Alcohol impacts health:
A rapid review of the evidence

Simone Kaptein, Analyst, Research and Policy, CDIP
Teresa Wan, Health Promoter, SM/IP Team, CDIP
Elizabeth Amorim & Suzanne Smith, Supervisors, CDIP
Pat Bromby, Manager, CDIP

June 2013

Region of Peel
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Key Messages

1. Alcohol is a risk factor for a wide-range of health conditions. Detrimental effects are seen at low levels of alcohol consumption, beginning at 10g/day.

2. Volume of drinking is related to health outcomes through dose-response relationships. These relationships can be linear (e.g., as more alcohol is consumed, risk increases for breast cancer); J-shaped (i.e., low levels of alcohol consumption are protective for heart disease and then risk increases at higher doses); or accelerating (i.e., risk for liver cirrhosis increases rapidly as consumption increases). However, irregular, heavy drinking patterns are also likely to result in harms such as suicide, violent behaviours, and heart disease.

3. Heart disease and all-cause mortality risks are lower in those over the age of 45 and only for those who drink low levels of alcohol on a regular basis. No health benefits are seen in those under age 45.

4. Gender and sex differences are seen in health outcomes from alcohol consumption.

Executive Summary

Issue and Context

This rapid review examines the evidence on the health impacts of different levels of alcohol consumption. These health effects include all-cause mortality, injury, cancers, cardiovascular disease, mental health and social harm. In a 2009/10 survey of Peel residents, approximately 71% of adults 19 years and older reported alcohol consumption. Males were more likely to consume alcohol than females; only 20.5% of males were non-drinkers compared to 36.6% of females.

Research Question

What is the impact of different levels of alcohol consumption on mental and physical health?

Methods and Results

A systematic search, limited to reviews published in English between 2008 and 2012, identified 885 potentially relevant articles. After the relevance assessment, 72 papers remained. Three documents were selected, two clinical guidelines and a book chapter, which received strong quality ratings using the AGREE II tool and an assessment tool for text/book chapters.

Synthesis of Findings

- As the average volume of alcohol consumption increases, the lifetime risk of alcohol-related disease increases. These include several types of cancer (e.g., breast, lip, oral, pharyngeal, oesophageal, and liver), hypertensive disease, and haemorrhagic stroke.

- On the one hand, beneficial effects are seen for ischaemic stroke and heart disease mortality for those over 45 years of age who drink moderately and on a regular basis. On the other hand, no beneficial effects of alcohol consumption are seen for those under the age of 45.

- Any alcohol consumption increases the risk of unintentional falls, motor vehicle crashes and drowning. The risk of death from injury is higher for men than for women at all levels of drinking.

- Many types of social harm (e.g., violence) and mental health disorders (e.g., depression, suicide) also increase with alcohol consumption; particularly among heavy drinkers/alcohol abusers.

Recommendations

Peel Public Health should:

- Explore appropriate messaging about the health impacts of alcohol for Peel residents/community.

- Seek to understand the specific risks for Peel residents and what health impacts would result if we reduced our high-risk drinking.

- Identify and develop partnerships with other health professionals and organizations locally and provincially who have an interest in reducing alcohol-related harm.

Glossary of Key Terms[1]

Absolute risk is the actual likelihood that an event will happen in a particular situation over a particular time. For example, the absolute risk of death from ischemic heart disease for the average Canadian up to the age of 70 years is a 1-in-13 likelihood.

All-cause mortality refers to death from all causes (i.e., not necessarily those with a proven causal association with drinking).

Attributable Risk is the proportion (or amount) of disease incidence that can be attributed to a specific exposure. (e.g., 3.5% of breast cancer cases can be attributed to alcohol). Whereas **relative risk** is important in etiologic relationships, the **attributable risk** addresses a different question, "How much of the risk of a disease can we hope to prevent if we are able to eliminate exposure to the agent in question?" In this case, the agent would be alcohol.

Lifetime risk** of alcohol-related harm is the accumulated risk from drinking either on many occasions, or on a regular basis, over a lifetime. Lifetime risk of death is a common outcome used for measuring risk from exposure to hazardous substances.

Morbidity refers to non-fatal illnesses and injuries that may be caused by drinking alcohol and/or other risk factors.

Mortality refers to fatal outcomes that may be caused by drinking alcohol and/or other risk factors.

Relative risk (RR) is the likelihood that an event will happen to a particular person in a particular situation in comparison with someone else. It is an important measure of the strength of the association (between exposure and outcome). For example, the risk of premature death from a hemorrhagic stroke for a woman who regularly has four drinks per day is two times higher than for a woman who is a lifetime abstainer.

Single occasion drinking is a sequence of drinks taken without the blood alcohol concentration reaching zero in between. This might include a drink at home over dinner, or at a specific event, such as a party, and can include drinking spread across more than one context or venue.

Standard drink – A Canadian standard drink is equal to 341ml (12 oz) bottle of 5% strength beer, cider or cooler; a 142 ml (5 oz) glass of 12% strength wine; or a 43 ml (1.5 oz) shot of 40% strength spirits. A standard drink contains 17.05 ml or 13.45 g of ethanol/pure alcohol. N. B. Each country has its own definition of a standard drink. In Australia, it is 10g (12.5ml) of alcohol. In the United States it is 14.5g (18 ml) of alcohol.

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[1] Definitions taken from *Alcohol and Health in Canada: A Summary of Evidence and Guidelines for Low-Risk Drinking.* ** Definition taken from *Australian guidelines to reduce health risks from drinking alcohol.*

1 Issue

New Canadian Low-Risk Alcohol Drinking Guidelines (LRDG) were publicly released in November 2011.[1, 2] These guidelines make recommendations on the quantity and frequency of alcohol consumption for adults aged 25 to 65, with daily and weekly alcohol consumption limits to reduce short- and long-term health risks. Different limits are provided for men and women. The new Canadian LRDG allow a higher limit of standard drinks per week than the Ontario Low-Risk Drinking Guidelines created by the Centre for Addiction and Mental Health in 1997 and re-confirmed in 2003 (Appendix A compares the Ontario and new national guidelines).[3] Not only is the Canadian standard drink larger than many countries' at 13.45g of alcohol, but the new Canadian LRDG has some of the highest drink limits per day and per week in the world.[4]

As part of our evidence-informed practice, the Substance Misuse/Injury Prevention team (SM/IP) critically appraised the new national LRDG using the Agree II tool. The team scored the Canadian LRDG low in the 'rigour' domain because of missing methodology information.[2] The National Alcohol Strategy Advisory Committee - which is leading the implementation of the National Alcohol Strategy, including the new LRDG - has participation from experts in alcohol-related issues from governmental/non-governmental organizations and the alcohol industry. The International Public Health Community recently submitted a Statement of Concern to the WHO Secretariat; they are recommending that the public health community avoid funding from industry

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[2]In December 2012, the CCSA released the methodology for the national guidelines and sent us the background systematic reviews used to support the guideline development. We have re-appraised the national guidelines using this new information. The critical appraisal can be found in Appendix B.

sources for prevention, research and information dissemination activities; refrain from any form of association with industry education programmes; and insist on industry support for evidence-based policies.[5]

A rapid review was then initiated to examine the evidence on the health impacts of different levels of alcohol consumption. This review will assist Peel Public Health in evaluating the potential implications of using the higher limits contained in the new Canadian guidelines.

2 Context

In a 2009/10 survey of Peel residents, approximately 71% of adults 19 years and older reported alcohol consumption.   Males were more likely to consume alcohol than females; only 20.5% of males were non-drinkers compared to 36.6% of females. A profile of Peel drinkers is presented in Appendix C.

There are limited data on alcohol-related harms in Peel (Table 1). Mortality rates for alcoholic liver disease have decreased over the past 20 years in Peel with 28 deaths reported in 2007. [6] However, Peel emergency department (ED) visits and hospitalizations for alcoholic liver disease have both increased in recent years. In 2010, the standardized rate of ED visits in Peel among males (9.7 visits per 100,000) was triple that of females (3.3 visits per 100,000). ED visits for alcohol-induced mental disorders have also increased, and in 2011 was ranked among the top 15 leading causes of all ED visits in Peel (10th leading cause of ED visits among males).[6]

Table 1. Alcohol-related harms, Peel and Ontario, 2011

Alcohol-related Health Outcomes	Number of Peel cases	Peel age-standardized rate (per 100,000)	Ontario age-standardized rate (per 100,000)
Hospitalizations			
Alcoholic liver disease	195	12.4	12.3
Alcohol-induced mental disorders	237	15.2	18.5
Alcohol-dependence syndrome*	57	0.8	2.7
Emergency Department Visits			
Alcoholic liver disease	85	5.6	6.5
Alcohol-induced mental disorders	2268	157.9	269.3
Alcohol-dependence syndrome	258	17.4	25.3

*Data for 5-years combined (2007-11).

Data retrieved from: http://www.peelregion.ca/health/statusdata/HealthBehaviours/alcohol-health.asp

Injuries and accidents due to alcohol are difficult to estimate and are likely under-reported as alcohol is not always stated as a factor in hospital or ED visits. Males are more likely to engage in risk-taking behavior and have higher rates of injury/accidents, even when alcohol is not a factor. In 2006, ED visits due to alcohol for young adults 15-24 years of age was 325.4 for males and 181.8 for females per 100,000.[7] Alcohol can also be a factor in motor vehicle crashes and other unintentional injuries. In 2010, there were 1431 arrests in Peel for a drinking and driving related offence[3]. The cost of alcohol-related harms in Canada has been estimated at $14.6 billion per year.[8]

In 2009/10, 82.8% of Peel residents aged 19 years and older reported adherence to the Ontario guidelines and were thus categorized as low-risk drinkers (see Appendix C). In total, 17.2% (N=161,900) of our drinking population is consuming above the recommended Ontario guideline limits. Applying the criteria in the new Canadian LRDG, 86.8% of Peel residents would be considered low-risk drinkers; 4.0% previously

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[3] http://www.peelpolice.on.ca/en/aboutus/regionalbreathunit.asp

considered at higher risk are now categorized as low risk. The change in definition has no impact on female drinkers, with 89.7% defined as low risk under the Ontario guidelines compared to 89.8% under the new Canadian LRDG. Using the new Canadian LRDG, 8.1% of male drinkers in Peel would no longer be categorized as at-risk drinkers: 83.8% of the male drinkers in Peel would be considered low-risk under the new Canadian LRDG compared to 75.7% under the more conservative Ontario guidelines. In total, using the new LRDG, 13.2% (N=123,800) of the drinking-aged population in Peel consumes above the recommended limits.

This rapid review will help inform two program areas that the SM/IP team is currently pursuing: 1) engagement with healthcare professionals; and 2) creating safer alcohol environments. Healthcare professionals should be discussing the health risks associated with different levels of alcohol consumption with their clients and helping healthy adults make informed decisions about the amount of alcohol they consume. The SM/IP team is encouraging healthcare providers to make screening, brief interventions and/or referral to specialized services a part of their routine clinical practice to reduce alcohol- related harm. This rapid review will help ensure that healthcare professionals in Peel are able to use the best available evidence to give their clients appropriate drinking limits.

Creating safer alcohol environments is also an area of focus for the SM/IP team. This rapid review may also provide support to the Ontario Safer Bars Network initiative by

raising awareness among patrons and servers within licensed establishments of the potential health impacts of alcohol consumption.

The new Canadian LRDG have increased the drinking limits that classify individuals as lower risk for alcohol-related problems. To ensure that Peel residents do not underestimate the risk of alcohol consumption to their health, it is prudent to evaluate the research evidence for the health effects associated with different levels of alcohol consumption. We have also received the unpublished Canadian data that provided the evidence base for the Canadian drinking guidelines.[9] The relative risks for health outcomes related to alcohol consumption from this report can be found in Appendix D. The key findings of this rapid review will assist Peel Public Health in determining the implications of using the LRDG with its higher limits and will inform our future programming in the area of alcohol use/misuse.

3 Conceptual Framework

The conceptual model frames the research question and includes healthy, non-pregnant adults as the population of interest, varying levels of alcohol consumption as the exposure of interest (rather than an intervention), and the subsequent harmful and beneficial health impacts.

The conceptual model is presented in Appendix E.

4 Literature Review Question

"What is the impact of different levels of alcohol consumption on mental and physical health?"

The research question can be described in the PECO format:

P (Population)	Healthy, non-pregnant, adults (25 and over)
E (Exposure)	Various levels of alcohol consumption
C (Comparison)	No alcohol consumption/adult abstainers
O (Outcome)	Beneficial and harmful impacts of alcohol on physical and mental health

5 Literature Search

Searches of both grey literature and electronic databases were conducted in November 2012. A search of the grey literature included the websites from the World Health Organization, the Centers for Disease Control and the National Institute for Alcohol Abuse and Alcoholism. The TRIP database was used to search for relevant guidelines from 2000 to 2013. Ovid Medline and PsycINFO databases were searched for alcohol and health-related guidelines, systematic reviews, and meta-analyses. Due to the high number of results, the Ovid Medline and PscyINFO searches were limited to studies published in English between 2008 and 2012. The complete search strategy, including search terms, is presented in Appendix F.

<u>Search Results</u>

The final search identified 885 potentially relevant articles. Titles and abstracts were reviewed to determine relevance. Studies were considered relevant if they met the following criteria:

> *Inclusion criteria*: English; synthesized research; focused on healthy, non-pregnant adults; addressed health conditions and/or outcomes related to alcohol consumption.
>
> *Exclusion criteria*: focused on healthy pregnancy/breastfeeding; population with current serious chronic disease (e.g., heart failure, cancer); and/or population with alcohol dependence.

Following the relevance assessment, the 72 remaining papers included one book chapter, six clinical guidelines, and 65 systematic reviews. Four of the clinical guidelines contained information about alcohol but focused on preventing a specific disease (i.e., prevention of diabetes, osteoporosis, cancer, cardiovascular disease). The book chapter and two of the guidelines substantially covered a broad range of health impacts of alcohol consumption. These three documents were the most highly synthesized research documents and provided sufficient information to answer the rapid review question. In particular, the evidence for the major diseases and conditions known to be related to alcohol consumption was well described. Although several of the systematic reviews were very recent and relevant to the topic (e.g., periodontitis, gynaecologic cancers), the rapid review team decided to end the search for further resources at this point. These other topic areas will be monitored and may be used for program purposes in the future. A total of three resources were subsequently critically appraised. The search results flowchart is presented in Appendix G.

6 Critical Appraisal

Three documents were critically appraised. The book chapter was appraised using an internal Peel Public Health critical appraisal tool developed for textbooks/books.[10] The clinical guidelines were appraised using the AGREE II tool.[11] All three documents were appraised independently by a minimum of 3 reviewers. The reviewers included the rapid review team as well as several members of the SM/IP team. Discrepancies were resolved through discussion.

The book chapter and both guidelines received strong quality ratings.

7 Description of Included Documents

The three resources appraised in this review are:

1. Chapter Four – *The global burden of alcohol consumption*, found in the book, "Alcohol: No Ordinary Commodity. Research and public policy" (2010), by Thomas Babor and colleagues. [12]
2. Australian Guidelines to Reduce Health Risks from Drinking Alcohol. (2009). [13]
3. Dietary Guidelines for Americans, 2010. [14]

Due to the volume of research findings synthesized in these documents, a broad overview of the documents and results is given here. Details can be found in the synthesis tables (Appendix H) and data extraction tables (Appendix I).

1. Chapter Four: The global burden of alcohol consumption, found in the book, "Alcohol: No Ordinary Commodity. Research and public policy." Second edition (2010). [12]

Chapter Four, "The global burden of alcohol consumption" [12] describes a range of alcohol-related consequences: the role of alcohol in the global burden of disease and disability; alcohol and all-cause mortality; and the relation of alcohol to specific causes of death and disease. Research evidence for this chapter is based upon meta-analytic reviews and other key studies. The authors explain what types of research they use in the chapter and reasons why, but do not give quality ratings for the included studies.

2. "Australian Guidelines to Reduce Health Risks from Drinking Alcohol."

Second edition (2009). [13]

This is the second edition of the National Health and Research Medical Council's (NHRMC) evidence-based alcohol guidelines (first edition issued in 2001). These guidelines were developed in collaboration with the Population Health Division of the Australian Government Department of Health and Ageing. The aim of these Guidelines is to provide an evidence base and resource for policy makers, decision makers, and alcohol providers with a focus on reducing health risks from drinking alcohol for populations that include healthy adults, young people under 18 years of age, and pregnant/breastfeeding women. Public consultation and international and Australian experts peer reviewed the guidelines.

The guidelines are based on scientific evidence from the following sources:

(1) A literature review of epidemiological studies on a broad range of alcohol-related issues, with a focus on meta-analyses and systematic reviews of prospective cohort and other epidemiological studies of alcohol's causative role in different health conditions.

(2) A model based on single-episode data from major epidemiological studies. The model was used to estimate a level of drinking that leads to a lifetime risk of death from alcohol-related injury or disease of less than 1 in 100 people with that drinking pattern.

(3) A re-examination of a range of existing datasets to estimate the harms associated with single-occasion drinking.

(4) An investigation of the risk of being hospitalized for injury at different frequencies/amounts of single-occasion drinking using the Victorian Admitted Episode Database.

(5) An analysis of adult respondents (aged 18+) in the 2004 National Drug Strategy Household Survey concerning gender patterns in hazardous and delinquent behaviour.

The authors comment that the guidelines are based on the best available evidence on alcohol-related disease, including epidemiological studies and meta-analyses. They provide a table of references used to inform the guidelines but do not provide quality ratings of the included studies.

Although four guidelines are presented, only Guidelines 1 and 2 are relevant to our rapid review question:

 (1) "Reducing the risk of alcohol-related harm over a lifetime. The lifetime risk of harm from drinking alcohol increase with the amount consumed. *For healthy men and women, drinking no more than two standard drinks on any day reduces the lifetime risk of harm from alcohol-related disease or injury."* [13]

(2) "Reducing the risk of injury on a single occasion of drinking. On a single occasion of drinking, the risk of alcohol-related injury increases with the amount consumed. *For healthy men and women, drinking no more than four standard drinks on a single occasion reduces the risk of alcohol-related injury arising from that occasion."* [13]

3. Dietary Guidelines for Americans, 2010 [14]

This is the seventh edition of the Dietary Guidelines; they form the basis for nutrition policy in Federal food, education and information programs. They are reviewed, updated if necessary, and published every 5 years jointly by the U.S. Department of Agriculture and the U.S. Department of Health and Human Services (mandated by law). The Dietary Guidelines are intended for Americans ages 2 years and older, including those at risk of chronic disease.

