- 17 15 or 16 (42995)
- 18 14 or 17 (216066)
- 19 (comment or letter or editorial or note or erratum or short survey or news or newspaper article or patient education handout or case report or historical article).pt. (1771822)
- 20 18 not 19 (209409)
- 21 10 and 20 (17)
- 22 remove duplicates from 21 (11)

Appendix D: Embase Search Strategy

Database: Embase <1980 to 2013 Week 44>

Search Strategy:

-
- 1 exp smoking/ (177267)
 - 2 (arguileh or narghil or narghile or arghil or arghileh or argil).ti,ab. (120)
 - 3 (waterpipe or water-pipe or "waterpipe").ti,ab. (508)
 - 4 (hookah or hukka or guza or goza).ti,ab. (228)
 - 5 (shisha or sheesha).ti,ab. (133)
 - 6 (tumbak or gurak or ajami).ti,ab. (7)
 - 7 (moassel or mo'assel or muessel or mu'essel or maasel).ti,ab. (5)
 - 8 "hubble bubble".ti,ab. (34)
 - 9 2 or 3 or 4 or 5 or 6 or 7 or 8 (785)
 - 10 (meta-analysis or systematic review or review).ti,ab. (1089483)
 - 11 9 and 10 (43)

Appendix E: EBSCO Search Strategy

#	Query	Limiters/Expanders	Last Run Via	Results
S11	S9 AND S10	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	86
S10	TI (review or systematic review or meta-analysis) OR AB (review or systematic review or meta-analysis)	Limiters - Scholarly (Peer Reviewed) Journals Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	1,975,751
S9	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7	Limiters - Scholarly (Peer Reviewed) Journals Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	998
S8	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	1,364
S7	TI "hubble bubble" OR AB "hubble bubble"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	33
S6	TI (moassel or mo'assel or muessel or mu'essel or maasel) OR AB (moassel or	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	10

	mo'assel or muessel or mu'essel or maasel)			
S5	TI (tumbak or jurak or ajami) OR AB (tumbak or jurak or ajami)	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	170
S4	TI (shisha or sheesha) OR AB (shisha or sheesha)	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	144
S3	TI (hookah or hukka or guza or goza) OR AB (hookah or hukka or guza or goza)	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	464
S2	TI (arguileh or narghil or narghile or arghil or arghileh or argil) OR AB (arguileh or narghil or narghile or arghil or arghileh or argil)	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	123
S1	TI (waterpipe or water-pipe or "waterpipe") OR AB (waterpipe or water-pipe or "waterpipe") AND TX smok*	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - Academic Search Premier;CINAHL Plus with Full Text;Environment Complete	681

Appendix F: Grey Literature Search Strategy Results

In February and November 2013 a grey literature search was conducted by Peel Public Health librarians on the sites listed below. Public Health Ontario also conducted a grey literature search which was reviewed.

PICOT/Search Strategy	Hookah OR shisha OR waterpipe OR narghile OR argileh OR goza OR guza OR hubble-bubble
------------------------------	---

Resource	
WHO	
Page Title	Location
Advisory note waterpipe tobacco smoking: health effects, research needs and recommended actions by regulators	http://www.who.int/tobacco/publications/prod_regulation/waterpipe/en/
Tobacco use in shisha: studies on waterpipe smoking in Egypt	http://www.emro.who.int/tobacco/publications/waterpipe-tobacco-smoking.html

Resource	
CDC	
Page Title	Location
Opportunities for Policy Interventions to Reduce Youth Hookah Smoking in the United States	http://www.cdc.gov/pcd/issues/2012/12_0082.htm
CDC – Fact sheet - Hookahs	http://www.cdc.gov/tobacco/data_statistics/fact_sheets/tobacco_industry/hookahs/index.htm

Resource	
Google Scholar	
Page Title	Location
US Health Policy Related to Hookah Tobacco Smoking	http://www.primack.net/professional/articles/r048ajph2012.pdf
The hookah series part 1: total metal analysis in hookah tobacco (narghile, shisha) – an initial study	http://pubs.rsc.org/en/content/articlelanding/2012/ay/c2ay26065d

Resource	
WHO	

Page Title	Location
Waterpipe smoking in Kuwait	http://applications.emro.who.int/emhj/v16/11/16_11_2010_1115_1120.pdf
Tobacco-free cities for smoke-free air: a case study in Mecca and Medina	http://www.who.int/kobe_centre/interventions/smoke_free/mecca_medina_web_final.pdf
Only the first 40 results were searched.	

Resource	
NICE	
Page Title	Location
Open wide project: raising awareness of the risks of smokeless tobacco and shisha pipe smoking and the signs and symptoms of mouth cancer.	http://www.nice.org.uk/usingguidance/sharedlearningimplementingnicguidance/examplesofimplementation/eximpresults.jsp?o=664