The Dietary Guidelines Advisory Committee and Nutrition Evidence Library's team conducted a series of systematic reviews for the guidelines. Health outcomes associated with alcohol intake are described in their background report: weight gain, cognitive decline with age, coronary heart disease (CHD), bone health, and

unintentional injury. The Committee limited the reviews to studies with greater methodological rigour and only conducted systematic reviews of observational prospective studies and randomized control trials.

There were two exceptions: (1) alcohol intake and unintentional injury because cross-sectional or case control studies are of equal or better validity; and (2) alcohol intake related to CHD - only systematic reviews and meta-analyses were used as they were the most recent evidence available. Quality ratings were provided for each of the included studies and an overall grade was provided for each systematic review's summary of evidence. The grades ranged from moderate to strong for the alcohol-related systematic reviews we included in this report. More detail about the quality of the evidence can be found in Appendix I.

The Dietary Guidelines provide these alcohol consumption recommendations: "*For adults of legal drinking age who choose to drink alcohol, consume it in moderation. Avoid alcohol in certain situations that can put you at risk."* [14] Moderate drinking is defined as up to 1 drink per day for women and up to 2 drinks per day for men.

8 Synthesis of Findings

The health outcomes related to alcohol consumption are summarized in Tables 2 and 3. A synthesis of the findings are presented here for alcohol and all-cause mortality, heart disease and stroke, several cancers, alcohol-related dependence, overweight and diabetes, bone health, injury, mental health, violence and other social harms. More detailed synthesis tables can be found in Appendix H and data extraction tables in Appendix I.

A comparison of the alcohol drinking guidelines in Canada, Australia, and the United States is presented in Table 4.

Table 2. Effect sizes for health impacts of alcohol consumption for women

26.9 g/day to reduce long-term health risks (Canadian LRDG)	40.4 g/day to reduce short-term health risks (Canadian LRDG)

	Effect sizes for health impacts of alcohol consumption (g/day) for women*									
Disease Conditions**	10g	20g	30g	40g	50g	60g	70g	80g	90g	≥100g
All-cause mortality (≥45 years)	**RR=0.87 (>0-10g)**	RR=1.01 (>10-30g)	**RR=1.40 (>30-50g)**	**RR=1.40 (>30-50g)**	**RR=1.43 (>50g)**	**RR=1.43 (>50g)**	**RR=1.43 (>50g)**	**RR=1.43 (>50g)**	**RR=1.43 (>50g)**	**RR=1.43 (>50g)**
Alcohol-related mortality†	*0.29 in 100*	*0.77 in 100*	*2.32 in 100*	*3.85 in 100*	*5.52 in 100*	*8.92 in 100*	*11.77 in 100*	*13.70 in 100*		
Injury mortality†	*0.13 in 100*	*0.39 in 100*	*0.91 in 100*	*1.32 in 100*	*1.84 in 100*	*2.99 in 100*	*4.16 in 100*	*5.33 in 100*		
Injury hospitalization†	*4.89 in 100*	*10.63 in 100*	*16.89 in 100*	*20.36 in 100*	*23.65 in 100*	*29.18 in 100*	*33.65 in 100*	*37.09 in 100*		
Liver cirrhosis (mortality)	*RR=1.32*	*RR=1.73*	*RR=2.25*	*RR=2.89*	*RR=3.68*	*RR=4.64*	*RR=5.8*	*RR=7.17*	*RR=8.80*	*RR=10.69*
Liver cancer (mortality)	*RR=1.08*	*RR=1.15;* **RR=1.2 (25g)**	*RR=1.23*	*RR=1.31;* **RR=1.4**	*RR=1.40*	*RR=1.48*	*RR=1.56*	*RR=1.65*	*RR=1.73*	*RR=1.81;* **RR=1.8**
Breast cancer (mortality)	*RR=1.08*	*RR=1.17*	*RR=1.26*	*RR=1.36*	*RR=1.47*	*RR=1.58*	*RR=1.71*	*RR=1.85*	*RR=1.99*	*RR=2.15*
Lip, oral, pharyngeal cancer (mortality)	*RR=1.33*	*RR=1.72*	*RR=2.18*	*RR=2.69*	*RR=3.26*	*RR=3.88*	*RR=4.52*	*RR=5.19*	*RR=5.85*	*RR=6.51*
Oesophageal cancer (mortality)	*RR=1.17*	*RR=1.37*	*RR=1.61*	*RR=1.88*	*RR=2.19*	*RR=2.55*	*RR=2.95*	*RR=3.42*	*RR=3.94*	*RR=4.52*
Hypertensive disease (morbidity/mortality)	*RR=1.15*	*RR=1.33;* **RR=1.4 (25g)**	*RR=1.53*	*RR=1.77*	*RR=2.04*	*RR=2.35*	*RR=2.71*	*RR=3.12*	*RR=3.60*	*RR=4.15*
Ischemic heart disease (morbidity/mortality)		**RR=0.80**	**RR=0.93 (31g)**		**RR=0.87**					**RR=1.13**
Ischemic stroke (morbidity/mortality)		**RR=0.9 (25g)**		*RR=1.12*	**RR=1.4**	*RR=1.73*	*RR=2.04*	*RR=2.21*	*RR=2.12*	*RR=1.72*
Haemorrhagic stroke (morbidity/mortality)	*RR=1.16*	*RR=1.35;* **RR=1.5 (25g)**	*RR=1.57*	*RR=1.82*	*RR=2.12;* **RR=2.1**	*RR=2.46*	*RR=2.86*	*RR=3.32*	*RR=3.86*	*RR=4.48;* **RR=4.5**
Tuberculosis (morbidity)				**RR=2.94**						
Bone health (hip fracture risk)	RR=0.84 (≤7g)	**RR=0.80 (7-14g);** RR=0.91 (14-28g)	**RR=1.39 (>28g)**							
Overweight/Obesity/Weight Gain (morbidity)‡	**OR=0.94 (≤4.9g), OR=0.92 (≤14.9g)**	**OR=0.86 (≤29.9g)**	**OR=1.07 (≥30g)**							

* Confidence intervals not reported for all effect sizes. Significance levels are not provided where numbers in italics. Shaded text/boxes denote a different study's results included for same disease condition Please see synthesis tables in Appendix H for the confidence intervals for relative risks (where available). Please see synthesis tables in Appendix H for the confidence intervals for relative risks (where available).

** Data not available for women for alcohol dependence, all-cause mortality <45 years of age.. Effect sizes not available for exact alcohol consumption for cognitive decline; effect sizes not available for diabetes, suicide attempt/ideation. More details available in Appendix H and I.

†Risk per 100 drinkers – data from Australian guidelines which set risk at this level. For example, a woman who has 3 standard drinks daily (30 g) has a lifetime risk of over 2 in 100 of dying from alcohol-related conditions/injury. These risk levels are for daily drinking at these amounts. ‡ Data from a prospective cohort study; not a SR/meta-analysis.

Table 3. Effect sizes for health impacts of alcohol consumption for men

	Effect sizes for health impacts of alcohol consumption (g/day) for men*									
Disease Conditions**	10g	20g	30g	40g	50g	60g	70g	80g	90g	≥100g
All-cause mortality (<45 years)	RR=1.09 (>0-10g)	**RR=1.40 (>10-20g)**	**RR=1.78 (>20-30g)**	**RR=1.89 (>30-40g)**	**RR=2.86 (>40-70g)**	**RR=2.86 (>40-70g)**	**RR=2.04 (>70-110g)**	**RR=2.04 (>70-110g)**	**RR=2.04 (>70-110g)**	**RR=2.04 (>70-110g)**
All-cause mortality (≥45 years)	**RR=0.85 (>0-10g)**	**RR=0.80 (>10-20g)**	**RR=0.91 (>20-30g)**	RR=0.96 (>30-40g)	**RR=1.04 (>40-70g)**	**RR=1.04 (>40-70g)**	**RR=1.27 (>70-110g)**	**RR=1.27 (>70-110g)**	**RR=1.27 (>70-110g)**	**RR=1.46 (>110g)**
Alcohol-related mortality†	*0.41 in 100*	*0.92 in 100*	*2.76 in 100*	*4.20 in 100*	*5.81 in 100*	*9.09 in 100*	*12.17 in 100*	*14.83 in 100*		
Injury mortality†	*0.20 in 100*	*0.48 in 100*	*1.50 in 100*	*2.21 in 100*	*3.11 in 100*	*5.29 in 100*	*7.51 in 100*	*9.69 in 100*		
Injury hospitalization†	*5.89 in 100*	*12.71 in 100*	*19.86 in 100*	*23.63 in 100*	*27.06 in 100*	*32.74 in 100*	*37.06 in 100*	*40.06 in 100*		
Liver cirrhosis (mortality)	*RR=1.21*	*RR=1.45*	*RR=1.72*	*RR=2.02*	*RR=2.35*	*RR=2.71*	*RR=3.1*	*RR=3.51*	*RR=3.94*	*RR=4.38*
Liver cancer (mortality)	*RR=1.08*	*RR=1.15;* **RR=1.2 (25g)**	*RR=1.23*	*RR=1.31*	*RR=1.40;* **RR=1.4**	*RR=1.48*	*RR=1.56*	*RR=1.65*	*RR=1.73*	*RR=1.81;* **RR=1.8**
Lip, oral, pharyngeal cancer (mortality)	*RR=1.31*	*RR=1.67*	*RR=2.08*	*RR=2.53*	*RR=3.02*	*RR=3.53*	*RR=4.06*	*RR=4.58*	*RR=5.09*	*RR=5.57*
Oesophageal cancer (mortality)	*RR=1.17*	*RR=1.37*	*RR=1.61*	*RR=1.88*	*RR=2.19*	*RR=2.55*	*RR=2.95*	*RR=3.42*	*RR=3.94*	*RR=4.52*
Hypertensive disease (morbidity/mortality)	*RR=1.15*	*RR=1.33;* **RR=1.4 (25g)**	*RR=1.53*	*RR=1.77*	*RR=2.04;* **RR=2.0**	*RR=2.35*	*RR=2.71*	*RR=3.12*	*RR=3.60*	*RR=4.15;* **RR=4.1**
Ischemic heart disease (morbidity/mortality)		**RR=0.81**			**RR=0.87**			**RR=0.94 (87 g)**		**RR=1.13**
Ischemic stroke (morbidity/mortality)		**RR=0.9 (25g)**		*RR=1.12*	**RR=1.4**	*RR=1.73*	*RR=2.04*	*RR=2.21*	*RR=2.12*	*RR=1.72*
Haemorrhagic stroke (morbidity/mortality)	*RR=1.16*	*RR=1.35;* **RR=1.5 (25g)**	*RR=1.57*	*RR=1.82*	*RR=2.12;* **RR=2.1**	*RR=2.46*	*RR=2.86*	*RR=3.32*	*RR=3.86*	*RR=4.48;* **RR=4.5**
Tuberculosis (morbidity)				**RR=2.94**						
Bone health (hip fracture risk)‡	RR=0.84 (≤7g)	**RR=0.80 (7-14g);** RR=0.91 (14-28g)	**RR=1.39 (>28g)**							
Overweight/Obesity/Weight Gain (morbidity)			⬆BMI, weight							

*Confidence intervals not reported for all effect sizes. Significance levels are not provided where numbers in italics. Shaded text/boxes denote a different study's results included for same disease condition. Please see synthesis tables in Appendix H for the confidence intervals for relative risks (where available). ** Effect sizes not available for exact alcohol consumption for cognitive decline; effect sizes not provided for diabetes, alcohol use disorder, suicide attempt/ideation. More details are available in Appendix H and I.

†Risk per 100 drinkers – data from Australian guidelines which set risk at this level. For example, a man who has 4 standard drinks daily (40 g) has a lifetime risk of over 4 in 100 of dying from alcohol-related conditions/injury. These risk levels are for daily drinking at these amounts. ‡ Data from a prospective cohort study; not a SR/meta-analysis.

Summary of health outcomes related to alcohol consumption

<u>All-cause mortality</u>

As the average volume of alcohol consumption increases, the lifetime risk of alcohol-related disease increases. For younger men (<45 years old), there is a linear relationship between the volume of alcohol consumed and all-cause mortality (RR=1.09 at >10g/day). However, for both men and women over age 45, a J-shaped relationship emerges, with women experiencing deleterious effects from alcohol at lower levels of consumption than men (RR=0.87 at >10g/day for women; RR=0.85 at >10 g/day for men; RR=1.40 at >30-50g/day for women; RR=0.96 at >30-40 g/day for men). The J-shaped curve may be because of the beneficial effects of alcohol on coronary heart disease and ischemic stroke, and the detrimental effect of alcohol on other health conditions.

<u>Cancers</u>

Many types of cancer are related to alcohol consumption and mortality risk increases with increasing alcohol consumption. Mortality risk increases even at 10g per day for lip, oral, and pharyngeal (RR=1.31 for men and RR=1.33 for women), oesophageal (RR=1.17), and breast cancers (RR=1.08).

<u>Stroke and Heart Disease</u>

On the one hand, beneficial effects are seen for ischaemic stroke and heart disease morbidity and mortality at low levels of alcohol consumption; particularly for those over 45 years of age who drink moderately and on a regular basis (significant protective effect up to 31g/day for women: RR=0.93; up to 87g/day

for men: RR=0.94). On the other hand, irregular heavy drinking (i.e., binge drinking) increases the risk for heart disease. As well, alcohol consumption at 10g per day is detrimental for hypertensive disease (RR=1.15) and haemorrhagic stroke (RR=1.16).

Bone Health

There is a J-shaped association between alcohol consumption and incidence of hip fracture, with detrimental effects seen at more than 28g per day (RR=1.39). A linear relationship was seen between femoral neck and vertebral spine bone density and alcohol consumption. An inverse relationship was seen in studies that examined bone density loss over time and alcohol consumption in women; in contrast, a U-shaped relationship was found for men.

Alcohol-related liver disease

An increased risk of mortality from alcohol-related liver disease (cirrhosis) is seen at 10g per day (RR=1.21 for men; RR=1.32 for women). Increased risk for liver cancer is also seen at 10g per day (RR=1.08).

Injury

Strong evidence exists that drinking alcohol increases the risk of unintentional injuries, including falls, motor vehicle crashes and drowning. When alcohol is consumed in moderation, evidence for risk of injury is less well established for activities like swimming and athletic participation. The risk of death from injury

is higher for men than for women at all levels of drinking (risk of hospitalization for injury is 4.89 for women and 5.89 for men, per 100 drinkers at 10g/day).

Mental health and Cognitive disorders

Mental health disorders (e.g., depression, suicide), violence, and other types of social harm also increase with alcohol consumption. There is an increased risk of suicide, suicide attempts, and other violent incidence among heavy drinkers/alcohol abusers and with frequency of intoxication. The risk for alcohol-use disorder increases with the amount of alcohol consumed per day (risk is approximately 5% at 20g/day). Neuropsychiatric disorders (e.g., alcohol use disorders, depression) account for the largest proportion of alcohol-attributable disease burden (36.4%) as measured by disability-adjusted life years.

In older people, small to moderate amounts of alcohol consumption were associated with a decrease in dementia and Alzheimer's disease.

Social harm

Divorce, marital problems and child abuse may be associated with increased alcohol consumption. There is also some indication of negative effects of alcohol consumption on work-related problems. Evidence is insufficient for many of these social harms – limited in terms of quality and quantity of studies.

<u>Tuberculosis</u>

The risk of developing tuberculosis increases with alcohol abuse (RR= 2.94 at

≥40 g/day); no risk is found at lower drinking levels (i.e., threshold effect).

<u>Overweight/Obesity/Diabetes</u>

Moderate drinking is not associated with weight gain but heavier consumption

over time is detrimental (for men, risk increases >30 g/day; for women, OR=1.07

≥ 30 g/day). There is suggestive evidence of a protective effect of low levels of

drinking for Type 2 diabetes.

Overall limitations of the literature reviewed

Many methodological limitations exist in the alcohol research literature

reviewed. In the survey-based research there are issues related to self-report

including recall bias, underestimation of alcohol consumption, and social

desirability bias. Concerns over legal issues may encourage people to either

overestimate amount consumed (to excuse socially undesirable behaviour) or

underestimate amount consumed (to avoid liability).

Other limitations of alcohol health research include publication bias; non-

standardized measures for alcohol consumption across studies; and different

definitions being used to classify lifelong abstainers versus people who quit

drinking. Individual variability is also not taken into account, which is an issue in

studies that used blood alcohol concentration; for example, in calculating risk for

injury. New evidence has emerged that was not reviewed (e.g., alcohol and

colorectal cancer, alcohol and gynaecological cancers). Finally, much of the literature is focused on mortality as an outcome, whereas morbidity and disability are important measures for public health.

Comparison of Canadian, Australian and American Alcohol Drinking Guidelines

We compared the Ontario guidelines, the new Canadian LRDG, the Australian alcohol drinking guidelines and the American Dietary Guidelines to assess the consistency of the recommendations. The results are shown in Table 4. The new Canadian LRDG had the highest daily limits (40.4g) and weekly limits (201.8g) for men. For women, the Ontario and new Canadian LRDG recommended similar daily limits (27.2g vs 26.9g), which were higher than the other drinking guidelines. The Australian drinking guidelines had the highest weekly limits for women (140g); these guidelines did not have sex/gender specific limits in comparison to the other three guidelines which do.

Table 4. Comparison of Alcohol Drinking Guidelines in Canada, Australia, and the United States

	Canada		Australia	United States
Source	**Ontario Low-Risk Drinking Guidelines (CAMH)**	**National Low-Risk Alcohol Drinking Guidelines**	**Australian Guidelines to Reduce Health Risks from Drinking Alcohol**	**Dietary Guidelines for Americans, 2010**
Year Published	2003	2011	2009	2010
Who are the guidelines for?	Adults of legal drinking age	Adults aged 25 to 65 years	Adults aged 18 years or older	Adults of legal drinking age
Standard drink size (amount of pure alcohol in grams)	13.60g (17.24ml)	13.45g (17.05ml)	10g (12.5ml)	14g (18ml)
To reduce long-term health risks				
Daily drinking limits	**Women**: No more than 2 drinks per day (27.2g) **Men**: No more than 2 drinks per day (27.2g)	**Women**: No more than 2 drinks per day (26.9g) **Men**: No more than 3 standard drinks per day (40.4g)	**Women**: No more than 2 drinks per day (20g) **Men**: No more than 2 drinks per day (20g)	**Women**: No more than 1 drink per day (14g) **Men**: No more than 2 drinks per day (28g)
Weekly drinking limits	**Women**: No more than 9 drinks per week (122.4g) **Men**: No more than 14 drinks per week (190.4g)	**Women**: No more than 10 drinks per week (134.5g) **Men**: No more than 15 drinks per week (201.8)	**Women**: No more than 14 drinks per week (140g) **Men**: No more than 14 drinks per week (140g)	**Women**: No more than 7 drinks per week (98g) **Men**: No more than 14 drinks per week (196g)
To reduce short-term health risks				
Limits to avoid excessive (heavy or binge) drinking	**Women**: No more than 2 drinks on any one day (27.2g) **Men**: No more than 2 drinks on any one day (27.2g)	**Women**: No more than 3 standard drinks in one day (40.4g) **Men**: No more than 4 standard drinks in one day (53.8g)	**Women**: No more than 4 drinks on a single occasion (40g) **Men**: No more than 4 drinks on a single occasion (40g)	**Women**: No more than 3 drinks on any day or within 2 hours of consumption (42g)* **Men**: No more than 4 drinks on any day or within 2 hours of consumption (56g)*

* Please note that these drinking limits for reducing excessive drinking were derived from the definitions of heavy drinking and binge drinking stated in the Dietary Guidelines for Americans. The guidelines provided a general statement to remind drinkers to avoid excessive alcohol consumption. The drinking limits here are consistent with those defined by the National Institute on Alcohol Abuse and Alcoholism. As a general rule, alcohol should be limited to no more than 1 drink per day for women and 2 drinks per day for men.

9 Applicability and Transferability

Peel Public Health staff involved in alcohol-related programming met on April 10 2013 for a facilitated discussion. The group discussed the findings of the rapid review and implications of the report for the Region of Peel.

<u>Applicability</u>

Political Acceptability/Leverage

- Broad-based interest in Ontario and Canada in alcohol consumption and sensible alcohol use; the National Alcohol Strategy was released in 2007 to establish a common understanding of what constitutes sensible drinking and to provide a bench mark for Canadians in evaluating their personal drinking practices (i.e., the development of the new Canadian LRDG).

- Alcohol is a legal substance in Canada. Public Health has a role in promoting safe levels of drinking for our population.

- Public Health Units are required to report drinking levels in their community to the Ministry of Health and Long-Term Care. This Accountability Indicator is currently tied to the LRDG.   It is politically acceptable to promote safe levels of drinking that are relevant to our community.

Social Acceptability

- It is important to understand what is acceptable risk to the Peel community (i.e., health risks from alcohol). What is considered 'normal' drinking here in Peel with its cultural diversity?

- Peel Public Health needs to provide accurate information to the community; to support evidence-based decision-making based on the risks of different levels of consumption and patterns of drinking. The communication strategy will need to be carefully crafted to provide nuanced messaging about drinking.

- 'No amount of alcohol consumption is safe during pregnancy' is the current messaging from Peel Public Health's Family Health Division; there is a high level of knowledge about the risk of drinking during pregnancy in our community.[15] Peel Public Health could consider increasing messaging about alcohol intake during the preconception period and about gender/sex differences in health risks from alcohol consumption.

Available Essential Resources

- SM/IP, Family Health and Tobacco staff members from Peel Public Health have expertise in promoting safe levels of alcohol consumption.

- A number of health agencies (Public Health Units, Public Health Ontario, CAMH, CCSA, etc), have materials available to support safe levels of drinking.

- More data will be available in Peel Public Health's Alcohol Health Status Report that will be released later in 2013. The data utilized in this rapid review will also be used to inform this Health Status Report.

Organizational Expertise and Capacity

- Staff from the SM/IP team, as well as Tobacco, School Health, Family Health, Healthy Sexuality, and Workplace Health teams from Peel Public Health already provide expertise and collaborate on alcohol-related programs/projects.

- The Physician Outreach Specialist and the Office of the Medical Officer of Health at Peel Public Health already actively engage in messaging/communications to health care professionals around safe levels of alcohol consumption.

- Alcohol policy initiatives can be leveraged on the SM/IP team (i.e., Safer Bars initiative; residence policy at University of Toronto, Mississauga campus).

Transferability

Magnitude of Health Issue in Local Setting

- Approximately 71% of Peel adults over 19 years and older reported alcohol consumption in a 2009/10 survey; males are more likely to consume alcohol than females (79.5% vs 63.4, respectively).

- By applying the new LRDG criteria, 8.1% more male Peel residents would be considered low-risk drinkers than under the more conservative Ontario guidelines (83.8% vs 75.7%, respectively).

Magnitude of Reach and Cost Effectiveness of Interventions

- Even under the new LRDG, 13.2% (N= 123,800) of our population are drinking over the recommended limit. Population level interventions will be needed to reach this high-risk group.

- Health care professionals can be leveraged to discuss health risks and benefits associated with alcohol consumption with their patients/clients.

Target Population Characteristics

- Peel has a diverse population; some of the studies used to inform the rapid review may not be reflective of our population. Our data indicates that many of

the diverse cultures here in Peel do not drink alcohol (see Appendix C).

However, our youth and non-immigrant populations may be engaging in high-risk

drinking behaviours and these groups may need targeted

messaging/programming (see Appendix C).

10 Recommendations and Next Steps

Recommendations

It is recommended that Peel Public Health:

- Use the risk information acquired in the rapid review to inform the Alcohol Health

  Status report for Peel (e.g., what is the alcohol-attributable risk for Peel, with

  which conditions should we be most concerned?).

- Use the information of lifetime health risks at varying levels of alcohol

  consumption to focus messaging and interventions for the Peel population.

- Develop programming to reduce alcohol-related risk for Peel's 'at risk'

  populations (i.e., youth, the elderly, men drinking above the guidelines).

- Use the framework of the MOHLTC's accountability agreement (i.e., %

  adherence to LRDG) to build alcohol programming specific to Peel's situation.

Next Steps

- Explore targeted messaging promoting low-risk drinking that is appropriate to the

  Peel context.

- Investigate interventions targeted at identifying and reducing 'high risk' alcohol consumption (i.e., physician screening, interventions for licensed establishments)

- Discuss alcohol policy approaches and what action we can take as a Public Health Unit/Regional Municipality as well as with other key stakeholders locally and provincially.

- Build on internal and external partnerships seeking opportunities for alcohol related programming that addresses both short and long term risks.

- Continue to monitor the research and address gaps/limitations of the literature included in the rapid review (e.g., mental health, other health conditions not included).

References

[1] Butt, P., Beirness, D., Cesa, F., Gliskman, L., Paradis, C., & Stockwell, T. (2011). Alcohol and health in Canada: A summary of evidence and guidelines for low risk drinking. Ottawa ON: Canadian Centre on Substance Abuse.

[2] Canadian Centre on Substance Abuse. Canadian Low-Risk Alcohol Drinking Guidelines.   Retrieved on November 22 2012 from: http://www.ccsa.ca/Eng/Priorities/Alcohol/Canada-Low-Risk-Alcohol-Drinking-Guidelines/Pages/default.aspx

[3] Centre for Addiction and Mental Health (2003). Low-Risk Drinking Guidelines. Retrieved on November 22 2012 from: http://www.lrdg.net/guidelines.html

[4] International Center for Alcohol Policy. International Drinking Guidelines. Retrieved on November 22 2012 from http://www.icap.org/

[5] Global Alcohol Policy Alliance. Statement of Concern submitted to the WHO Secretariat (February 8 2013). The International Public Health Community responds to the Global Alcohol Producers' attempts to implement the WHO Global Strategy on the harmful use of alcohol. Retrieved from: http://www.globalgapa.org/

[6] Peel Health Status Data retrieved on February 4 2013 from: http://www.peelregion.ca/health/statusdata/HealthBehaviours/alcohol-health.asp

[7] Data from National Ambulatory Care Reporting System 2006, Provincial Health Planning Database, Ontario Ministry of Health and Long-Term Care.   Accessed from draft report, 'Alcohol use in Peel and Ontario, 2009', prepared by epidemiology team at Peel Public Health, Mississauga, ON.

[8] Rehm, J., Baliunas, D., Brochu, B., Fischer, W., Gnam, J., Patra, S., Popova, A. Sarnocinska-Hart, B., with Adlaf, M, and Recel, E., (2006). The costs of substance abuse in Canada 2002. Ottawa ON: Canadian Centre on Substance Abuse.

[9] Rehm, J., Kehoe, T., Taylor, B., & Patra, J., with the assistance of S. Popova, (2009). Evidence Base for the Development of Canadian Drinking Guidelines. Report prepared by the Centre for Addiction and Mental Health for the Canadian Centre on Substance Abuse on behalf of the Low-Risk Drinking Guidelines Expert Working Group.

[10] Datta, S., Funnell, K., & Ramuscak, N. (2012). Textbook and textbook chapter critical appraisal tool. Peel Public Health, Mississauga, ON.

[11] Brouwers M, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, Fervers B, Graham ID, Grimshaw J, Hanna S, Littlejohns P, Makarski J, Zitzelsberger L for the AGREE Next Steps Consortium. AGREE II: Advancing guideline development, reporting

and evaluation in healthcare. *Can Med Assoc J. 2010.* Dec 2010; 182:E839-842; doi:10.1503/090449

[12] Babor, T., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., et al. (2010). Alcohol: No Ordinary Commodity. Research and public policy. (2nd Ed.). Oxford University Press: New York.

[13] National Health and Medical Research Council. Australian Guidelines to reduce health risks from Drinking Alcohol. (2009). Retrieved on November 23 2012 from: http://www.nhmrc.gov.au/your-health/alcohol-guidelines

[14] U.S. Department of Agriculture and U.S. department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7th edition. Washington, DC: U.S. Government Printing Office, December 2010. Retrieved on November 24 2012 from: www.dietaryguidelines.gov

[15] Kusi-Achampong, M., Gayle-Thompson, E., & Caprara, R. (2011). Effective interventions to prevent alcohol-exposed pregnancies: A rapid review of the literature. Peel Public Health, Mississauga, ON.

References Used in Synthesis Tables

Andreaason, S., Allebeck, P., Romelsjo, A. (1988). Alcohol and mortality among young men: longitudinal study of Swedish conscripts. *British Medical Journal, 296*, 1021-1025.

Ashley, M.J., Rehm, J., Bondy, S., Single, E., & Rankin, J. (2000). Beyond ischemic heart disease: Are there other health benefits from drinking alcohol? *Contemporary Drug Problems, 27,* 735-77.

Bagnardi, V., Zatonski, W., Scott, L., La Vecchia, C., & Corrao, G. (2008). Does drinking pattern modify the effect of alcohol on the risk of coronary heart disease? Evidence from a meta-analysis. *Journal of Epidemiology and Community Health, 62*, 615-9.

Berg, K. M., Kunins, H. V., Jackson, J.L., Nahvi, S., Chaudhry, A., Harris, K.A., et al., (2008). Association between alcohol consumption and both osteoporotic fracture and bone density. *The American Journal of Medicine, 121,* 406-418.

Borges, G., Cherpitel, C., Orozco, R. et al. (2006). Multicenter study of acute alcohol use and non-fatal injuries: data from the WHO Collaborative Study on Alcohol and Injuries. *Bulletin of the World Health Organization, 84(6),* 453–60.

Collaborative Group on Hormonal Factors in Breast Cancer. (2002). Alcohol, tobacco and breast cancer – collaborative reanalysis of individual data from 53 epidemiological studies, including 58 515 women with breast cancer and 95 067 women without the disease. *British Journal of Cancer, 87*, 1234-1245.

Corrao, G., Bagnardi, V., Zambon, A., & Arico, S. (1999). Exploring the dose-response relationship between alcohol consumption and the risk of several alcohol-related conditiopns: A meta-analysis. *Addiction, 94*, 1551-1573.

Corrao, G., Rubbiatai, L., Bagnardi, V., Zambon, A., & Poikolainen, K. (2000). Alcohol and coronary heart disease: A meta-analysis. *Addiction, 95*, 1505-1523.

Corrao, G., Bagnardi, V., Zambon, A., & La Vecchia, C. (2004). A meta-analysis of alcohol consumption and the risk of 15 diseases. *Preventive Medicine, 38,* 613-619.

Dawson., D. A. (1997). Alcohol, drugs, fighting, and suicide attempt/ideation. *Addiction Research, 5,* 451-472.

Eckardt, M.J., File, S.E., Gessa, G.L., Grant, K. A., Guerri, C., Hoffman, P.L., et al. (1998). Effects of moderate alcohol consumption on the central nervous system. *Alcoholism: Clinical and Experimental Research, 212*, 998-1040.

Fu, H., & Goldman, N. (2000). Association between health-related behaviours and the risk of divorce in the USA. *Journal of Biosocial Science, 32*, 63-88.

Gmel, G., Gutjahr, E., & Rehm, J. (2003). How stable is the risk curve between alcohol and all-cause mortality and what factors influence the shape? A precision-weighted hierarchical meta-analysis. *European Journal of Epidemiology, 18*, 631-642.

Gruenewald, P.J., Mitchell, P. R., & Treno, A. J. (1996). Drinking and driving: drinking patterns and drinking problems. *Addiction, 91,* 1637-1649.

Leonard, K. E., & Rothbard, J. C. (1999). Alcohol and the marriage effect. *Journal of Studies on Alcohol, Suppl. 13*, 139-46S.

Lonroth, K., Williams, B.G., Stadlin, S., Jaramillo, E., & Dye, C. (2008). Alcohol use as a risk factor for tuberculosis – a systematic review. *BMC Public Health, 8*, 289-291

Peters, R., Peters, J., Warner, J., Beckett, N., & Bulpitt, C. (2008). Alcohol, dementia, and cognitive decline in the elderly: A systematic review. *Age and Ageing, 37,* 505-512.

Rehm, J.T., Gutjahr, E., & Gmel, G. (2001). Alcohol and all-cause mortality: A pooled analysis. *Comtemporary Drug Problems, 28*, 337-61.

Rehm, J.T., Room, R., & Taylor, B. (2008). Method for moderation: measuring lifetime risk of alcohol-attributable mortality as a basis for drinking guidelines. *International Journal of Methods in Psychiatric Research, 17*, 141-151.

Rehm, J. T., Mathers, C., Popova, S., Thavorncharoensap, M., Teerawattanon, Y., & Patra, J. (2009). Global burden of disease and injury and economic cost attributable to alcohol use and alcohol use disorders. *Lancet, 373,* 2223-33.

Rossow, I. (2000). Suicide, violence and child abuse: Review of the impact of alcohol consumption on social problems. *Contemporary Drug Problems, 27*, 397-434.

Single, E., Robson, L., Rehm, J., & Xie, X. (1999). Morbidity and mortality attributable to alcohol, tobacco, and illicit drug use in Canada. *American Journal of Public Health, 89*, 385-390.

Wannamethee, S. G., Shaper, A. G. (2003). Alcohol, body weight, and weight gain in middle-aged men. *American Journal of Clinical Nutrition. 77*, 1312-7.

Wannamethee, S. G., Field, A.E., Colditz, G.A., & Rimm, E.B. (2004). Alcohol intake and 8-year weight gain in women: A prospective study. *Obesity Research, 12,* 1386-1396.

Wright, C. B., Elkind, M. S., Luo, X., Paik, M.C., Sacco, R. L. Reported alcohol consumption and cognitive decline: the Northern Manhattan study. *Neuroepidemiology, 27*, 201-207.

Appendices

Appendix A: Comparison of Ontario guidelines and new Canadian LRDG

Appendix B: Critical appraisal of new Canadian LRDG

Appendix C: Profile of Peel Drinkers

Appendix D: Canadian risk data for health impacts from alcohol consumption

Appendix E: Conceptual Model

Appendix F: Search Strategy

Appendix G: Literature Search Flowchart

Appendix H: Synthesis Tables

Appendix I: Data Extraction Tables

Appendix J: Applicability & Transferability Worksheet

Appendix A: Comparison between previous Ontario LRDG (2003) and new Canadian guidelines (2011).

Previous ON LRDG (2003)		New Canadian LRDG (2011)	
A "standard drink" is equal to a 341 ml (12 oz.) bottle of 5% strength beer, cider or cooler; a 142 ml (5 oz.) glass of 12% strength wine; or a 43 ml (1.5 oz.) shot of 40% strength spirits (NB: 1 Canadian standard drink = 17.05 ml or 13.45 g of ethanol)			
To Reduce Short-term Health Risks			
0 = lowest risk		0 = lowest risk	
≤ 2 standards drinks on any one day		Women ≤ 3 standard drinks on any single occasion (should only happen occasionally)	Men ≤ 4 standard drinks on any single occasion (should only happen occasionally)
To Reduce Long-term Health Risks			
Women	Men	Women	Men
0-2 standard drinks per day; ≤ 9 standards drinks per week	0-2 standard drinks per day; ≤ 14 standard drinks per week	0-2 standard drinks per day; ≤ 10 standards drinks per week	0-3 standard drinks per day; ≤ 15 standard drinks per week
Comparison			
▪ No guidelines specified.		▪ There are a total of 5 specific guidelines.	
▪ Provided situations when one should not drink.		▪ Guideline 1 outlines situations when one should not drink (similar but enhanced from old guidelines)	
▪ Same average daily recommended alcohol consumption for men and women to reduce short-term health risks. ▪ Different weekly alcohol consumption for men and women to reduce long-term health risks.		▪ Guideline 2 & 3 address the most notable changes to the average recommended daily/weekly alcohol consumption for men and women to reduce short and long-term health risks. ▪ In addition, the average drinking level for special occasion is recommended.	
▪ Previous guidelines noted pregnancy or planning to become pregnant under "the guidelines do not apply to you" and "tips for following the guidelines".		▪ Guideline 4 specifically addresses the safest option of no drinking alcohol at all during pregnancy or when planning to become pregnant.	
▪ Previous guidelines stated that the low-risk drinking guidelines were for people of legal drinking age. ▪ Recommended talking to kids about alcohol under the "Tips for following the guidelines".		▪ Guideline 5 addresses alcohol consumption for youth and children which should be delayed at least until the late teens and be consistent with local legal drinking age laws.	
▪ No mention of guidelines for seniors or Aboriginals		▪ Stated that no separate guidelines for older adults needed as major risk factors are identified under other guidelines; recommended need for consultation with Aboriginals.	