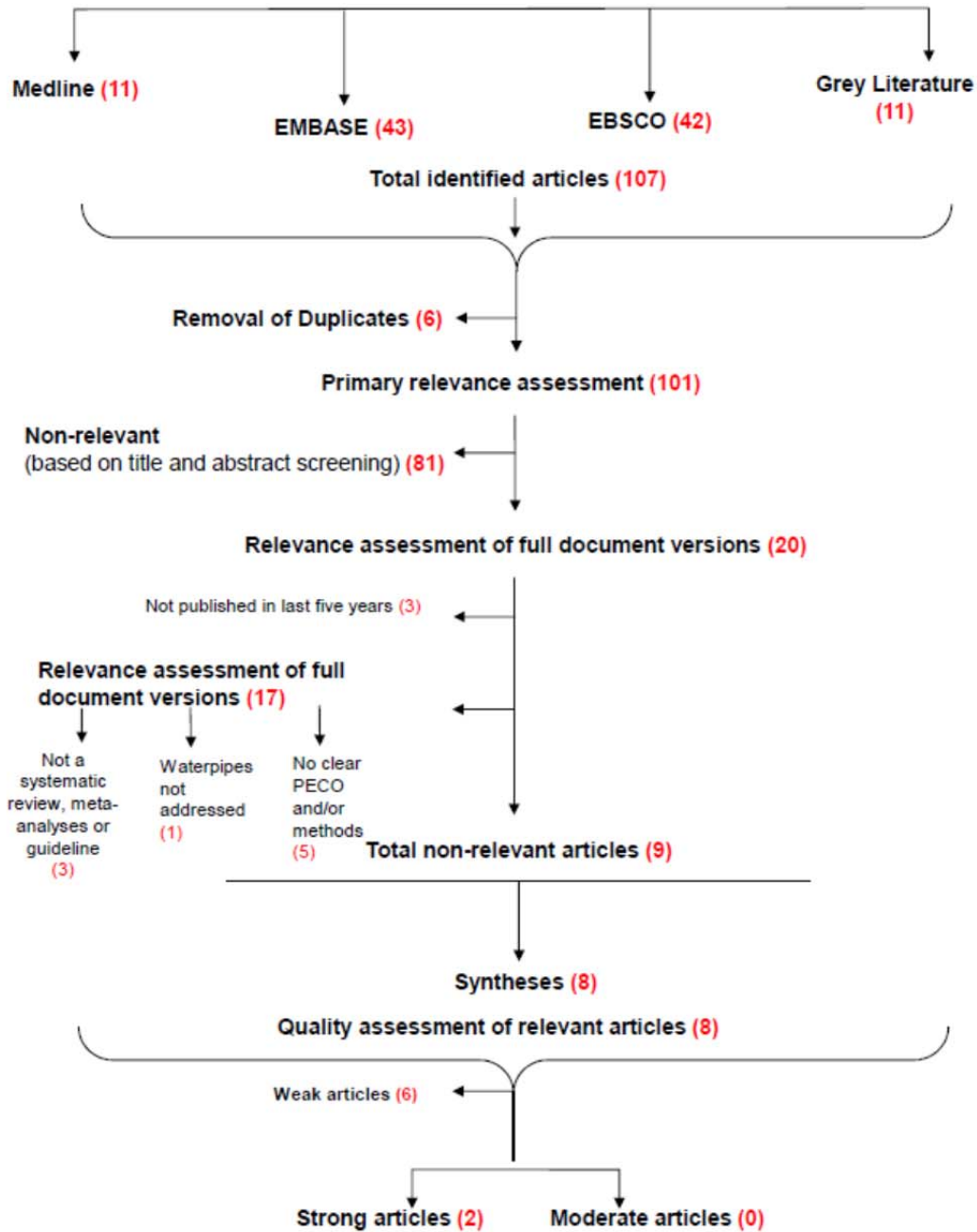
Resource	
Duck Duck Go	
Page Title	Location
Shisha Facts: A regularly updated review of waterpipe tobacco smoking	http://shishafacts.com/
Waterpipe Smoking: a Growing health Concern	http://otru.org/wp-content/uploads/2012/06/update_jan2011.pdf

Websites Searched:

National Guideline Clearinghouse http://www.guideline.gov/index.aspx	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Registered Nurses Association of Ontario http://rnao.ca/bpg	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
World Health Organization (WHO) http://www.who.int/en/	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
National Institute for Health and Clinical Excellence (NICE) http://www.nice.org.uk/	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
CDC – The community Guide http://www.thecommunityguide.org/index.html	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
The TRIP database http://www.tripdatabase.com/	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Public Health Agency of Canada http://www.phac-aspc.gc.ca/index-eng.php	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Health Evidence http://health-evidence.ca/ <i>1 result, also found in OVID database search</i>	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Google Scholar (only the first 5 pages, limited to current year)	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
DuckDuckGo	N/A <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>

http://duckduckgo.com/?t=&kl=ca-en (only the first 20 returns)	
Guideline Advisory Committee http://www.gacguidelines.ca/index.cfm?pagePath=GAC_Endorsed_Guidelines&id=21080	N/A <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Center for Reviews and Dissemination http://www.crd.york.ac.uk/CRDWeb/	N/A <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
EPPI http://eppi.ioe.ac.uk/cms/Default.aspx?tabid=53	N/A <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
NCCMT (National Collaborating Centre for Methods and Tools) Public Health portal http://www.nccmt.ca/public_health_plus/all/1/list-eng.html	N/A <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
The Campbell Collaboration http://www.campbellcollaboration.org/	N/A <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Guideline Advisory Committee http://www.gacguidelines.ca/index.cfm?pagePath=GAC_Endorsed_Guidelines&id=21080	N/A <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>

Appendix G: Literature Search Flowchart



Adapted from: healthevidence.org Keeping Track of Search Results: A Flowchart. [Retrieved January 13, 2010] Version 2013 October

Appendix H: Data Extraction Tables

Item Reviewed	Review #1 (Akl, et al)
General Information and Quality Rating	
1. Author, Year, Title	Akl, E.A., Gaddam, S., Gunukula, S.K., Honeine, R., Jaoude, P.A. and J. Irani. 2010. The Effects of Waterpipe Tobacco Smoking on Health Outcomes: A Systematic Review
3. Quality Rating	High (10/10) - rated using Health Evidence Quality Assessment Tool
4. Objectives of Review	To systematically review the medical literature for the effects of waterpipe tobacco smoking on health outcomes.
Search Strategy	
5. Number of Primary Studies	N = 23 - 10 studies (11 analyses) included in the meta-analyses
6. Types of Studies Included	Case-control, retrospective cohort, cross-sectional and cohort study
7. Databases Searched and Years Searched	MEDLINE (1950 – June 2008), EMBASE (1980 – June 2008), ISI Web of Science (no date range given) - search strategy design based on preliminary review of relevant articles, extensive internet search for waterpipe synonyms and the search strategy of a systematic review on interventions for waterpipe smoking cessation - two medical librarians reviewed and commented on the search strategy - reviewed reference lists of included and relevant papers - used Related Articles feature in PubMed
8. Inclusion and Exclusion Criteria	Inclusion: - observational studies (cohort, case-control and cross-sectional studies) assessing the association between waterpipe tobacco smoking and health outcomes - no language restrictions Exclusion: - case reports, case series, outbreak investigations, abstracts - studies assessing physiological outcomes (e.g. Forced Expiratory Volume in 1 Second (FEV ₁)) - assessing waterpipe use for non-tobacco smoking purposes - not distinguishing waterpipe smoking from other forms of smoking - not reporting any measure of association
General Comments and Limitations	
<ul style="list-style-type: none"> - for most outcomes, evidence was either lacking, indirect or of low quality - lung cancer studies mostly conducted in India and China where tobacco is unprocessed and burned directly by charcoal - measurement bias affected the quality of evidence for most outcomes - only one study reported using a standardized exposure measurement tool - no study reported using a standardized measurement tool for other forms of tobacco - inappropriate handling of confounding for many outcomes (particularly for other forms of tobacco, radon exposure) - no studies reported tests for interactions between waterpipes and smoking 	

Results

- waterpipe tobacco smoking was possibly associated with lung cancer, respiratory illness, low birth-weight, newborn pulmonary problems and periodontal disease.
- waterpipe tobacco smoking was not significantly associated with bladder cancer, nasopharyngeal cancer, oesophageal cancer, oral dysplasia or infertility
- overall quality of evidence for the various outcomes varied from low to very low

Details of Studies Included in Review - Review #1 (Akl, et al)		
Study Methodology	OUTCOMES	
Outcome	Lung Cancer Diagnosis	Lung Cancer Mortality
Study Design and Quality	5 case-control studies overall quality of evidence is very low	1 retrospective cohort study overall quality of evidence is very low
Setting	China (3), India (1), Tunisia (1)	China
Population	<ul style="list-style-type: none"> - majority of population males - age range: 35 – 80 - three Chinese studies reported data from the same population (tin workers from one company) 	<ul style="list-style-type: none"> - males
Exposure Type and Levels	<ul style="list-style-type: none"> - waterpipe (Chinese waterpipe, hookah), cigarettes, bidis - exposure level: mean pipe years, number of pipe years or not reported 	<ul style="list-style-type: none"> - waterpipe (Chinese waterpipe), cigarette - exposure level: cumulative dose quartiles (calculated as cumulative exposure and categorized into quartiles of liang (Chinese unit of measurement for month year))
Results	<ul style="list-style-type: none"> - pooled OR for association of waterpipe tobacco smoking with lung cancer diagnosis was 2.12 (95% CI 1.32-3.42; I² = 0%) - sensitivity analysis for the one study with no major methodological limitations for which OR was 3.0 (95% CI 1.2-7.6) 	<ul style="list-style-type: none"> - calculated crude relative risk for association with lung cancer mortality risk was 4.39 (95% CI 3.82-5.04)
Comments/ Limitations	<ul style="list-style-type: none"> - two studies reported statistically significant dose-response relationship in terms of the total amount of exposure and duration of exposure - four of five studies did not appropriately deal with confounding - tobacco typically used in China and India is unprocessed and burned directly by charcoal - none of the studies used a standardized measurement tool - participation rate not reported - blinding of outcome adjudicator not reported 	<ul style="list-style-type: none"> - did not appropriately deal with confounding - tobacco typically used in China and India is unprocessed and burned directly by charcoal - measurement tool not reported - no standardized exposure measurement - participation rate not reported

Details of Studies Included in Review - Review #1 (Akl, et al)		
Study Methodology	OUTCOMES	
Outcome	Bladder Cancer Diagnosis	Oesophageal Cancer Oesophageal Squamous Cell Carcinoma Diagnosis
Study Design and Quality	1 case-control study overall quality of evidence is very low	1 case-control study overall quality of evidence is low
Setting	Egypt	Iran
Population	<ul style="list-style-type: none"> - cases: males admitted with invasive bladder cancer - controls: males admitted for acute, non-neoplastic, non-urinary tract, non-smoking related conditions - age range: 31-74 	<ul style="list-style-type: none"> - cases: oesophageal squamous cell carcinoma cases - controls: two-population-based matched control subjects per case
Exposure Type and Levels	<ul style="list-style-type: none"> - waterpipe, cigarette, hashish - exposure level: not reported 	<ul style="list-style-type: none"> - waterpipe (hookah), cigarettes, nass chewing opium - exposure level: median of 32 hookah-years
Results	<ul style="list-style-type: none"> - waterpipe tobacco smoking was not significantly associated with bladder cancer - study reported a potential protective association between waterpipe tobacco smoking and bladder cancer diagnosis OR 0.8 (95% CI 0.2-4.0) 	<ul style="list-style-type: none"> - OR for the association of waterpipe tobacco smoking with oesophageal cancer diagnosis of 1.85 (95% CI 0.95-3.58) - OR for the association of waterpipe only tobacco smoking with oesophageal cancer diagnosis of 1.69 (95% CI 0.76-3.77) - test for trend significant for intensity (P=0.03), but not for duration, total amount or age (started)
Comments/ Limitations	<ul style="list-style-type: none"> - use of prevalent cases - imprecision¹⁵ - no standardized exposure measurement - confounding adjusted for age, education, type of house, history of schistosomiasis, high-risk occupation, tobacco smoking - participation rate >95% - blinding of outcome adjudicator not reported 	<ul style="list-style-type: none"> - imprecision - the study reported statistically significant dose response relationship in terms of intensity of use - study used standardized exposure measurement - confounding matched for age, sex, residence and adjusted for education, ethnicity, other types of tobacco use, total intake of fruit and vegetables - participation rate not reported - blinding of outcome adjudicator not reported