Ontario's previous LRDG (2003)

0	Zero drinks = lowest risk of an alcohol-related problem
2	No more than 2 standard drinks on any one day
9	Women – up to 9 standard drinks a week
14	Men – up to 14 standard drinks a week

- If you don't already drink, don't start for "health reasons".
- If you do drink, avoid getting drunk or intoxicated.
- Wait **at least one hour** between drinks.
- Have something to eat.
- Drink non-alcoholic beverages, such as water, soft drinks, or fruit juice.

The Low-Risk Drinking Guidelines are for people of legal drinking age.

The Guidelines do not apply if you:

- have health problems, such as liver disease or mental illness
- are taking medications, such as sedatives, painkillers, or sleeping pills
- have a personal or family history of drinking problems
- have a family history of cancer or other risk factors for cancer
- are pregnant, trying to get pregnant, or breastfeeding
- will be operating vehicles such as cars, trucks, motorcycles, boats, snowmobiles, all-terrain vehicles, or bicycles
- need to be alert; for example, if you will be operating machinery or working with farm implements or dangerous equipment
- will be doing sports or other physical activities where you need to be in control
- are responsible for the safety of others at work or at home
- are told not to drink for legal, medical, or other reasons

If you are concerned about how drinking may affect your health, check with your doctor.

Tips for following these Guidelines:

- Know what a standard drink is.
- Keep track of how much you drink — daily and weekly.
- Never drink and drive, nor ride with a driver who has been drinking.
- Don't start drinking for "health reasons". To keep your heart healthy, eat better, exercise more, and don't smoke.
- Don't drink if you are pregnant or planning to become pregnant.
- Be a responsible host — encourage your guests to follow these guidelines.
- Talk to your kids about alcohol.
- Find out about programs and policies that support low-risk drinking.
- Develop an alcohol policy for your home, workplace, school, and/or community organization. Check the APN website for some sample policies.

Canada's First Low-Risk Alcohol Drinking Guidelines (2011)

Recommended Guidelines for Low-Risk Drinking		
Note: These Guidelines are not intended to encourage people who choose to abstain for cultural, spiritual or other reasons to drink, nor are they intended to encourage people to commence drinking to achieve health benefits. People of low bodyweight or who are not accustomed to alcohol are advised to consume below these maximum limits.		

Guideline 1 Do not drink in these situations:	When operating any kind of vehicle, tools or machinery; using medications or other drugs that interact with alcohol; engaging in sports or other potentially dangerous physical activities; working; making important decisions; if pregnant or planning to be pregnant; before breastfeeding; while responsible for the care or supervision of others; if suffering from serious physical illness, mental illness or alcohol dependence.	
Guideline 2 If you drink, reduce *long-term* health risks by staying within these **average** levels:	**Women**	**Men**
	0–2 standard drinks* per day No more than 10 standard drinks per week	0–3 standard drinks* per day No more than 15 standard drinks per week
	Always have some non-drinking days per week to minimize tolerance and habit formation. Do not increase drinking to the upper limits as health benefits are greatest at up to one drink per day. Do not exceed the daily limits specified in Guideline 3.	
Guideline 3 If you drink, reduce *short-term* risks by choosing safe situations and restricting your alcohol intake:	Risk of injury increases with each additional drink in many situations. For both health and safety reasons, it is important not to drink more than: ▪ Three standard drinks* in one day for a woman ▪ Four standard drinks* in one day for a man Drinking at these upper levels should only happen *occasionally* and always be consistent with the *weekly* limits specified in Guideline 2. It is especially important on these occasions to drink with meals and not on an empty stomach; to have no more than two standard drinks in any three-hour period; to alternate with caffeine-free, non-alcoholic drinks; and to avoid risky situations and activities. Individuals with reduced tolerance, whether due to low bodyweight, being under the age of 25 or over 65 years old, are advised to never exceed Guideline 2 upper levels.	
Guideline 4 When pregnant or planning to be pregnant:	*The safest option during pregnancy or when planning to become pregnant is to not drink alcohol at all.* Alcohol in the mother's bloodstream can harm the developing fetus. While the risk from light consumption during pregnancy appears very low, there is no threshold of alcohol use in pregnancy that has been definitively proven to be safe.	
Guideline 5 Alcohol and young people:	Alcohol can harm healthy physical and mental development of children and adolescents. Uptake of drinking by youth should be delayed at least until the late teens and be consistent with local legal drinking age laws. Once a decision to start drinking is made, drinking should occur in a safe environment, under	

	parental guidance and at low levels (i.e., one or two standard drinks* once or twice per week). From legal drinking age to 24 years, it is recommended women never exceed two drinks per day and men never exceed three drinks in one day.

Appendix B: Critical appraisal of Canada's Low-Risk Alcohol Drinking Guidelines

Guideline Title	Canada's Low-Risk Alcohol Drinking Guidelines			
Organization	Canadian Centre on Substance Abuse			
Date	2011			
Country	Canada			
Guideline Development Summary	An independent Low-Risk Drinking Guidelines Expert Advisory Panel was convened by the National Alcohol Strategy Advisory Committee and included representatives from addiction research agencies from across Canada. Financial and in-kind support for the development of the guidelines was provided by the organizations represented on the Panel. All members of the Panel declared no conflict of interest (N.B. Membership of the Committee includes Alcohol Industry representatives). A summary of evidence is provided in the background report – *Alcohol and Health in Canada: A Summary of Evidence and Guidelines for Low-Risk Drinking*. The guidelines highlighted in the Report are intended to help members of the public reduce their risk from drinking alcohol; they are not intended to be used as clinical practice guidelines.			
Quality rating (using AGREE II tool)	Reviewer #1 (SK) Overall assessment: 4/7 Scope & Purpose – 16/21 Stakeholder involvement – 13/21 Rigour of development – 25/56 Clarity of presentation – 19/21 Applicability – 6/28 Editorial independence – 7/14 Recommended for use – No.	Reviewer #1 (PB) Overall assessment: 4/7 Scope & Purpose – 17/21 Stakeholder involvement – 14/21 Rigour of development – 21/56 Clarity of presentation – 20/21 Applicability – 15/28 Editorial independence – 6/14 Recommended for use – No.	Reviewer #1 (LG) Overall assessment: 3/7 Scope & Purpose – 16/21 Stakeholder involvement – 12/21 Rigour of development – 29/56 Clarity of presentation – 16/21 Applicability – 10/28 Editorial independence – 7/14 Recommended for use – No.	Reviewer #1 (TW) Overall assessment: 4/7 Scope & Purpose – 16/21 Stakeholder involvement – 12/21 Rigour of development – 25/56 Clarity of presentation – 17/21 Applicability – 12/28 Editorial independence – 9/14 Recommended for use – Yes, with modifications.
Definition of Canadian Standard Drink	1 Canadian standard drink = 17.05 ml or 13.45 g of ethanol. A standard drink is equal to a 341 ml (12 oz) bottle of 5% strength beer, cider or cooler; a 142 ml (5 oz) glass of 12% strength wine; or a 43 ml (1.5 oz) shot of 40% strength spirits.			
Summary of Guidelines	**See Appendix A**			

Appendix C: Profile of Peel Drinkers

Table 1. Types of Drinkers in Peel compared to Ontario, over age 19

Indicator	Peel (2009/10)			ON (2009/10)		
	Estimated Population	%	CI	Estimated Population	%	CI
Regular Drinker[†]	**548,000**	**56.5**	**53.1-59.8**	**6,106,900**	**62.0**	**61.1-63.0**
Male	322,400	68.3	63.8-72.5	3,458,800	72.2	71.0-73.5
Female	225,600	45.3	40.7-50.0	2,648,100	52.4	51.1-53.7
Occasional Drinker[†]	**143,000**	**14.7**	**12.6-17.2**	**1,588,900**	**16.1**	**15.5-16.9**
Males	52,600	11.2	8.7-14.2	537,200	11.2	10.4-12.1
Females	90,300	18.1	14.8-22.1	1,051,700	20.8	19.8-21.9
Non-drinker	**279,100**	**28.8**	**25.8-32.0**	**2,147,400**	**21.8**	**21.0-22.7**
Males	96,800	20.5	16.9-24.6	792,800	16.6	15.5-17.7
Females	182,200	36.6	32.1-41.3	1,354,600	26.8	25.6-28.0
Total Population	**970,100**	**100**		**9,843,200**	**99.9**	
Weekly Drinker	**362,000**	**52.4**	**48.5-56.3**	**4,228,800**	**54.9**	**53.9-56.0**
Males	236,200	63.0	57.9-67.9	2,598,800	65.0	63.6-66.5
Females	125,800	39.8	34.3-45.5	1,630,000	44.1	42.6-45.5
Daily Drinker	**72,900**	**10.6**	**8.3-13.3**	**795,700**	**10.3**	**9.8-10.9**
Males	53,300	14.2	10.6-18.8	540,100	13.5	12.6-14.5
Females	19,600*	6.2*	4.4-8.8	255,600	6.9	6.3-7.5

*Use estimate with caution; [†] Occasional drinker is defined as drinking less than once per month; Regular drinker is defined as drinking once per month or more frequently; Non-drinker is defined as no alcohol in last 12 months; Weekly drinker is defined as drinking weekly; Daily drinker is defined as drinking daily.

Source: Canadian Community Health Survey, Statistics Canada, Share File, Ontario Ministry of Health and Long-Term Care

Table 2. Profile of Current Drinkers in Peel compared to Ontario, over age 19 in 2009/10

	Peel			Ontario		
	#	%	CI	#	%	CI
Total	691,800	71.3	(68.1-74.2)	7,713,000	78.2	(77.4-79.0)
MALE	375,200	79.5	(75.4-83.1)	4,003,700	83.5	(82.4-84.5)
FEMALE	316,600	63.5	(58.7-68.0)	3,709,300	73.2	(72.0-74.5)
19-24	86,700	72.3	(63.4-79.7)	883,900	83.6	(81.0-86.0)
25-44	275,900	71.0	(65.7-75.8)	2,870,300	80.1	(78.7-81.5)
45-64	259,800	76.2	(70.8-80.8)	2,836,400	79.9	(78.4-81.4)
65+	69,300	57.1	(49.2-64.7)	1,122,400	67.1	(65.5-68.7)
Lowest to middle	13,600	50.1	(35.3-64.9)	294,900	61.9	(57.5-66.1)
Middle	55,200	47.7	(39.1-56.5)	737,000	63.3	(60.8-65.8)
Upper-Middle	166,200	67.1	(59.2-74.1)	1,848,200	77.0	(75.2-78.7)
Highest	335,000	84.0	(80.1-87.2)	3,629,100	87.8	(86.7-88.8)
Not Stated	121,800	67.2	(60.2-73.5)	1,203,700	71.4	(69.2-73.6)
< THAN SECONDARY	67,400	60.2	(51.0-68.7)	769,400	63.7	(61.4-65.9)
SECONDARY GRAD.	131,100	66.1	(57.2-74.0)	1,304,600	74.9	(72.5-77.2)
OTHER POST-SEC.	47,500	69.9	(58.1-79.6)	648,300	83.9	(81.3-86.2)
POST-SEC. GRAD.	441,400	75.8	(72.1-79.1)	4,883,900	81.9	(80.9-82.9)
Recent immigrant	88,100	48.8	(41.0-56.5)	480,200	53.6	(49.7-57.6)
Long-term immigrant	274,900	67.5	(62.0-72.5)	1,681,800	69.6	(67.4-71.7)
Non-immigrant	323,900	87.6	(84.4-90.2)	5,465,600	85.4	(84.8-86.1)
White	432,700	89.0	(86.5-91.1)	6,150,800	84.9	(84.2-85.5)
Black	49,600	77.9	(67.8-85.6)	209,200	63.5	(56.7-69.8)
East/Southeast Asian	65,100	57.4	(47.4-66.9)	480,000	57.8	(53.3-62.2)
West Asian/Arab	5,500*	30.7*	(15.1-52.5)	97,800	55.0	(45.7-64.0)
South Asian	80,800	38.9	(32.3-46.0)	256,200	42.9	(38.4-47.6)
Latin American	21,800*	64.1*	(28.7-88.8)	117,200	79.8	(66.8-88.6)
Other	22,500	76.4	(59.3-87.7)	137,400	76.5	(68.2-83.2)
Aboriginal	6,700	83.2	(53.3-95.6)	159,400	79.5	(75.3-83.2)
Not Stated	7,100*	67.0*	(41.8-85.1)	105,000	69.3	(59.8-77.4)

Current drinker defined as those who have had a drink in the last 12 months.
Use estimate with caution
NR - Not releasable due to small numbers
Source: Canadian Community Health Survey 2009/10 Statistics Canada, Share File, Ontario Ministry of Health and Long-Term Care

Table 3. Percent of the Population 19 years and older who adhere to the old LRDG, Peel, 2009/2010

	Total				Males				Females		
	#	%	CI		#	%	CI		#	%	CI
Total	777,200	82.8	(80.0-85.2)		353,200	75.7	(71.3-79.6)		424,000	89.7	(86.5-92.3)
19-24	94,900	80.5	(73.2-86.1)		42,700	73.6	(61.2-83.2)		52,200	87.1	(79.7-92.1)
25-44	300,900	82.4	(78.0-86.0)		137,300	73.7	(66.8-79.6)		163,600	91.4	(86.8-94.5)
45-64	269,400	80.0	(74.4-84.6)		123,100	73.6	(65.1-80.7)		146,300	86.3	(78.4-91.6)
65+	112,100	94.0	(90.9-96.1)		50,200	90.9	(84.8-94.7)		61,900	96.7	(93.7-98.3)
Lowest to middle	24,800	94.3	(86.0-97.8)		11,400	91.7	(74.1-97.7)		13,400	96.7	(88.8-99.1)
Middle	101,800	93.6	(88.5-96.5)		42,700	92.4	(82.6-96.9)		59,100	94.5	(87.9-97.6)
Upper-Middle	208,600	86.4	(81.6-90.2)		88,500	78.0	(69.4-84.7)		120,000	93.9	(89.4-96.6)
Highest	288,600	74.3	(69.4-78.6)		150,700	68.2	(61.4-74.3)		138,000	82.3	(75.1-87.7)
Not Stated	153,400	88.1	(81.1-92.7)		59,900	81.4	(68.2-90.0)		93,500	92.9	(84.8-96.9)
< THAN SECONDARY	90,900	82.5	(74.2-88.5)		44,300	78.1	(65.9-86.9)		46,600	87.1	(74.2-94.1)
SECONDARY GRAD.	163,700	84.6	(78.5-89.2)		62,200	75.7	(65.2-83.9)		101,500	91.0	(83.4-95.4)
OTHER POST-SEC.	55,100	82.5	(73.5-89.0)		30,800	78.5	(64.5-88.0)		24,300	88.3	(78.3-94.1)
POST-SEC. GRAD.	460,600	82.2	(78.5-85.4)		213,500	75.0	(69.1-80.1)		247,100	89.7	(85.1-93.0)
Recent immigrant	153,300	90.9	(85.2-94.6)		75,700	87.7	(79.4-92.9)		77,600	94.3	(83.2-98.2)
Long-term immigrant	353,100	88.5	(84.8-91.4)		163,000	81.0	(74.4-86.2)		190,100	96.0	(93.5-97.6)
Non-immigrant	261,900	72.5	(67.5-77.0)		110,100	63.6	(56.1-70.4)		151,800	80.8	(74.2-86.1)
White	348,300	73.6	(69.1-77.7)		159,200	65.5	(58.7-71.7)		189,100	82.3	(76.6-86.8)
Black	55,800	90.0	(79.2-95.5)		26,500	88.8	(76.7-95.0)		29,300	91.1	(68.2-98.0)
East/Southeast Asian	103,100	93.4	(88.3-96.4)		48,100	89.2	(79.9-94.5)		55,100	97.4	(91.6-99.2)
West Asian/Arab	16,200	99.0	(93.0-99.9)		9,500	98.3	(88.1-99.8)		6,700	100.0	(100.0-100.0)
South Asian	184,600	93.3	(89.6-95.7)		86,600	86.7	(79.6-91.6)		98,000	100.0	(100.0-100.0)
Latin American	32,500	97.4	(91.2-99.3)		8,800	93.7	(76.0-98.6)		23,600	98.9	(91.7-99.9)
Other	23,300	79.6	(64.0-89.6)		9,500	74.0	(50.7-88.8)		13,800	84.0	(59.8-94.9)
Aboriginal	6,200*	80.3*	(40.3-96.1)		NR	NR			NR	NR	
Not Stated	7,200*	79.0*	(41.7-95.2)		3,400*	67.7*	(22.0-94.0)		3,800	92.6	(60.5-99.0)

Note: Low risk drinking includes females who have 9 or less drinks in the past week, males who have 14 or less drinks in the past week and no more than 2 drink on each day of the week for both males and females.

Pregnant and lactating women are excluded from analysis.

Source: Canadian Community Health Survey 2009/2010 Statistics Canada, Share File, Ontario Ministry of Health and Long-Term Care.