¹⁵ Imprecision – Results are imprecise when studies include relatively few patients and few events and thus have wide CIs around the estimate of the effect. The 95% CI (or alternative estimate of precision) around the pooled or best estimate of association includes both negligible association and appreciable benefit or appreciable harm.

Details of Studies Included in Review - Review #1 (Akl, et al)		
Study Methodology	OUTCOMES	
Outcome	Nasopharyngeal Cancer Nasopharyngeal Carcinoma	Oral Dysplasia Dysplasia of Oral Mucosa Diagnosis
Study Design and Quality	1 case-control study overall quality of evidence is very low	1 cross-sectional study overall quality of evidence is very low
Setting	Algeria, Morocco, Tunisia	Yemen
Population	<ul style="list-style-type: none"> - cases of nasopharyngeal cancer - controls: patients hospitalized for non-cancer diseases and friends/family of non-cancer patients 	<ul style="list-style-type: none"> - Yemeni volunteers (27 men and 6 women) - 11 waterpipe smokers, 11 cigarette smokers, 11 non-smokers - recruited exclusively subjects who chewed takhzeen al-qat (alqat), a green-leaved plant for its stimulant effect - mean age 38.5, ranged from 22-58
Exposure Type and Levels	<ul style="list-style-type: none"> - cigarette, waterpipe (shisha), snuff, cannabis - exposure level: not reported 	<ul style="list-style-type: none"> - cigarette, waterpipe, alqat - exposure level: not reported
Results	<ul style="list-style-type: none"> - study reported OR for association between waterpipe tobacco smoking and nasopharyngeal cancer was 0.49 (95% CI 0.20-1.23) 	<ul style="list-style-type: none"> - study reported OR for association of waterpipe tobacco smoking with dysplasia of the oral mucosa on the chewing side to be 8.33 (95% CI 0.78-9.47)
Comments/ Limitations	<ul style="list-style-type: none"> - investigators used matching for hospital, age, sex, household type (urban/rural) and adjusted for age, but not for other types of smoking - imprecision - no standardized exposure measurement - participation rate >90% 	<ul style="list-style-type: none"> - no matching or adjustment of confounding factors - analysis was stratified by chewing side (i.e. analysis of outcome occurring on the chewing side separate from the analysis of outcome occurring on the non-chewing side) - imprecision - volunteer recruitment into the study - no standardized exposure measurement

Details of Studies Included in Review - Review #1 (Akl, et al)		
Study Methodology	OUTCOMES	
Outcome	Pregnancy Outcomes Low-Birth Weight	Pregnancy Outcomes Apgar Score <7, Pulmonary Problems, Malformations, Perinatal Complications
Study Design and Quality	<ul style="list-style-type: none"> - three studies included - all three studies assessed low-birth weight - one study reported on Apgar score, pulmonary problems, malformations, perinatal complications 	
	2 retrospective cohort study, 1 case-control study overall quality of evidence is low	1 retrospective cohort study overall quality of evidence is low
Setting	Lebanon, Iran	Lebanon
Population	the population for the various studies included: <ul style="list-style-type: none"> - pregnant women delivering in hospitals - all term infants (gestational age 37-42 weeks) - singleton newborns to women classified as being: <ul style="list-style-type: none"> - exclusive waterpipe (narghile) smokers, - exclusive cigarette smokers, - smoking both waterpipe (narghile) and cigarettes, - non-smokers 	<ul style="list-style-type: none"> - pregnant women delivering in hospitals - waterpipe smokers, cigarette smokers and non-smokers - mean age for the three groups ranged from 27.6 to 29.1
Exposure Type and Levels	<ul style="list-style-type: none"> - waterpipe (narghile, hookah smoking by mother), cigarettes - exposure level: not reported, categorized into daily and broken down by trimester 	<ul style="list-style-type: none"> - waterpipe (narghile), cigarettes - exposure level: categorized into daily and broken down by trimester
Results	<ul style="list-style-type: none"> - pooled OR for association of waterpipe tobacco smoking with low-birth weight was 2.12 (95% CI 1.08-4.18; I²=0%) 	<ul style="list-style-type: none"> - pooled OR for association of waterpipe tobacco smoking with newborn pulmonary problems was 3.65 (95% CI 1.52-8.75) - associations were not significant for Apgar scores at 1 and 5 minutes, malformations or perinatal complications
Comments/ Limitations	comments for all three studies include: <ul style="list-style-type: none"> - no standardized exposure measurement - participation rate not reported - adjusted for confounding - blinding of outcome adjudicator not reported 	

Details of Studies Included in Review - Review #1 (Akl, et al)		
Study Methodology	OUTCOMES	
Outcome	Periodontal Disease Periodontal Bone Height Loss, Plaque Index and Gingivitis, Deepening of Sulci or Pockets and Vertical Periodontal Bone Loss	Periodontal Disease Dry Socket
Study Design and Quality	4 cross-sectional studies overall quality of evidence is low	1 cohort study overall quality of evidence is low
Setting	Saudi Arabia	Egypt
Population	- volunteers had to have at least 20 teeth and not be pregnant (three of the four studies)	- male waterpipe smokers, cigarette smokers and non-smokers
Exposure Type and Levels	- waterpipe (shisha), cigarettes - exposure level: varied from not reported to mean exposure of 56.8 running years of waterpipe smoking	- waterpipe (shisha), cigarettes - exposure level: not reported
Results	- the results of the four cross sectional studies were not pooled as the data was obtained from the same (or in a subgroup of the same) group of participants - the results consistently showed a statistically significant association between waterpipe tobacco smoking and periodontal disease (OR = 3-5)	- for the fifth study, the reported RR with dry socket was 3.7 (P=0.001)
Comments/ Limitations	- partially dealt with confounding factors (three adjusted for age only and one adjusted for age and dental care habit) - two studies found a statistically significant dose relationship in terms of total amount of exposure - two studies reported blinding of outcome adjudicator	- no matching or adjustment of confounding factors - statistically significant dose relationship in terms of total amount of exposure - participation rate not reported - no standardized exposure measurement - only healthy patients not taking medications were included - blinding of outcome adjudicator not reported

Details of Studies Included in Review - Review #1 (Akl, et al)			
Study Methodology	OUTCOMES		
Outcome	Respiratory Illness Perennial Rhinitis including Nasal Congestion and Wheezing	Infertility Male Factor Infertility	Infectious Disease Hepatitis C Infection
Study Design and Quality	1 cross-sectional study overall quality of evidence is very low	1 case-control study overall quality of evidence is very low	3 cross-sectional studies overall quality of evidence is very low
Setting	Beirut	Egypt	Egypt
Population	- 5 primary schools - students aged 10-15	- lower/lower-middle class males aged 15-45 years old - husbands of female patients of the university infertility clinic who were diagnosed with male-factor infertility problems	- males - village inhabitants
Exposure Type and Levels	- second-hand exposure to cigarettes and waterpipe (narghile) - exposure level: not reported	- husband's waterpipe and smoking behaviours (categorized as regular smokers and never smokers) - exposure level: not reported	- exposed to group waterpipe (goza) smoking - exposure level: not reported
Results	- OR compared with no exposure at home - waterpipe only exposure 2.3 (95% CI 1.1-5.1) - waterpipe and/or cigarette exposure was 2.5 (95% CI 1.6-3.8)	- OR compared with never smoking: 2.5 (95% CI 1.0-6.3) (regular waterpipe smoking)	- pooled OR for association of group waterpipe tobacco and Hepatitis C was 0.98 (95% CI 0.80-1.21; I ² =0%)
Comments/Limitations	- no matching or adjusting of confounding reported - no standardized exposure measurement - participation rate not reported - blinding of outcome adjudicator not reported	- imprecision - no standardized exposure measurement - blinding of outcome adjudicator not reported - participation rate >98% - confounding: - matched for age group, socio-economic class - adjusted for cigarette smoking, tea drinking, marital duration, husband's age, husband's education	- no standardized exposure measurement - discrepancies between the results of MEIA ¹⁶ and PCR ¹⁷ - did not identify any eligible studies assessing the association between waterpipe smoking and the transmission of tuberculosis - identified two reports of outbreak investigations suggesting an association between tuberculosis and sharing tobacco - waterpipe and marijuana waterpipe - blinding of outcome adjudicator not reported

¹⁶ MEIA – micro-particle enzyme immunoassay

¹⁷ PCR – polymerase chain reaction

Items Reviewed - Review #2 (Raad et al)	
General Information and Quality Rating	
1. Author, Year, Title	Raad, D., Gaddam, S., Schunemann, H.J., Irani, J., Jaoude, P.A., Honeine, R. and E.A. Akl. 2011. Effects of Water-Pipe Smoking on Lung Function
2. Quality Rating	High (9/10), rated using Health Evidence Quality Assessment Tool
3. Objectives of Review	Primary Objective: To systematically review the effects of waterpipe smoking on lung function. Secondary Objective: To compare the effects of waterpipe smoking and cigarette smoking on lung function.
Search Strategy	
4. Number of Primary Studies Included	N = 6
5. Types of Studies Included	Cross-sectional studies
6. Databases Searched and Years Searched	MEDLINE (Date of inception – June 2008), EMBASE (Date of inception – June 2008), ISI Web of Science (Date of inception – June 2008) - reviewed reference lists of included and other relevant papers - used the Related Articles feature in PubMed
7. Inclusion and Exclusion Criteria	Inclusion: - studies that assessed the association between waterpipe tobacco use and lung function - eligible studies had to include a group of individuals smoking a waterpipe exclusively - studies had to include at least one of the following: - a group of non-smokers - a group of individuals practicing cigarette smoking exclusively - no language restrictions - outcomes of interest include: FEV ₁ , FVC and FEV ₁ /FVC
8. Setting	Turkey (3), Kuwait (1), Saudi Arabia (1), Syria (1)
9. Period	- not reported for 5 studies - 1994-95
10. Population	Waterpipe smokers, cigarette smokers, non-smokers, passive smokers
Comments/Limitations:	
<ul style="list-style-type: none"> - all studies used an objective outcome evaluation - collected data for three different exposure groups (waterpipe smokers, cigarette smokers, non-smokers) and FEV, FVC and FEV₁/FVC were calculated as percentages of predicted values and reported at the group level as mean and SD of these percentages - available data from cross-sectional studies provide evidence for an association, but does not establish causality - variability in exposure - only two studies failed to distinguish passive smokers from non-smokers for exposure to waterpipe or cigarette smoking, but the results of sensitivity analyses excluding the two studies were consistent with the other results - studies did not report using a standardized exposure assessment tool (smoking patterns, frequency and length of smoking session, type and quality of tobacco used) - only one study reported handling of confounding by matching for gender and two studies reported no difference between mean age for the groups 	