Table 4. Percent of the population 19 years and older who adhere to the new LRDG, Peel, 2009/2010

	Total				Males				Females		
	#	%	CI		#	%	CI		#	%	CI
Total	815,300	86.8	(84.4-88.9)		391,000	83.8	(80.1-86.9)		424,400	89.8	(86.5-92.4)
19-24	100,200	85.0	(79.0-89.5)		47,900	82.8	(72.6-89.7)		52,200	87.1	(79.7-92.1)
25-44	317,600	86.9	(83.2-89.9)		154,000	82.7	(76.7-87.3)		163,600	91.4	(86.8-94.5)
45-64	282,400	83.9	(78.6-88.0)		135,700	81.2	(73.5-87.0)		146,700	86.5	(78.6-91.8)
65+	115,200	96.6	(94.4-98.0)		53,300	96.6	(92.2-98.5)		61,900	96.7	(93.7-98.3)
Lowest to middle	24,900	94.8	(86.2-98.1)		11,500	92.6	(74.2-98.2)		13,400	96.7	(88.8-99.1)
Middle	102,100	93.8	(88.7-96.7)		42,900	92.9	(82.8-97.2)		59,100	94.5	(87.9-97.6)
Upper-Middle	211,900	87.8	(83.0-91.4)		91,900	81.0	(72.3-87.4)		120,000	93.9	(89.4-96.6)
Highest	319,100	82.1	(77.9-85.7)		180,700	81.8	(76.4-86.2)		138,400	82.5	(75.3-87.9)
Not Stated	157,300	90.4	(83.4-94.6)		63,800	86.8	(72.9-94.1)		93,500	92.9	(84.8-96.9)
< THAN SECONDARY	92,400	83.9	(75.8-89.6)		45,900	80.8	(69.1-88.8)		46,600	87.1	(74.2-94.1)
SECONDARY GRAD.	170,200	87.9	(82.0-92.0)		68,700	83.6	(73.3-90.5)		101,500	91.0	(83.4-95.4)
OTHER POST-SEC.	55,800	83.5	(74.5-89.8)		31,500	80.2	(66.2-89.3)		24,300	88.3	(78.3-94.1)
POST-SEC. GRAD.	488,500	87.2	(84.0-89.9)		241,100	84.7	(79.8-88.6)		247,500	89.8	(85.3-93.1)
Recent immigrant	158,500	94.0	(88.9-96.9)		80,800	93.7	(88.0-96.8)		77,600	94.3	(83.2-98.2)
Long-term immigrant	364,300	91.3	(88.2-93.6)		173,800	86.4	(80.9-90.5)		190,500	96.2	(93.7-97.8)
Non-immigrant	282,200	78.1	(73.4-82.2)		130,300	75.2	(68.1-81.2)		151,800	80.8	(74.2-86.1)
White	377,500	79.8	(75.7-83.3)		188,000	77.3	(71.2-82.4)		189,500	82.4	(76.7-87.0)
Black	56,600	91.3	(80.3-96.5)		27,300	91.5	(80.2-96.7)		29,300	91.1	(68.2-98.0)
East/Southeast Asian	104,800	94.9	(90.6-97.3)		49,700	92.3	(84.5-96.3)		55,100	97.4	(91.6-99.2)
West Asian/Arab	16,200	99.0	(93.0-99.9)		9,500	98.3	(88.1-99.8)		6,700	100.0	(100.0-100.0)
South Asian	188,100	95.1	(91.6-97.1)		90,100	90.2	(83.6-94.3)		98,000	100.0	(100.0-100.0)
Latin American	32,800	98.4	(92.9-99.6)		9,100	96.9	(79.9-99.6)		23,600	98.9	(91.7-99.9)
Other	24,400	83.2	(67.3-92.2)		10,600	82.1	(57.8-93.9)		13,800	84.0	(59.8-94.9)
Aboriginal	6,200*	80.3*	(40.3-96.1)		NR	NR			NR	NR	
Not Stated	8,900	96.6	(78.8-99.5)		5,000	100.0	100.0-100.0		3,800	92.6	(60.5-99.0)

Note: Low risk drinking includes females who have 10 or less drinks in the past week and no more than 2 drinks on each day of the week
and males who have 15 or less drinks in the past week and no more than 3 drinks on each day of the week.

Pregnant and lactating women are excluded from analysis.

Source: Canadian Community Health Survey 2009/2010 Statistics Canada, Share File, Ontario Ministry of Health and Long-Term Care.

Appendix D: Canadian risk data for health impacts from alcohol consumption.

Table 1. Relative risks for health impacts for various level s of average consumption of alcohol in Canadian drink sizes

Disease	1 drk per day (13.6 g)			2 drks per day (27.2 g)			3-4 drinks per day 3.5 drks (47.6 g)		
	RR	LB	UB	RR	LB	UB	RR	LB	UB
Tuberculosis	1.00	1.00	1.00	1.00	1.00	1.00	2.94	1.89	4.59
Oral Cavity and Pharynx Cancer	1.42	1.38	1.47	1.96	1.84	2.07	2.97	2.73	3.23
Oral Oesophagus Cancer	1.20	1.18	1.21	1.43	1.40	1.46	1.87	1.80	1.94
Colon Cancer	1.03	1.01	1.05	1.05	1.01	1.09	1.09	1.02	1.17
Rectum Cancer	1.05	1.04	1.06	1.10	1.07	1.13	1.18	1.13	1.23
Liver Cancer	1.10	1.07	1.14	1.21	1.13	1.29	1.38	1.23	1.54
Larynx Cancer	1.21	1.19	1.24	1.47	1.42	1.53	1.95	1.83	2.08
Breast Cancer	1.13	1.10	1.15	1.27	1.22	1.32	1.52	1.41	1.63
Ischaemic heart disease	0.81	0.78	0.83	0.81	0.78	0.84	0.86	0.81	0.91
Epilepsy	1.19	1.14	1.24	1.41	1.30	1.52	1.81	1.58	2.06
Conduction Disorders and other Dysrythmias	1.08	1.05	1.11	1.17	1.11	1.23	1.32	1.20	1.45
Pancreatitis	1.03	1.02	1.04	1.12	1.09	1.15	1.41	1.31	1.52
Lower Respiratory Infections	1.07	1.01	1.12	1.14	1.03	1.26	1.25	1.05	1.50
Hemorrhagic Stroke – morbidity MEN	1.11	1.06	1.16	1.23	1.13	1.34	1.44	1.25	1.67
Hemorrhagic Stroke – morbidity WOMEN	0.71	0.55	0.91	0.86	0.65	1.14	1.18	0.85	1.64
Haemorrhagic Stroke – mortality MEN	1.10	1.07	1.13	1.21	1.14	1.28	1.39	1.25	1.54
Haemorrhagic Stroke – mortality WOMEN	1.22	1.11	1.34	1.49	1.23	1.80	2.01	1.44	2.80
Ischemic Stroke – morbidity MEN	0.87	0.81	0.94	0.94	0.88	1.01	1.07	0.98	1.15
Ischemic Stroke – morbidity WOMEN	0.82	0.74	0.92	0.87	0.77	0.99	1.01	0.88	1.16
Ischemic Stroke – mortality MEN	0.87	0.81	0.94	0.95	0.89	1.02	1.08	1.01	1.16
Ischemic Stroke – mortality WOMEN	0.66	0.55	0.79	0.75	0.63	0.89	1.05	0.91	1.21
Diabetes Mellitus – MEN	0.88	0.80	0.97	0.88	0.74	1.03	0.94	0.71	1.23
Diabetes Mellitus – WOMEN	0.64	0.57	0.72	0.60	0.52	0.71	0.96	0.65	1.40
Hypertension – MEN	1.13	1.10	1.16	1.28	1.22	1.35	1.54	1.41	1.69
Hypertension – WOMEN	0.99	0.80	1.22	1.48	1.10	1.99	2.61	1.76	3.86
Liver Cirrhosis – morbidity MEN	1.26	1.20	1.33	1.59	1.43	1.76	2.24	1.87	2.67
Liver Cirrhosis – morbidity WOMEN	2.39	2.03	2.82	3.42	2.72	4.31	5.08	3.75	6.88
Liver Cirrhosis – mortality MEN	0.38	0.33	0.44	0.76	0.66	0.87	1.33	1.16	1.51
Liver Cirrhosis – mortality WOMEN	1.21	1.04	1.37	1.70	1.47	1.94	2.25	1.94	2.56
Low Birth Weight	1.05	0.97	1.13	1.29	1.15	1.45	1.84	1.53	2.22

| Disease	5-6 drinks per day 5.5 drks (74.8 g)			More than 6 drinks per day ->9 drks (122.4 g)		
	RR	LB	UB	RR	LB	UB
Tuberculosis	2.94	1.89	4.59	2.94	1.89	4.59
Oral Cavity and Pharynx Cancer	4.68	4.22	5.19	7.97	7.03	9.04
Oral Oesophagus Cancer	2.64	2.50	2.79	4.67	4.27	5.09
Colon Cancer	1.15	1.04	1.28	1.26	1.06	1.50
Rectum Cancer	1.30	1.22	1.39	1.53	1.38	1.71
Liver Cancer	1.60	1.37	1.88	1.99	1.60	2.47
Larynx Cancer	2.81	2.55	3.09	4.99	4.34	5.73
Breast Cancer	1.93	1.72	2.16	2.93	2.44	3.53
Ischaemic heart disease	0.98	0.90	1.06	1.31	1.15	1.48
Epilepsy	2.52	2.05	3.10	4.53	3.24	6.33
Conduction Disorders and other Dysrythmias	1.54	1.33	1.78	2.02	1.59	2.58
Pancreatitis	2.33	1.92	2.81	9.51	5.74	15.76
Lower Respiratory Infections	1.43	1.08	1.89	1.79	1.13	2.84
Hemorrhagic Stroke - morbidity/MEN	1.78	1.41	2.24	2.56	1.76	3.74
Hemorrhagic Stroke - morbidity/WOMEN	1.78	1.18	2.69	3.49	1.94	6.30
Haemorrhagic Stroke - mortality/MEN	1.68	1.42	1.98	2.33	1.77	3.06
Haemorrhagic Stroke - mortality/WOMEN	2.99	1.78	5.04	6.02	2.57	14.09
Ischemic Stroke - morbidity/MEN	1.25	1.13	1.38	1.63	1.39	1.89
Ischemic Stroke - morbidity/WOMEN	1.31	1.10	1.55	2.21	1.65	2.96
Ischemic Stroke - mortality/MEN	1.29	1.17	1.41	1.70	1.47	1.98
Ischemic Stroke - mortality/WOMEN	1.86	1.46	2.38	5.97	3.26	10.96
Diabetes Mellitus - MEN	1.11	0.71	1.74	1.72	0.76	3.87
Diabetes Mellitus - WOMEN	8.39	1.93	36.49	16.60	2.72	101.3
Hypertension - MEN	1.97	1.71	2.27	3.03	2.40	3.83
Hypertension - WOMEN	5.17	3.12	8.55	15.14	7.79	29.40
Liver Cirrhosis – morbidity MEN	3.54	2.68	4.68	7.91	5.01	12.47
Liver Cirrhosis – morbidity WOMEN	7.66	5.24	11.21	13.51	8.31	21.97
Liver Cirrhosis – mortality MEN	2.09	1.82	2.37	3.42	2.97	3.88
Liver Cirrhosis – mortality WOMEN	2.82	2.43	3.20	3.60	3.10	4.10
Low Birth Weight	3.07	2.27	4.15	7.85	4.63	13.33

Table 2. Relative risks for various levels of acute consumption of alcohol before the event for non-motor vehicle injuries (Canadian drink sizes)

Dose (grams of pure alcohol)	OR predicted	95% LB	95% UB
0	1	1	1
13.6	1.40	1.30	1.52
27.2	1.92	1.70	2.18
40.8	2.62	2.23	3.09
54.4	3.56	2.92	4.35
68	4.84	3.83	6.12
81.6	6.57	5.02	8.59
95.2	8.90	6.59	12.03
108.8	12.07	8.65	16.82
122.4	16.34	11.36	23.50

Table 3. Relative risks for various levels of acute consumption of alcohol before the event for motor vehicle injuries (Canadian drink sizes)

Dose (grams of pure alcohol)	OR predicted	95% LB	95% UB
0	1	1	1
13.6	1.57	1.49	1.64
27.2	2.45	2.23	2.69
40.8	3.83	3.33	4.40
54.4	6.00	4.98	7.22
68	9.38	7.44	11.83
81.6	14.69	11.12	19.40
95.2	22.98	16.61	31.79
108.8	35.96	24.82	52.11
122.4	56.28	37.08	85.41

Figure 1. Effects of different level of drinking on premature mortality in Canada in 2002 (for people ≤ 70 years of age).
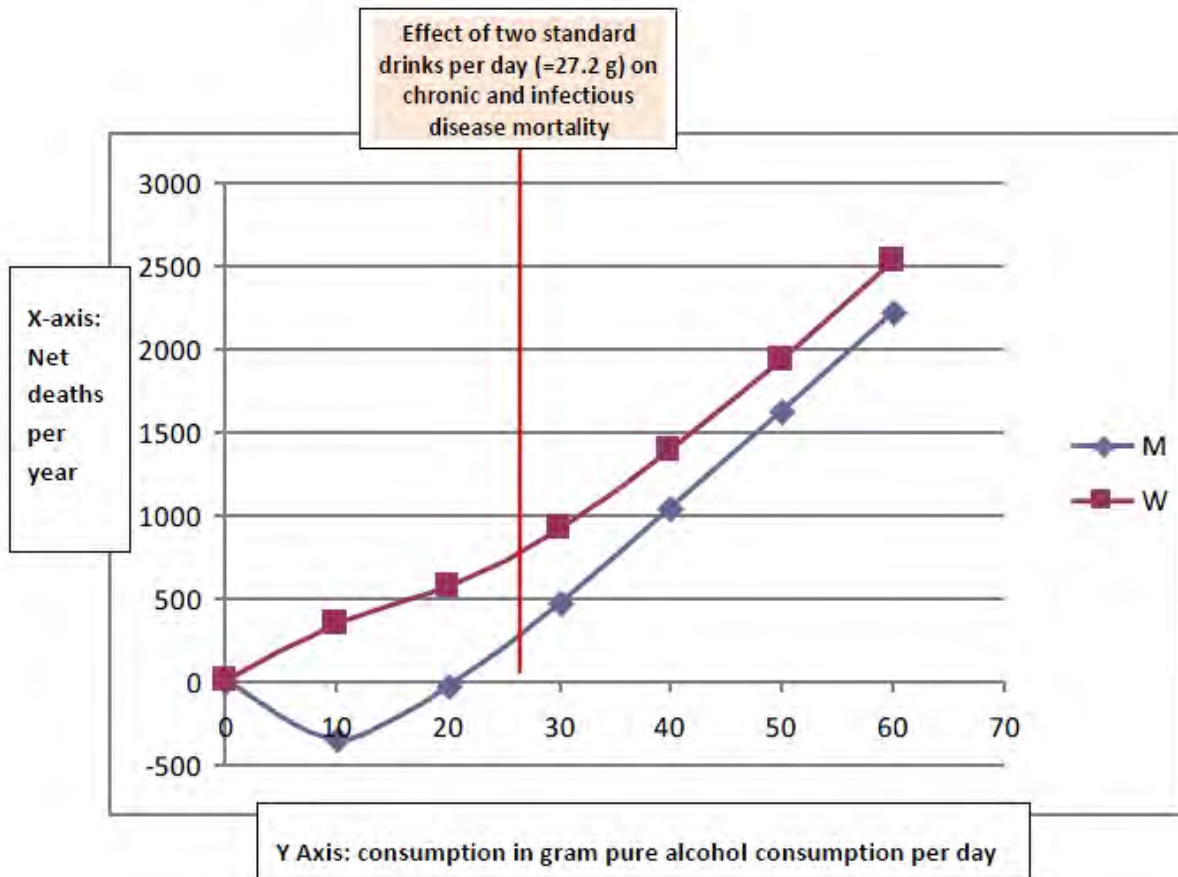
Data source: Rehm, J, Kehoe, T, Taylor, B., Patra, J. with the assistance of S. Popova. (2009). Evidence base for the development of Canadian Drinking Guidelines. Report prepared by the Centre for Addiction and Mental Health for the Canadian Centre on Substance Abuse on behalf of the Low-Risk Drinking Guidelines Expert Working Group.