involved

- only one study reported blinding of outcome adjudicator
- only one study reported percentages of participation (88%) and complete data (96%)
- selection of study participants done by visiting local coffee shops, by volunteer recruitment or by a field study

Results

- Waterpipe tobacco smoking negatively affects lung function and may be as harmful as cigarette smoking
- Waterpipe tobacco smoking is likely to be a cause of COPD

Details of Studies Included in Review - Review #2 (Raad et al)		
Study Methodology	OUTCOMES	
	Waterpipe Tobacco Smoking Compared with Non-Smoking	Association Between Duration of Waterpipe Tobacco Smoking
FEV ₁	<ul style="list-style-type: none"> - pooled SMV was -0.43 (95% CI -0.58 to -0.29; I² = 24%) equivalent to a 4.04% lower FEV₁% value in waterpipe group or a small effect size¹⁸ - in the sensitivity analysis excluding studies where nonsmokers were described as passive smokers, the pooled SMD remained statistically significant at -0.46 (95% CI -0.60 to -0.31; I² = 21%) - GRADE overall quality of evidence was moderate; downgraded secondary to study limitations 	<ul style="list-style-type: none"> - four studies had mixed results - two studies reported no correlation between duration of waterpipe and decline in FEV₁ - one study found a marked decline in FEV₁ and FEV₁/FVC when comparing heavy smokers (>2 waterpipe/d) with light smokers (1-2 waterpipe/d) - one study reported a negative correlation for cumulative quantity of waterpipe smoking with FEV₁, FVC and FEV₁/FVC
FVC	<ul style="list-style-type: none"> - SMD was -0.15 (95% CI -0.34 to 0.04; I² = 0%), equivalent to a 1.38% reduction in FVC% in the waterpipe group - in the sensitivity analysis, the pooled SMD was -0.19 (95% CI -0.40 to 0.01; I² = 0%) 	
FEV ₁ /FVC	<ul style="list-style-type: none"> - SMD was -0.46 (95% CI -0.93 to 0.01; I² = 92%), suggesting a lower percent predicted value in the waterpipe group by 3.08% - in the sensitivity analysis, the pooled mean difference was -0.51 (95% CI -1.06 to 0.05; I² = 94%) 	
Overall Results / Comments / Limitations	<ul style="list-style-type: none"> - compared with no smoking, waterpipe smoking was associated with lower FEV₁ (SMD = -0.43; 95% CI -0.58 to -0.29; equivalent to a 4.04% lower FEV₁% or a small effect size). - in a sensitivity analysis excluding passive smokers, the results remained significant for FEV₁. - the association between waterpipe smoking and reduction in FEV₁ is statistically significant and of clinical relevance. The minimal important difference for FEV₁ is in the range of 100 to 140 mL. The mean difference in the study was estimated to 	

¹⁸ Cohen's Criteria general definitions for interpreting effect size estimates states that a small effect size ranges from 0.20 to 0.50. A medium effect size ranges from 0.50 to 0.80 and a large effect size is 0.80 and above (5).

	<p>be around 4%, which approximates to 173 mL for a 40-year-old white man of 180 cm height.</p> <ul style="list-style-type: none">- there was no effect on FVC or on FEV₁/FVC- the GRADE overall quality of evidence for FEV₁ was moderate	
--	---	--

Appendix I: Data Synthesis

Waterpipe Tobacco Smoking IS Possibly Associated with the Following Health Outcomes			
Health Outcomes	# of Studies	Results	Overall Quality
Lung Cancer Diagnosis	5	- pooled OR for association of waterpipe tobacco smoking with lung cancer diagnosis was 2.12 (95% CI 1.32-3.42)	Very low
Lung Cancer Mortality	1	- calculated crude relative risk for association with lung cancer mortality risk was 4.39 (CI 3.82-5.04)	Very low
Pregnancy Outcomes Low-Birth Weight	3	- pooled OR for association of waterpipe tobacco smoking with low-birth weight was 2.12 (95% CI 1.08-4.18)	Low
Pregnancy Outcomes Newborn Pulmonary Problems	1	- pooled OR for association of waterpipe tobacco smoking with newborn pulmonary problems was 3.65 (95% CI 1.52-8.75)	Low
Periodontal Disease Periodontal Bone Height Loss, Plaque Index And Gingivitis, Deepening of Sulci or Pockets, Vertical Periodontal Bone Loss	4	- results consistently showed a statistically significant association between waterpipe tobacco smoking and periodontal disease (OR = 3-5) - the results of the four cross sectional studies were not pooled as the data was obtained from the same (or in a subgroup of the same) group of participants	Low
Periodontal Disease Dry Socket	1	- the reported RR with dry socket was 3.7 (P=0.001)	Low
Respiratory Illness Perennial Rhinitis Including Nasal Congestion and Wheezing	1	- OR compared with no exposure at home - waterpipe only exposure was 2.3 (95% CI 1.1-5.1) - waterpipe and/or cigarette exposure was 2.5 (95% CI 1.6-3.8)	Very low
Lung Function FEV ₁	6	- compared with no smoking, waterpipe smoking was associated with a statistically significant reduction of FEV₁ (SMD = -0.43; 95% CI – 0.58 to -0.29; equivalent to a 4.04% lower FEV ₁ % or a small effect size ¹⁹)	Moderate

¹⁹ Cohen's Criteria for interpreting SMD effect size estimates states that a small effect size ranges from 0.20 to 0.50. A medium effect size ranges from 0.50 to 0.80 and a large effect size is 0.80 and above (5).

Waterpipe Tobacco Smoking IS Not Significantly Associated with the Following Health Outcomes

Health Outcomes	# of Studies	Results	Overall Quality
Bladder Cancer Diagnosis	1	- study reported a potential protective association between waterpipe tobacco smoking and bladder cancer diagnosis OR 0.8 (95% CI 0.2-4.0)	Very low
Oesophageal Cancer Oesophageal Squamous Cell Carcinoma Diagnosis	1	- study reported an OR for the association of waterpipe tobacco smoking with oesophageal cancer diagnosis of 1.85 (95% CI 0.95-3.58) - study reported an OR for the association of waterpipe only tobacco smoking with oesophageal cancer diagnosis of 1.69 (95% CI 0.76-3.77)	Low
Nasopharyngeal Cancer Nasopharyngeal Carcinoma	1	- study reported OR for association between waterpipe tobacco smoking and nasopharyngeal cancer was 0.49 (95% CI 0.20-1.23)	Very low
Oral Dysplasia Dysplasia of Oral Mucosa Diagnosis	1	- study reported OR for association of waterpipe tobacco smoking with dysplasia of the oral mucosa on the chewing side to be 8.33 (95% CI 0.78-9.47)	Very low
Infertility Male Factor Infertility	1	- OR compared with never smoking: 2.5 (95% CI 1.0-6.3)	Very low
Infectious Disease Hepatitis C Infection	3	- pooled OR for association of group waterpipe tobacco and hepatitis C was 0.98 (95% CI 0.80-1.21)	Very low
Pregnancy Outcomes Apgar score <7, Malformations, Perinatal Complications	1	- associations were not significant for Apgar scores at 1 and 5 minutes, malformations or perinatal complications	Low
Lung Function FVC, FEV ₁ /FVC	6	- compared with no smoking, the SMD for FVC was -0.15; 95% CI -0.34 to 0.04; equivalent to a 1.38% reduction in FVC% for waterpipe users - pooled SMD in the sensitivity analysis was -0.19 (95% CI -0.40 – 0.01) - compared with no smoking, the SMD for FEV ₁ /FVC was -0.46; 95% CI -0.93 to 0.01; equivalent to a 3.08% lower FEV ₁ /FVC in waterpipe smokers - pooled mean difference in the sensitivity analysis was -0.51 (95% CI -1.06 – 0.05)	Moderate

Appendix J: Applicability and Transferability Worksheet

Factors	Questions	Notes
Applicability (Feasibility)		
Political acceptability or leverage	<ul style="list-style-type: none"> • Will the intervention be allowed or supported in current political climate? • What will the public relations impact be for local government? • Will this program enhance the stature of the organization? <ul style="list-style-type: none"> ○ <i>For example, are there reasons to do the program that relate to increasing the profile and/or create a positive image of public health?</i> • Will the public and target groups accept and support the intervention in its current format? 	<ul style="list-style-type: none"> • New Regional Council in Fall <ul style="list-style-type: none"> • Link waterpipes to MUDs • Tobacco is a current Term of Council Priority • Consider by-law development <ul style="list-style-type: none"> • Legal authority to enact? • Other jurisdictions have by-laws • SFOA amendments to include waterpipes • Possible advocacy given 4 municipalities have by-laws • Possible Peel by-law given requests for information/guidelines from restaurateurs, Toronto air quality studies/results, other jurisdictions have by-laws • 85% of population non-smokers and high % want restaurants smoke-free • Re-introduce Bill 131 • Need a well thought out campaign • Impact on existing businesses • Gap in local data – use and exposure • What are the attitudes of Peel residents regarding waterpipes? • Education and research safe approaches until the evidence evolves • Licensing may be an option • City of Mississauga may be a champion • May be seen as not doing enough to curb tobacco use • Politicians receiving complaints • No age limit to buy waterpipe • Operators of waterpipe establishments have a heightened awareness of whom they are providing waterpipes to.
Social acceptability	<ul style="list-style-type: none"> • Will the target population find the intervention socially acceptable? Is it ethical? <ul style="list-style-type: none"> • <i>Consider how the program would be perceived by the population.</i> 	<ul style="list-style-type: none"> • Cultural sensitivity – prepare for concerns • Push back from public • Common belief that waterpipes are safer than cigarettes • What percentage of adults use a waterpipe? • Growing trend among youth