Appendix E: Conceptual Model

What is the impact of different levels of alcohol consumption on mental and physical health?
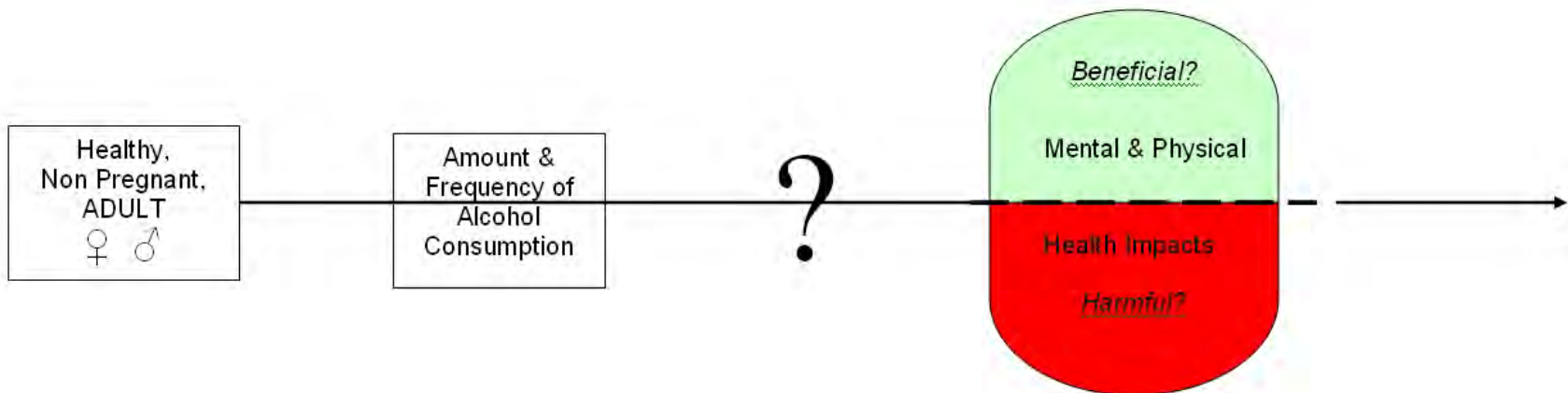
Appendix F: Search Strategy

PECO Question

P (Population)	Health, non-pregnant, adults (25 and over)
E (Exposure)	Various levels of alcohol consumption
C (Comparison)	None/adult lifetime abstainers
O (Outcome)	Beneficial and harmful impacts of alcohol on physical and mental health

Search Terms

	Population	Intervention or Exposure	Comparisons	Outcomes
Terms	Healthy, non pregnant adults, aged 25-65 years of age	Varying levels of alcohol consumption	None/adult lifetime abstainers	Physical or mental health impacts, can be harmful or beneficial

	• Male
	• Female
	• Age 19+
	• Those that have attained the age of majority
	• Not pregnant
	• Healthy
		Alcohol:
		• Ethanol
		• Alcohol
		• Beer
		• Wine
		• Spirit
		• Coolers
		
		Levels of consumption:
		• Low levels
		• Moderate levels
		• High levels
		• Glasses
		• Servings
		• Ounces
		• Milliliters
		• Number of drinks
		• Alcohol concentration
		• Binge
		• Blood Alcohol Concentration
				• Injury
				• Acute illness
				• Psychological effects
				• Violence
				• Psychosocial
				• Mental Health
				• Epilepsy
				• Pancreatitis
				• Hemorrhagic stroke
				• Dysrhythmias
				• Liver cirrhosis
				• Hypertension
				• Cancer
				  o Mouth
				  o Pharynx
				  o Larynx
				  o Esophagus
				  o Liver
				  o Breast
				  o Colon
				  o Rectum
				• Alcohol toxicity
				• Alcohol poisoning
				• Alcohol dependence syndrome
				• Alcoholic psychosis
				• Nervous system degeneration
				• Alcoholic polyneuropathy

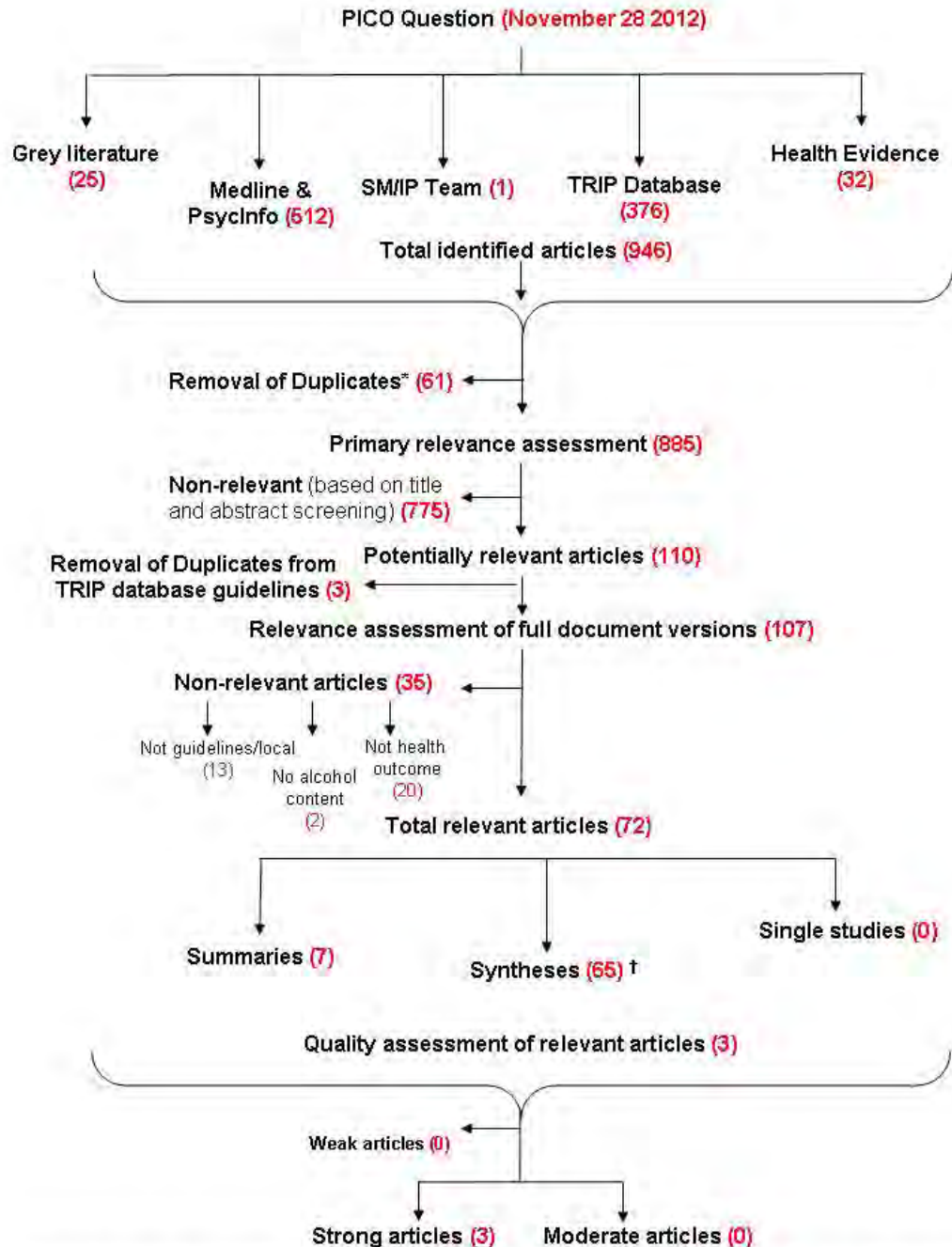|	Population	Intervention or Exposure	Comparisons	Outcomes
Terms	Healthy, non pregnant adults, aged 25-65 years of age	Varying levels of alcohol consumption	None/adult lifetime abstainers	Physical or mental health impacts, can be harmful or beneficial
				• Alcoholic myopathy • Alcoholic cardiomyopathy • Alcoholic gastritis • Alcohol liver diseases and hepatitis • Alcohol induced pancreatitis • Mortality • Morbidity • All-cause mortality

Search Results

Source	Date	Terms used/Limits	# of findings
TRIP database	November 15 2012	'Alcohol drinking' (proximity 3 words) AND 'health outcome' OR 'benefit' OR 'risk' OR 'harm' OR 'health'; NOT 'pregnant', 'pregnancy', 'fetal alcohol syndrome', 'prenatal', 'neonatal'; dates 2000-2013; Guidelines	376
OVID Medline 1946-2012, PsychINFO 2002-2012	November 28 2012	1 Alcohol Drinking/ (47738) 2 exp Ethanol/ (90221) 3 exp Alcoholic Beverages/ (13811) 4 Alcoholic Intoxication/ (10627) 5 exp "Wounds and Injuries"/ (660836) 6 exp Social Problems/ (277642) 7 exp Neoplasms/ (2432868) 8 exp Epilepsy/ (132621) 9 exp Pancreatitis/ (41280) 10 exp Cerebral Hemorrhage/ (26844) 11 exp Stroke/ (83172) 12 exp Arrhythmias, Cardiac/ (156123) 13 exp Liver Cirrhosis/ (67460) 14 exp Hypertension/ (202518) 15 exp Mental Disorders/ (1089818) 16 exp Violence/ (96265) 17 psych*.ti. (333585) 18 low level*.tw. (99689) 19 binge.tw. (10500) 20 moderate level*.tw. (6554) 21 high level*.tw. (174060) 22 glass*.tw. (55977) 23 serving*.tw. (30166) 24 ounce*.tw. (856) 25 millilitre*.tw. (790) 26 number of drink*.tw. (935) 27 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 (358654) 28 alcohol*.tw. (241086) 29 27 and 28 (11267) 30 1 or 2 or 3 or 4 or 29 (152704) 31 Alcoholism/ (71781) 32 Psychoses, Alcoholic/ (2240) 33 exp Nerve Degeneration/ (22076) 34 Alcoholic Neuropathy/ (83) 35 exp Muscular Diseases/ (126040) 36 Cardiomyopathy, Alcoholic/ (687) 37 exp Gastritis/ (17406) 38 exp Liver Diseases, Alcoholic/ (11480) 39 Pancreatitis, Alcoholic/ (842) 40 exp Mortality/ (271995) 41 exp Morbidity/ (334425) 42 exp Diabetes Mellitus/ (294234) 43 exp Heart Diseases/ (841284) 44 lower risk*.tw. (14202)	456

		45 exp Brain Ischemia/ (76395) 46 exp Myocardial Ischemia/ (338575) 47 alcohol related death*.tw. (207) 48 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 (6341783) 49 30 and 48 (60986) 50 limit 49 to yr="2002 -Current" (24836) 51 meta-analys*.tw. (52571) 52 guideline*.tw. (176530) 53 systematic review*.tw. (42388) 54 51 or 52 or 53 (254009) 55 50 and 54 (759) 56 guideline*.ti. (45040) 57 meta-analys*.ti. (26095) 58 review*.ti. (279674) 59 56 or 57 or 58 (343756) 60 50 and 59 (633) 61 limit 60 to yr="2007 -Current" (466) 62 limit 61 to english language (445) 63 limit 62 to yr="2008 -Current" (396) 64 exp alcohols/ (539907) 65 exp alcohol drinking patterns/ (20045) 66 exp Chronic Alcoholic Intoxication/ or exp Acute Alcoholic Intoxication/ (64751) 67 2 or 3 or 29 or 64 or 65 or 66 (631474) 68 exp injuries/ (670849) 69 pancreatitis.tw. (40628) 70 heart disorders/ or cardiovascular disorders/ or "arrhythmias (heart)"/ (7603) 71 "cirrhosis (liver)"/ (53428) 72 exp Alcoholic Psychosis/ (234) 73 nerve damage.tw. (3605) 74 nerve degener*.tw. (692) 75 exp Peripheral Neuropathy/ or exp Neuropathy/ (120465) 76 exp Muscular Disorders/ (25673) 77 alcoholic cardiomyopathy.mp. (428) 78 exp Myopathy/ (126385) 79 exp Gastrointestinal Disorders/ (702078) 80 exp liver disorders/ (1934) 81 exp cerebral ischemia/ or cerebrovascular disorders/ (116430) 82 exp Ischemia/ (52320) 83 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 (1805465) 84 67 and 83 (30696) 85 59 and 84 (461) 86 limit 85 to (english language and	

		yr="2008 -Current") (140) 87 63 or 86 (512) 88 remove duplicates from 87 (456)	
Health Evidence	December 3 2012	'Alcohol drinking' OR 'alcohol abuse/use'	32
Grey literature/websites: NIAAA, WHO, CDC	December 3 2012	Alcohol guidelines; major reports on alcohol and health impacts/chronic disease	25
SM/IP Team	December 6 2012	None	1

Appendix G: Literature Search Flowchart

PICO Question (November 28 2012)

Grey literature (25)

Medline & PsycInfo (512)

SM/IP Team (1)

TRIP Database (376)

Health Evidence (32)

Total identified articles (946)

Removal of Duplicates* (61)

Primary relevance assessment (885)

Non-relevant (based on title and abstract screening) (775)

Removal of Duplicates from TRIP database guidelines (3)

Potentially relevant articles (110)

Relevance assessment of full document versions (107)

Non-relevant articles (35)

Not guidelines/local (13)

No alcohol content (2)

Not health outcome (20)

Total relevant articles (72)

Summaries (7)

Syntheses (65) †

Single studies (0)

Quality assessment of relevant articles (3)

Weak articles (0)

Strong articles (3)

Moderate articles (0)

*Removal of duplicates between Medline/PsychINFO results and TRIP database was not possible. This was done at the relevance assessment step. † Excluded lower-level syntheses at this step.
Source: Health-evidence.ca.(2009, November 25). *Keeping Track of Search Results: A Flowchart.* [Retrieved January 13, 2013]. http://www.health-evidence.ca/public/tools/10/Keeping_Track_of_Search_Results_-_A_Flowchart.ppt

Appendix H: Detailed Synthesis Table

Impact of alcohol consumption on health by critically appraised resources.

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
Alcohol and All-Cause Mortality				
Detrimental Effect	**Yes: Linear relationship**			**Detrimental effect at low levels of drinking (<10g/day).**
• Population	Men <45 years			
• Level of consumption	**Low levels < 10g/day** Men: RR=1.09 (95%CI: 0.93-1.27) at >0-10g/day; RR=1.40 (95%CI: 1.18-1.68) at >10-20g/day; RR=1.78 (95%CI: 1.43-2.22) at >20-30g/day; RR=1.89 (95%CI: 1.41-2.54) at >30-40g/day; RR=2.86 (95%CI: 2.13-3.84) at >40-70g/day; RR=2.04 (95%CI: 1.14-3.65) at >70-110g/day (Rehm, Gmel, et al., 2001; Rehm, Gutjar et al., 2001)			
Detrimental Effect	**Yes: J-shaped relationship**	**Yes: J-shaped relationship**		**↟ risk for women at lower levels of consumption**
• Population	Both men and women ≥ 45 years	Both men and women ≥ 45 years		

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption	**Women experience negative effects at ↓ consumption levels than men** Women: RR=0.87 (95%CI: 0.84-0.89) at >0-10g/day; RR=1.01 (95%CI: 0.99-1.04) at >10-30g/day; RR=1.40 (95%CI: 1.34-1.47) at >30-50g/day; RR=1.43 (95%CI: 1.34-1.53) at >50g/day. Men: RR=0.85 (95%CI: 0.83-0.87) at >0-10g/day; RR=0.80 (95%CI: 0.78-0.82) at >10-20g/day; RR=0.91 (95%CI: 0.89-0.94) at >20-30g/day; RR=0.96 (95%CI: 0.93-1.00) at >30-40g/day; RR=1.04 (95%CI: 1.01-1.07) at >40-70g/day; RR=1.27 (95%CI: 1.23-1.31) at >70-110g/day; RR=1.46 (95%CI: 1.33-1.60) at >110g/day (Rehm, Gutjahr & Gmel, 2001).	Women: RR=0.87 (95%CI: 0.84-0.89) at >0-10g/day; RR=1.01 (95%CI: 0.99-1.04) at >10-30g/day; RR=1.40 (95%CI: 1.34-1.47) at >30-50g/day; RR=1.43 (95%CI: 1.34-1.53) at >50g/day (Gmel, Gutjahr & Rehm, 2003). Men: RR=0.85 (95%CI: 0.83-0.87) at >0-10g/day; RR=0.80 (95%CI: 0.78-0.82) at >10-20g/day; RR=0.91 (95%CI: 0.89-0.94) at >20-30g/day; RR=0.96 (95%CI: 0.93-1.00) at >30-40g/day; RR=1.04 (95%CI: 1.01-1.07) at >40-70g/day; RR=1.27 (95%CI: 1.23-1.31) at >70-110g/day; RR=1.46 (95%CI: 1.33-1.60) at >110g/day (Gmel, Gutjahr & Rehm, 2003).		**than men**
Alcohol-Related Mortality (death from disease and injury combined)				
Detrimental Effect		**Yes**		**Detrimental effect with overall risk ↑ by about 10% for**
• Population		Both men and women have similar risk of alcohol-related death below 40g/day		

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption		Level of acceptable risk identified at 1 in 100. **Men:** At 10g/day= 0.41 in 100; At 20g/day= 0.92 in 100; At 30g/day= 2.76 in 100; At 40g/day= 4.20 in 100; At 50g/day=5.81 in 100; At 60 g/day- 9.09 in 100; At 70g/day=12.17 in 100; At 80g/day=14.83 in 100. **Women:** At 10g/day= 0.29 in 100; At 20g/day= 0.77 in 100; At 30g/day = 2.32 in 100; At 40g/day =3.85. in 100; At 50g/day=5.52 in 100; At 60g/day=8.92 in 100; At 70g/day= 11.77 in 100; At 80g/day=13.70 in 100.		**each 10g.**
• Patterns of drinking		Drinking this amount daily		
Ischemic Heart Disease				
Beneficial Effect	**Yes**	**Yes: J-shaped relationship**	**Yes: ↓ risk CHD**	**Beneficial for moderate drinkers age > 45 who**
• Population	> 45 years	Not specified	Male and female	

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption	Light to moderate Alcohol consumption averted an estimated 7401 deaths (5162 men, 2239 in women)in Canada in 1992: 4205 deaths due to ischemic heart disease; 2965 deaths due to stroke; 183 deaths due to heart failure and other heart conditions; and 47 deaths from other causes (Single et al., 1999). Also used: RR=0.80 (95%CI: 0.78-0.83) at 20g/day (Corrao et al., 2000). Other data from Maclure et al., 1993; English et al., 1995; not shown here.	**Moderate to high: RR=1.01 and AAF=1.0 at 80g/day (8 standard drinks)** Risk for CHD: RR=0.81 (95%CI: 0.79-0.83) at 25g/day; RR=0.87 (95%CI: 0.84-0.90) at 50g/day; RR=1.13 (95%CI: 1.06-1.21) at 100g/day (Corrao et al., 2004). RR=0.80 (95%CI: 0.78-0.83) at 20g/day (Corrao et al., 2000).	**Moderate to high** Females: protective up to 31g/day – RR=0.93 (95%CI: 0.87-1.00). Harmful evident at 52g/day – RR=1.12 (95%CI: 1.00-1.26). Males: protective up to 87g/day – RR=0.94 (95%CI: 0.88-1.00). Harmful evident at 114g/day – RR=1.09 (95%CI: 1.00-1.19). (Corrao et al., 2000). Vascular disease: Statistically significant inverse relationship found for wine intake up to 150ml/day. RR=0.68 (95%CI: 0.59-0.77) comparing drinkers to non-drinkers (Di Castelnuovo et al., 2002).	**drink on a regular basis**
• Patterns of drinking	Regular drinking with meals; no heavy drinking episodes	Not specified	Regular light to moderate drinking	
Detrimental Effect	**Yes: ✦ risk for heart disease**	**Yes: ✦ risk for heart disease**	**Yes: ✦ risk for CHD**	**Detrimental when**

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level and patterns of drinking	**Irregular, heavy drinking** RR=1.05 (95%CI: 1.00-1.11) at 89g/day (Corrao et al., 2000).	**Heavy drinking: RR=1.01 and AAF=1.0 at 80g/day (8 standard drinks)** Risk for CHD: Heavy drinking: RR=1.13 (95%CI: 1.06-1.21) at 100g/day (Corrao et al., 2004). RR=1.05 (95%CI: 1.00-1.11) at 89g/day (Corrao et al., 2000).	**Heavy or binge drinking** RR=0.75 (95%CI: 0.64-0.89) for regular heavy drinkers; RR=1.10 (95%CI: 1.03-1.17) for heavy irregular drinkers. Definition of heavy drinking varied, minimum used ≈50g (Bagnardi et al., 2008).	**irregular, heavy-drinking episodes (>89 g/day)**
Ischaemic Stroke				
Beneficial Effect		**Yes: ⬇ risk of ischaemic stroke**		**Beneficial effect** **< 40g per day**
• Level of consumption		**Moderate to high levels: RR=1.12 and AAF=10.9 at 40g/day (4 standard drinks)** Risk for Ischaemic stroke: RR=0.9 (95%CI: 0.3-2.4) at 25g/day; RR=1.4 (95%CI: 0.1-43.4) at 50g/day; RR=1.4 (95%CI: 0.0-999.9) at 100g/day (Corrao et al., 1999).		
Detrimental Effect		**Yes: ⬆ risk at ⬆levels of consumption**		**Detrimental effect at >40g per day**
• Level of consumption		See above		
Haemorrhagic Stroke				
Detrimental Effect		**Yes: ⬆ risk with ⬆consumption**		**Detrimental effect seen at <10 g per**

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption		**Low levels: RR=1.16 and AAF=13.9 at 10g/day (1 standard drink)** Risk for haemorrhagic stroke: RR=1.5 (95%CI: 1.3-1.6) at 25g/day; RR=2.1 (95%CI: 1.8-2.5) at 50g/day; RR=4.5 (95%CI: 3.2-6.3) at 100g/day (Corrao et al., 1999).		**day**
Hypertensive Disease				
Detrimental Effect		**Yes: ↑ risk with ♠consumption**		**Detrimental effect seen at <10 g per day**
• Level of consumption		**RR=1.15 and AAF=13.3 at 10g/day (1standard drink)** RR=1.4 (95%CI: 1.3-1.5) at 25g/day; RR=2.0 (95%CI:1.8-2.3) at 50g/day; RR=4.1 (95%CI: 3.1-5.9) at 100g/day (Corrao et al., 1999).		
Breast Cancer				
Detrimental Effect	**Yes: ↑ risk with ♠consumption**	**Yes: ↑ risk with ♠consumption**		**Detrimental effect seen at <10 g per day**
• Population	Women	Women		

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption	**RR>1.0 at 10 g/day** RR=1.01 (SE=0.014) at <5g/day; RR=1.03 (SE=0.015) at 5-14g/day; RR=1.13 (SE=0.028) at 15-24g/day; RR=1.21 (SE=0.036) at 25-34g/day; RR=1.32 (95%CI: 1.19-1.45) at 35-44g/day, RR=1.46 (95%CI: 1.33-1.61) at ≥45g/day. RR ♠ by 7.1% for each ♠10g/day (Collaborative Group on Hormonal Factors in Breast Cancer, 2002).	**Mortality: RR=1.08 and AAF=7.4 at 10g/day (1 standard drink)** **Alcohol-related risk:** Mediterranean countries: RR=1.4 (95%CI: 1.3-1.5) at 25g/day; RR=1.8 (95%CI: 1.6-2.1) at 50g/day; RR=3.4 (95%CI: 2.6-4.6) at 100g/day. Other areas: RR=1.2 (95%CI: 1.0-1.4) at 25g/day; RR=1.5 (95%CI: 1.1-2.0) at 50g/day; RR=2.2 (95%CI: 1.1-4.0) at 100g/day (Corrao et al., 1999).		
• Patterns of drinking	♠risk with binge drinking (evidence suggestive)	Not specified		
Lip/Oral/Pharyngeal Cancer				
Detrimental Effect		**Yes: ♠ risk with ♠consumption**		**Detrimental effect seen at <10 g/day**
• Population		Men and women		

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption		**Mortality: RR= 1.31 (men) and 1.33 (women); and AAF=23.5 (men), 24.7 (women) at 10g/day (1 standard drink).** **Alcohol-related risk:** Men/Mediterranean: RR=2.2 (95%CI: 1.9-2.5) at 25g/day; RR=4.2 (95%CI: 3.0-5.5) at 50g/day. Men/Other: RR=1.9 (95%CI: 1.5-2.3) at 25g/day.; RR=3.0 (95%CI: 1.9-4.8) at 50g/day. Women/Mediterranean: RR=2.3 (95%CI: 1.7-3.0) at 25g/day; RR=4.5 (95%CI: 2.4-7.7)) at 50g/day.Women/Other: RR=1.9 (95%CI: 1.3-2.8) at 25g/day; RR=3.2 (95%CI: 1.5-7.1) at 50g/day. (Corrao et al., 1999).		
Oesophageal Cancer				
Detrimental Effect		**Yes: ✦ risk with ✦consumption**		**Detrimental effect seen at <10 g/day**
• Population		Men and women		

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption		**Mortality: RR=1.17 and AAF=14.6 at 10g/day (1 standard drink)** **Alcohol-related risk:** Mediterranean countries: RR=1.6 (95%CI: 1.5-1.7) at 25g/day; RR=2.5 (95%CI: 2.2-2.8) at 50g/day; RR=6.0 (95%CI: 4.6-7.8) at 100g/day. Other areas: RR=1.5 (95%CI: 1.3-1.7) at 25g/day; RR=2.2 (95%CI: 1.7-2.8) at 50g/day); RR=4.5 (95%CI: 2.6-7.8) at 100g/day (Corrao et al., 1999).		
Liver Cancer				
Detrimental Effect		**Yes: ♠ risk with ♠consumption**		**Detrimental effect seen at < 10g/day**
• Population		Men and women		
• Level of consumption		**Mortality: RR=1.08 at 10g/day (1 standard drink)** **Alcohol-related risk:** RR=1.2 (95%CI: 1.1-1.3) at 25g/day; RR=1.4 (95%CI: 1.2-1.6) at 50g/day; RR=1.8 (95%CI: 1.2-2.6) at 100g/day (Corrao et al., 1999).		
Alcohol-related Liver Disease (liver cirrhosis)				
Detrimental Effect		**Yes: ♠ risk with ♠consumption**		**Detrimental effect seen at < 10g/day**
• Population		Men and women.		

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption		**Mortality: RR= 1.21 (men), 1.32 (women) and AAF= 17.3 (men), 24.4 (women) at 10 g/day (1 standard drink).** **Alcohol-related risk:** Men/Mediterranean: RR=2.4 (95%CI: 2.1-2.2) at 25g/day; RR=5.5 (95%CI: 4.0-7.7) at 50g/day; RR=24.3 (95%CI: 10.3-52.7) at 100g/day. Men/Other: RR=1.6 (95%CI: 1.3-2.1) at 25g/day; RR=2.4 (95%CI: 1.5-4.2) at 50g/day; RR=4.4 (95%CI: 1.4-15.3) at 100g/day. Women/Mediterranean: RR=3.0 (95%CI: 2.1-4.6) at 25g/day; RR=8.7 (95%CI: 3.9-20.3) at 50g/day; RR=59.3 (95%CI: 10.7-301.1) at 100g/day. Women/Other: RR=2.0 (95%CI: 1.3-3.5) at 25g/day; RR=3.7 (95%CI: 1.3-9.7); RR=10.7 (95%CI: 1.3-77.7) at 100g/day. (Corrao et al., 1999).		
Alcohol Dependence/Alcoholism				
Detrimental Effect		**Yes: ⬆ risk with ⬆consumption**		**Detrimental effect seen at <20g/day**

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption		At 20 g/day, risk is ~5%; at 40g/day, risk is ~12%; at 60g/day, risk is ~22%. (Rehm et al., 2008).		
Tuberculosis				
Detrimental Effect	**Yes**			**Detrimental effect seen >40g/day**
• Level of consumption	⬆ risk >40g/day; RR=2.94 (95%CI: 1.89-4.59) (Lönnroth et al., 2008).			
• Population	Those with alcohol use disorder at increased risk.			
Overweight/Obesity/Weight Gain				
Detrimental Effect			**Yes**	**Detrimental at higher consumption levels: > 30g/day**
• Level of consumption			⬆ weight gain with heavier consumption Women: OR= 0.94 (95%CI: 0.89-0.99) at 0.1-4.9g/day; OR= 0.92 (95%CI: 0.85-0.99) at 5-14.9g/day; OR= 0.86 (95%CI: 0.76-0.78) at 15-29.9g/day; OR=1.07 (95%CI: 0.89-1.28) at ≥30g/day (Wannamethee et al., 2004). Men showed greatest weight gain and highest prevalence of ⬆ BMI at >30g/day (Wannamethee et al., 2003).	

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
Diabetes				
Beneficial Effect	**Potentially**			**Potentially beneficial at low to moderate drinking levels**
• Level of consumption	Light to moderate drinking (narrative review: Ashley et al., 2000).			
Bone Health				
Detrimental Effect			**Yes: J-shaped relationship between alcohol consumption and hip fracture**	**Detrimental effect seen at >28g/day**
• Level of consumption			Abstainers and heavy drinkers at higher risk than light drinkers: RR=1.0 for 0 g/day; RR=0.84 (95%CI: 0.70-1.01) up to 7g/day; RR=0.80 (95%CI: 0.71-0.91) for 7-14g/day; RR=0.91 (95%CI: 0.76-1.09) for 14-28g/day; RR =1.39 (95%CI: 1.08-1.79) for >28g/day (Berg et al., 2008).	
Beneficial Effect			**Yes – J-shaped relationship between alcohol consumption and hip fracture**	**Protective effect seen at very low levels of drinking: <7-14g per day**
• Level of consumption			< 7-14g/day See above for RR values	

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
Beneficial Effect			**Yes: Linear relationship between alcohol consumption and femoral neck and vertebral spine bone density**	**Protective effect**
• Level of consumption			Each drink per day (14g) associated with ♠ in femoral neck bone density of 0.045g/cm^2 (95%CI: 0.008-0.082)	
Detrimental Effect			**Yes: U-shaped relationship between alcohol consumption and bone density loss**	**Detrimental effect seen at very low or at low to moderate levels of drinking for men: <7 or >19.6g/day**
• Population			Men	
• Level of consumption			<7g or >19.6g/day	
Beneficial Effect			**Yes: U-shaped relationship between alcohol consumption and bone density loss**	**Protective effect seen at low levels of drinking for men: >9.8g and <23.8g/day**
• Population			Men	
• Level of consumption			>9.8g and <19.6 or 23.8 g/day	
Beneficial Effect			**Yes: Linear inverse relationship between alcohol consumption and bone density loss**	**Protective effect seen at low to moderate levels of drinking for women**
• Population			Women	
• Level of consumption			Exact range was not specified; approximately 14-28g/day	

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
Injury				
Detrimental Effect	**Yes: ♠ risk of traffic accidents with ♠consumption**	**Yes: ♠risk of death from injury with alcohol consumption**	**Yes: ♠risk of unintentional injuries: strong evidence for falls, motor vehicle crashes and drowning**	**Detrimental effect - seen with any alcohol consumption**

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption	BAC of ≥40mg% (0.4 g pure alcohol/kg) threshold for negative effect Subjective feelings of being intoxicated occur as low as BAC from 10-30mg% (Eckardt et al., 1998).	Risk of death from injury remains below 1 in 100 for men and women if always drink <20g per occasion (lifetime risk): **Men (amount daily):** At 10g/day= 0.20 in 100; At 20g/day= 0.48 in 100; At 30g/day= 1.50 in 100; At 40g/day= 2.21 in 100; At 50g/day=3.11 in 100; At 60 g/day- 5.29 in 100; At 70g/day=7.51 in 100; At 80g/day=9.69 in 100. **Women (amount daily):** At 10g/day= 0.13 in 100; At 20g/day= 0.39 in 100; At 30g/day = 0.91 in 100; At 40g/day =1.32. in 100; At 50g/day=1.84 in 100; At 60g/day=2.99 in 100; At 70g/day= 4.16 in 100; At 80g/day=5.33 in 100. Any consumption ♠risk of injury (single occasion risk): OR=1.9 for 10g; OR=3.8 for 30g (Borges et al., 2006).	In excess of current guidelines (<28g/day for men and <14g/day for women).	

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Patterns of drinking	Strong effect: ♠probability of driving while intoxicated when ♠frequency of drinking at bars/restaurants. The probability of driving after drinking increased from 0.367 to 0.440 with one standard deviation increase in frequency of drinking at bars/restaurants (Gruenewald et al., 1996). Midanik et al., 1996; Eckhardt et al., 1998; Rossow et al., 2001 data not shown here.	♠risk of death or hospitalization with ♠ frequency of drinking occasions	Not specified	
• Population	♠probability of driving while intoxicated when younger: at age 21, the expected probability was 0.068; at age 50 this probability declined to 0.021 (Gruenewald et al., 1996).	♠risk of death for men > than women at all levels of drinking	Not specified	
Mental Disorders (Suicide)				
Detrimental Effect	**Yes: Linear relationship between consumption and risk of suicide**			**Detrimental effect seen with heavier drinking and more frequent bouts of intoxication**
• Level of consumption	♠risk for heavy drinkers and alcohol abusers (Andreasson et al., 1988); AAF= 20-30% for suicide (Rossow, 2000).			

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Patterns of drinking	♠risk of attempted suicide with ♠ frequency of intoxication OR = 2.36 of suicide attempt/ideation for those who drank to the point of intoxication on half of their drinking days compared to those who never became intoxicated (Dawson, 1997).			
Cognitive decline with age				
Beneficial Effect			**Yes: ♥ risk of Alzheimer's disease and dementia**	**Potentially protective effect at low levels of alcohol consumption**
• Level of consumption			**Low to moderate amounts of alcohol** Low to moderate amounts of alcohol protective (exact amount not specified): dementia RR=0.63 (95%CI: 0.53-0.75) and Alzheimer's disease RR=0.57 (95%CI: 0.44-0.74); non-significant for cognitive decline RR=0.89 (95%CI: 0.67-1.17)(Peters et al., 2008). Drinking less than 28g/day associated with less cognitive decline (Wright et al., 2006).	

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Patterns of drinking			Limited evidence suggests that heavy drinking detrimental	
Violence				
Detrimental Effect	**Yes: ↟risk of violent events ↟alcohol consumption**			**Detrimental effect seen with heavier drinking and more frequent bouts of intoxication**
• Level of consumption	↟risk among heavy drinkers and alcohol abusers AAF = 25-60% (Rossow, 2000).			
• Patterns of drinking	↟risk with ↟ frequency of intoxication OR=1.00 at 1 drink/month (0.015oz); OR=1.01 (95%CI: 1.01-1.02) at 1 drink per week (0.075oz); OR= 1.10 (95%CI: 1.07-1.14) at 1 drink/day (0.50oz); OR=1.22 (95%CI: 1.15-1.30) at 2 drinks/day (1.00oz); OR=1.67 (95%CI: 1.44-1.93) at 5 drinks/day (2.5oz) (Dawson, 1997).			
Divorce and Marital Problems				
Detrimental Effect	**Yes: at higher levels of drinking**			**Detrimental effect seen with heavier**

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
• Level of consumption	Heavy drinking/alcohol abuse is related to marital problems (Leonard & Rothbard, 1996). No studies of dose-response relationship found/relationship between alcohol consumption and divorce (Fu & Goldman, 2000).			**drinking/alcohol abuse**
• Patterns of drinking	Heavy drinking/alcohol abuse is related to marital problems (Leonard & Rothbard, 1996).. No studies of dose-response relationship found/relationship between alcohol consumption and divorce (Fu & Goldman, 2000).			
Child Abuse				
Detrimental Effect	**Yes: ⬆risk of indicators of child abuse**			**Detrimental effect suggested– insufficient evidence**
• Level of consumption	Insufficient evidence			
• Frequency	Insufficient evidence			
Work-related Problems				
Detrimental Effect	**Yes: some indication of negative effect**			**Detrimental effect suggested – insufficient evidence**
• Level of consumption	Insufficient evidence			
• Frequency	Insufficient evidence			

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
Global burden of disease attributable to alcohol (disability-adjusted life-years)*				
Detrimental Effect	**Yes: 4.6% of all net DALYs in 2004 are attributable to alcohol; 7.6% for men, 1.4% for women (N=70, 910,000).**			**Neuropsychiatric diseases account for the largest portion of disease burden measured in DALYs.**
• Population	Men and women: Neuropsychiatric disorders= 36.4%; Unintentional injuries=25.4%; Intentional injuries=10.5%; Cardiovascular diseases =9.5%; Cirrhosis of the liver= 9.5%; Cancer=8.6%; Men: Neuropsychiatric disorders= 37.6%; Unintentional injuries=25.4%; Intentional injuries=10.7%; Cardiovascular diseases =9.7%; Cirrhosis of the liver= 8.9%; Cancer=7.6%; Women: Neuropsychiatric disorders= 30.1%; Unintentional injuries=25.6%; Intentional injuries=9.0%; Cardiovascular diseases =8.3%; Cirrhosis of the liver= 12.7%; Cancer=13.5%; Diabetes mellitus= 0.3%			

	Chapter 4 – Alcohol: No Ordinary Commodity (2010)	Australian LRDG (2009)	American Dietary Guidelines (2010)	Summary of Effect
Beneficial Effect	**Yes: alcohol-related burden 'prevented' (N=2,321,000)**			
• Population	Men and women: Diabetes mellitus=14.6%; Cardiovascular diseases: 85.4%. Men: Diabetes mellitus =22.2%; Cardiovascular diseases=77.8%. Women: Diabetes mellitus =8.1%; Cardiovascular diseases=91.9%.			

* Disability-adjusted life-years (DALYs) – combines years of life lost to premature death with years of life lost due to disability
to estimate the burden of disease in a given country. Disability is indirectly calculated from morbidity.