	<ul style="list-style-type: none"> • <i>Consider the language and tone of the key messages.</i> • <i>Consider any assumptions you might have made about the population. Are they supported by the literature?</i> • <i>Consider the impact of your program and key messages on non-target groups.</i> 	<ul style="list-style-type: none"> • Lack of local data (use, exposure) • Businesses • End users creating smoke-free environments help people quit smoking • Public education is socially acceptable • Tobacco waterpipe is not allowed and not safe • By-law will likely be accepted by most of the population since indoor air quality diminished by waterpipe smoking • Identify all products containing tobacco by brand
<p>Available essential resources (personnel and financial)</p>	<ul style="list-style-type: none"> • Who/what is available/essential for the local implementation? • Are they adequately trained? If not, is training available and affordable? • What is needed to tailor the intervention locally? • What are the full costs? <ul style="list-style-type: none"> • <i>Consider: in-kind staffing, supplies, systems, space requirements for staff, training, and technology/administrative supports.</i> • Are the incremental health benefits worth the costs of the intervention? <ul style="list-style-type: none"> • <i>Consider any available cost-benefit analyses that could help gauge the health benefits of the intervention.</i> • <i>Consider the cost of the program relative to the number of people that benefit/receive the intervention.</i> 	<ul style="list-style-type: none"> • 14 FTEs for tobacco (EH and CDIP) • SFOA budget may need to increase • Can't rely on self-policing • Waterpipe by-law would fit well with patio by-law • Potentially harmful substances that can be placed in waterpipe along with tobacco • Need to work with restaurant associations • Build education campaign with other tobacco priorities • Emerging issue that needs to be nipped in the bud • 20 out of 5,000 restaurants are affected. It is a small problem at the moment. • Interest from City of Mississauga • What are the potential activities to support policy development • Who are the community partners – NGOs, municipal licensing, province? • Depending on the approach, will need to consider stakeholder involvement. • Health benefits – exposure to second hand smoke for workers in establishments. • Training may be required • Staff and admin support requirements are likely to increase • Cost for testing, expert analysis • Test for indoor air quality (CO, PM, nicotine) • Difficult to assess without prevalence rate

<p>Organizational expertise and capacity</p>	<ul style="list-style-type: none"> • Is the intervention to be offered in line with Peel Public Health’s 10-Year Strategic Plan (i.e., 2009-2019, ‘Staying Ahead of the Curve’)? • Does the intervention conform to existing legislation or regulations (either local or provincial)? • Does the intervention overlap with existing programs or is it symbiotic (i.e., both internally and externally)? • Does the intervention lend itself to cross-departmental/divisional collaboration? • Any organizational barriers/structural issues or approval processes to be addressed? • Is the organization motivated (learning organization)? <ul style="list-style-type: none"> ○ <i>Consider organizational capacity/readiness and internal supports for staff learning.</i> 	<ul style="list-style-type: none"> • Requires collaboration between CDIP and EH • Tobacco Free Living Strategic Priority • Unclear how new Regional Council will respond • Limited staff available • Lower priority than patios or MUDs • Municipal Act allows by-laws to be passed for health and safety • By-law possible, supported by other policy and by-law initiatives <ul style="list-style-type: none"> - Smoke-free homes - Workplace smoking policy - MUDs
<p>Transferability (generalizability)</p>		
<p>Magnitude of health issue in local setting</p>	<ul style="list-style-type: none"> • What is the baseline prevalence of the health issue locally? • What is the difference in prevalence of the health issue (risk status) between study and local settings? <ul style="list-style-type: none"> • <i>Consider the Comprehensive</i> 	<ul style="list-style-type: none"> • Unclear • Low prevalence from what we know • Very different settings • Small issue among tobacco priorities • 2012 Burden of Tobacco

	<i>Health Status Report, and related epidemiological reports.</i>	
Magnitude of the “reach” and cost effectiveness of the intervention above	<ul style="list-style-type: none"> • Will the intervention appropriately reach the priority population(s)? <ul style="list-style-type: none"> • What will be the coverage of the priority population(s)? 	<ul style="list-style-type: none"> • Hard to reach young males • Need by-law to get coverage or create uneven playing field • Yes, will potentially directly affect waterpipe bars • Children are being brought to waterpipe bars that may have tobacco (complaints) • Education may need to address exposures
Target population characteristics	<ul style="list-style-type: none"> • Are they comparable to the study population? • Will any difference in characteristics (e.g., ethnicity, socio-demographic variables, number of persons affected) impact intervention effectiveness locally? <ul style="list-style-type: none"> • <i>Consider if there are any important differences between the studies and the population in Peel (i.e., consider demographic, behavioural and other contextual factors).</i> 	<ul style="list-style-type: none"> • Populations not comparable • Waterpipe smoking is new in Canada relative to other countries • Do not have research on local health effects • Peel data vs. ON, Canada, International data • Studies primarily focus on the Middle East where waterpipe smoking is a cultural activity • Population will be similar, but the regulatory context is different and broader social acceptability of the practice will be different, if not opposite.
<p>Proposed Direction (after considering the above factors):</p> <p>Add recommendation to develop by-law for waterpipe smoking linked to a smoke-free patio by-law. To further develop and implement program/research/policy analysis.</p>		

Completed by: Lori Greco, Franca Ursitti, Alex Krywoj, Andrea Chiefari, Dr. Megan Ward, Dr. Eileen de Villa, Teresa Ho, Brian Rawson, Maybellyne Biley, and Michael Tran.

Worksheet adapted from: Buffet C., Ciliska D., and Thomas H. National Collaborating Centre for Methods and Tools. November 2007. *Can I Use this Evidence in my Program Decision? - Assessing Applicability and Transferability of Evidence.*