Appendix I: Data Extraction Tables

AUSTRALIAN ALCOHOL DRINKING GUIDELINES

Guideline Title	Australian Guidelines to reduce health risks from drinking alcohol
Organization	National Health and Medical Research Council (NHMRC)
Date	2009
Country	Australia
Focus of guideline and relevant sections	Alcohol consumption and reducing health risks - Guidelines 1 and 2
Guideline Development Summary	This is the second edition of the NHRMC's evidence-based alcohol guidelines (first edition issued in 2001). The aim of these Guidelines is to provide an evidence base and resource for policy makers, decision makers, and alcohol providers with a focus on reducing health risks from drinking alcohol for various populations, including healthy adults, young people under 18 years of age, and pregnant/breastfeeding women.
Quality rating (using AGREE II tool)	Reviewer #1 (SK) Overall assessment: 6/7 Scope & Purpose – 21/21 Stakeholder involvement – 19/21 Rigour of development – 51/56 Clarity of presentation – 21/21 Applicability – 4/4 Editorial independence – 7/14 Recommended for use – Yes, with modification	Reviewer#2 (SM/IP Team) Overall assessment: 6/7 Scope & Purpose – 92% Stakeholder involvement – 84.7% Rigour of development – 75% Clarity of presentation – 100% Applicability – 100% Editorial independence – 25% Recommended for use – Yes, with modification
Definition of Australian Standard Drink	10g/12.5 ml of alcohol equivalent to 1 can/'stubbie' of mid-strength beer (3.5% alcohol); 1 glass of wine/100ml glass (9.5-13% alcohol), 1 'nip' of spirits/30 ml (37-40% alcohol).
Guideline 1	**Reducing the risk of alcohol-related harm over a lifetime. The lifetime risk of harm from drinking alcohol increases with the amount consumed. *For healthy men and women, drinking no more than two standard drinks on any day reduces the lifetime risk of harm from alcohol-related disease or injury.***
Summary of lifetime risk of alcohol-related harm	• Drinking less frequently over a lifetime (e.g., drinking weekly rather than daily) considerably reduces the risk of alcohol-related harm. • Drinking less on occasions when drinking does occur also considerably reduces the risk over a lifetime, both of alcohol-related disease and of injury. • Increasing consumption from two to four drinks daily increases the lifetime risk of death from alcohol-related injury more than four-fold for men and three-fold for women (men: 0.5 in 100 to 2.2 in 100; women: 0.4 in 100 to 1.3 in 100).

	• Increasing consumption from two to four drinks daily increase the lifetime risk of death from alcohol-related disease five-fold for men and more than six-fold for women (men: 0.4 in 100 to 2.0 in 100; women: 0.4 in 100 to 2.5 in 100).
Guideline 2	**Reducing the risk of injury on a single occasion of drinking. On a single occasion of drinking, the risk of alcohol-related injury increases with the amount consumed.** *For healthy men and women, drinking no more than four standard drinks on a single occasion reduces the risk of alcohol-related injury arising from that occasion.*
Summary of evidence on reducing risk of injury on a single occasion of drinking	• Any consumption of alcohol increases the risk of injury on a single drinking occasion (OR = 1.9 for one standard drink; OR = 3.8 for 3 standard drinks; OR = 5.6 for 5 standard drinks; OR = 10.0 for 7+ standard drinks). • Having four drinks on a single occasion more than doubles the relative risk of an injury in the six hours afterwards. • Relative risk rises more rapidly above the level of four drinks on an occasion. • Each drinking occasion contributes to the lifetime risk of alcohol-related injury and disease. • The lifetime risk of death from injury remains below 1 in 100 for both men and women if they always drink two drinks or less on an occasion, even if the occasions are every day. • The lifetime risk of hospitalization from injury is about 1 in 10 for men and 1 in 12 for women with a drinking pattern of four drinks on an occasion about once a week.

Details of Guideline 1 Methodology	
Guideline 1 Methodology	A/ Systematic review of the published evidence; B/ Use of a modelling approach based on a single episode data from major epidemiological studies to estimate lifetime risks of death from alcohol-related disease or injury from different patterns or levels of drinking; C/ Analysis of the harms of alcohol at different ages and for different sexes/genders (harm scores) using data from the 2004 National Drug Strategy Household Survey.
A/ Systematic review	
Databases searched	Embase.com (composite of MEDLINE and EMBASE), Cochrane library, Cochrane reviews, and Cochrane Central Register of clinical trials.
Search period	2000 – early 2007
Search terms	Alcohol, alcohol consumption, alcohol use, drinking, intoxication, problem drinking and related terms.
Inclusion criteria	Only human studies included. Health outcomes associated with alcohol consumption also included in review.
Exclusion criteria	Papers published before 2001, off topic, duplicates, not about humans, not research studies.
Search results	223, 153 articles from EMBASE.com, 74 Cochrane reviews, 208 articles from Cochrane library, 6, 637 clinical trials from Cochrane Central Register of clinical trials. These articles were then used as the basis for subject-specific searches. Subject-specific searches were also carried out in their project database (Project Cork) and other databases relevant to topics. Additional references were supplied by the Working Committee and searched through reference lists.
Additional Methods	• The subject areas addressed by the reviewers included: adolescents and young adults, elderly, people with family history of alcohol abuse, sex/gender differences, Aboriginal and Torres Strait Islander people, occupational groups, pregnant/breastfeeding

	• For each subject area, abstracts of all the identified articles were retrieved and reviewed for relevance. • The papers were grouped by study type (i.e., systematic review, RCT, prospective cohort studies, observational studies) and the relevant data extracted by two reviewers.
Quality Rating	Not given
Types of studies	Systematic reviews, meta-analyses, randomized control trials, prospective cohort studies, other observational studies
Primary reviews informing Guidelines 1 & 2	Corrao et al., 1999; Corrao et al., 2000; Corrao et al., 2004; Di Castelnuovo et al., 2002; Di Castelnuovo et al., 2006; Fell & Voas, 2006; Fillmore et al., 2006; Gmel et al., 2003; Reyolds et al., 2003; White et al., 2007.
B/ Calculation of lifetime risk for chronic disease causally related to alcohol	
Source(s)	(1) Corrao, G., Bagnardi, V., Zambon, A., Arico, S. (1999). Exploring the dose-response relationship between alcohol consumption and the risk of several alcohol-related conditions: A meta-analysis. Addiction, 94: 1551-1573.
Quality Rating	Not given
Type of studies	Meta-analysis of case control and cohort studies; 200 studies and 97, 351 cases included in meta-analysis
Databases searched	Medline, EMBASE, Current Contents, CAB Abstracts, Core Biomedical collection and manuscripts in press were considered; hand searched major epidemiological journals.
Search period	1966 – 1998
Health outcome(s)	Six types of cancer (oral cavity, oesophagus, colorectum, liver, larynx, breast), hypertension, cerebrovascular diseases, gastric and duodenal ulcer, liver cirrhosis and other chronic liver diseases, pancreatitis and injuries.
Inclusion/Exclusion criteria	If details were not provided on sample size and/or exposure level, duplication of studies, or if only two categories of alcohol consumption were considered.
Results of risk calculations	For people who regularly drink two standard drinks per day, the lifetime risk of death from an alcohol-related disease is about 0.4 in 100 people with that drinking pattern. Above that level, the risk increases with the number of drinks per day and is above 1 in 100 at three drinks per day. For example from tables in Guideline: Alcohol-Attributable Fractions (AAF) for lip, oral and pharyngeal cancer for men at 1 standard drink is 23.5; at 2 standard drinks per day it increases to 40.0. AAF for ischaemic stroke is not applicable until 4 standard drinks per day (AAF = 10.9) as there is no detrimental effect compared to abstainers until that consumption level.
Source(s)	(2) Corrao, G., Bagnardi, V., Zambon, A., La Vecchia, C. (2004). A meta-analysis of alcohol consumption and the risk of 15 diseases. Prev Med, 38: 613-619.
Quality Rating	Not given
Types of study	Meta-analysis of case control and cohort studies; 156 studies and 116, 702 cases included in meta-analysis.
Databases searched	Medline, EMBASE, Current Contents, CAB Abstracts, Core Biomedical collection and manuscripts in press were considered; hand searched major epidemiological journals.
Search period	1966-1998
Health outcome(s)	Only ischaemic heart disease was used from this meta-analysis for the risk calculation. Paper included: six types of cancer (oral cavity, oesophagus, colorectum, liver, larynx, breast), hypertension, cerebrovascular diseases, gastric and duodenal ulcer, liver cirrhosis and

	other chronic liver diseases, pancreatitis and injuries.
Inclusion/Exclusion criteria	Case-control or cohort study published as original article; findings expressed as odds ratios or relative risk, considering at least three levels of alcohol consumption; papers reporting the number of cases and non-cases, and estimates of odds ratios or relative risk for each exposure.
Results of risk calculations	Due to the cardiovascular benefits seen from alcohol consumption, the AAF or RR are not seen for ischaemic heart disease until 8 standard drinks per day: AAF =1.0 at 8 standard drinks per day; AAF=2.9 at 9 standard drinks per day; AAF = 11.5 at 10 standard drinks per day.
Source(s)	(3) National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), 2001/2002. (http://niaaa.census.gov/). Peer reviewed publication using this data source/approach: Rehm J, Klotsche J, Patra J (2007b) Comparative quantification of alcohol exposure as risk factor for global burden of disease. *Int J Methods Psychiatr Res* 16(2): 66–76.
Type of study	NESARC Survey; Longitudinal study
Sample	N= 43, 093; 18 years and older; response rate = 81%; United States
Outcome of interest	Risk of mortality from alcohol-use disorders
Methods	The risk of alcohol-use disorder by age and sex/gender was derived and modeled for daily consumption categories corresponding to Australian standard drinks. The risk calculations were based on average daily drinking that year. AAFs of all alcohol-use disorder deaths for different levels of drinking were based on these risk estimates.
Results of risk calculations	Risk for alcohol use disorder increases with amount of alcohol consumption per day. For example, at 20 grams per day, risk is approximately 5%; and at 60 grams per day, risk increases to approximately 22%. The data are shown in a figure in the original document so estimates are approximate.
Summary of modelled analysis	
Source(s)	Appendix 5 in the Guideline; Peer-reviewed publication: Rehm, J., Room, R., Taylor, B. (2008). Method for moderation: measuring lifetime risk of alcohol-attributable mortality as a basis for drinking guidelines. *Int J Methods Psych Res*, 17(3): 141-151.
Methods	The modeled analysis included those chronic conditions where accepted epidemiological criteria have shown a causal and detrimental effect of alcohol consumption. The following process was used to calculate lifetime absolute risk of death from each of these diseases as a result of drinking alcohol: • Calculation of the RR of developing each disease from drinking between 1 to 10 standard drinks per day, in 1 standard drink intervals (compared to people who do not drink alcohol) • Estimation of the AAF for diseases by number of standard drinks per day • Calculation of the absolute risk of dying from alcohol-attributable disease categories within one year and derivation of the absolute age-specific one-year risks for all chronic disease, separately for men and women. At low levels of consumption, alcohol may have health benefits for some age groups; but, as this evidence is uncertain, this was not incorporated into the modeling. Where there was no detrimental effect, or a beneficial effect, the relative risk was recorded as 1.0. It is acknowledged that recalculation of the model with estimated benefits included may have slightly altered results. The NHRMC decided on a lifetime risk of dying from alcohol-caused death or injury of 1 in 100 (i.e., 1 death for every 100 people) as the basis for guidance as to what could be seen as an acceptable risk from drinking in the context of present-day Australian society.

	Guideline 1 in general aims to keep drinking below that risk level for the drinker.
Overall Results	• As the average volume of alcohol consumption increases, the lifetime risk of alcohol-related disease increases. At higher levels of drinking, larger gender differences are seen, with risk for women being significantly higher than for men. For women, the risk increases faster with increased consumption than for men. • At 10g per day (one standard drink), lifetime risk for women is actually lower than that for men, but increases to over 50% higher (96 vs. 60 per 1000) at 100 grams (10 standard drinks). • Overall, lifetime risk for disease mortality increases by about 10% with each 10 gram (one standard drink) increase in alcohol consumption. • The risks for men and women are quite similar at average daily volume levels below 40 grams per day; at higher levels of drinking, large sex differences are seen.
Strengths	Innovative approach to modeling that gives insight into the extent of the contribution of different levels of drinking to lifetime mortality.
Limitations	(1) data based on population event-related data, therefore does not take into account individual variability; (2) new evidence that has emerged was not included (e.g., alcohol and colorectal cancer); (3) the underlying meta-analysis may be affected by biases concerning the definition of abstainers as different studies have different definitions of this group; (4) alcohol attributable illness, disability and social harm were not included.
C/ Calculation of lifetime risk of death from alcohol-related injury for an increasing number of drinks per occasion and for various numbers of drinking occasions over a lifetime	
Summary of modelled analysis	
Source(s)	Appendix 5 in the Guideline; Peer-reviewed publication: Rehm, J., Room, R., Taylor, B. (2008). Method for moderation: measuring lifetime risk of alcohol-attributable mortality as a basis for drinking guidelines. *Int J Methods Psych Res*, 17(3): 141-151.
Methods	Alcohol-attributable injury deaths per drinking occasion, and lifetime risk, were calculated using four main steps: • Calculation of overall gender- and age-specific risk of fatal injury per day for each category of injury without the impact of alcohol (i.e., baseline risk) • Calculation of the residual risk of death due to alcohol-related injury that would have occurred in Australia without any involvement of alcohol in the year 2002 • Estimation of the increased risk of injury after drinking a specific number of drinks compared to not drinking and of the absolute risk of having a fatal injury after consuming a specific number of drinks, taking into account the fraction of a day for which the risk is increased for that number of drinks • Incorporation into the model of the risk from alcohol consumption on multiple occasions based on the number of drinking occasions, the risk of injury death given the number of lifetime drinking occasions and the risk of injury death for one drinking occasion per year, depending on the number of risks per occasion. The estimates are conservative in that the increases in risk are based on studies of non-fatal injuries. The relevant literature indicates that injuries tend to be more severe when alcohol is involved, and the relative risks and proportion of alcohol-related injuries are larger for fatal compared with non-fatal injuries. Basing these estimates on emergency department studies may have led to an overestimate of the effects, because people who attend emergency departments are not representative of the general population.

	The method for investigating the risk of hospitalization for alcohol-related injury was similar, but used data from the Victorian Admitted Episode Database (2001/2002) for calculating risk for hospitalized injuries at different alcohol consumption levels. As stated in the table above, the NHRMC decided on a lifetime risk of dying from alcohol-caused death or injury of 1 in 100 (i.e., 1 death for every 100 people) as the basis for guidance as to what could be seen as an acceptable risk from drinking in the context of present-day Australian society. Guideline 1 in general aims to keep drinking below that risk level for the drinker.
Overall Results	Provided in four figures in the Appendix of the Guideline. • For both men and women, the lifetime risk of death or hospitalization due to alcohol-related injury increases with the frequency of drinking occasions. • Risk of death for men is higher than that for women at all levels of drinking. Risk is higher for men as injury mortality per se is higher among men than among women, based on higher rates of risk behavior at a given level of drinking by men. However, both men and women show similar patterns of increasing risk of injury mortality as both lifetime drinking occasions and the number of drinks consumed increase. • The risk of death from injury remains below 1 in 100 for both men and women if they always drink two drinks or less on an occasion even if the occasions are every day. • For both men and women, the risk of hospitalization for alcohol-related injury increases with frequency of drinking. The risk of being hospitalized for men is higher than that for women at all levels of drinking. When drinking occasions are frequent (i.e., nearly every day), the lifetime risk of hospitalization for alcohol-related injury is approximately 1 in 10 for both men and women, if they always drink two drinks or less on an occasion.
Limitations	Methodological limitations of studies used: recall bias; underestimation in the amount drunk; social desirability bias in survey-type questionnaires; legal or other issues may encourage people to minimize their reported consumption and conversely to overestimate consumption to excuse socially undesirable behavior (e.g., violence).
Strengths	Innovative approach to modeling that gives insight into the extent of the contribution of different levels of drinking to lifetime mortality from injury.

Details of Guideline 2 Methodology: based on A/ systematic review (see Guideline 1 methodology) and B/ re-calculation of harm scores for single-occasion drinking.

A/ Systematic review (details reported under Guideline 1 methods)

Evidence reviewed on the association between alcohol and injury	Relevant published studies were identified for the following areas: (1) emergency department visits for alcohol-related injury; (2) effect of alcohol on cognitive performance; (3) relationship between BAC and injury severity; and (4) differentiation between the alcohol-related risks of injury for men and women.
(1) Emergency department visits	
Primary studies reviewed	Stockwell et al., 2002; Vinson et al., 2003; Borges et al., 2004a; Cherpitel et al., 2004a; Watt et al., 2004; Spurling & Vinson, 2005; Borges et al., 2006; Gmel et al., 2006.
Results:	• Emergency department presentations: studies showed a greater increase in risk of injury after four standard drinks on a single occasion than after lower numbers of drinks.

	• A new meta-analysis (Taylor et al., 2009) found that the relative risk of injuries other than in motor vehicles is doubled after three drinks, compared with not drinking. • Studies also showed that risk of injury increased more for people whose level of consumption varied significantly from time to time, and was particularly high for those who occasionally drank much more than their usual amount. • The authors concluded that a greater increase in risk of injury after four standard drinks on a single occasion than after lower numbers of drinks is demonstrated by these data.
(2) Cognitive performance	
Primary studies reviewed	Tagawa et al., 200; Howland et al., 2001; Marinkovic et al., 2001; Verster et al., 2003; Marinkovic et al., 2004; Schweizer et al., 2004; Easdon et al., 2005; Moulton et al., 2005; Schweizer et al., 2006; Breitmeier et al., 2007.
Results	• Cognitive performance: as blood alcohol level increases, cognitive function and psychomotor performance decrease rapidly; • Consumption of less than two standard drinks potentially results in effects that increase risk of injury; • Driving ability is impaired at blood alcohol levels of about 0.05% - reached after two to three standard drinks; • Substantial impairment can exist well after alcohol has been metabolized and passed from the body and such a temporary impairment is the result of a 'hangover' effect.
(3) **BAC and injury severity**	
Primary studies	Li et al., 1997; Porter, 2000; Borges et al., 2004a; Cherpitel et al., 2004a; Johnston & McGovern, 2004; Borges et al., 2006; Watt et al., 2006.
Results	• Injury severity: mixed results were found with several studies showing a higher proportion of violence-related injuries among those drinking before the incident than for non-alcohol related injuries. • Other studies found that injury severity increased proportionate to BAC and another study found no significant association between BAC and fatal injuries.
(4) Gender differentiation	
Primary studies:	Mcleod et al., 1999; Mumenthaler et al., 1999; Bergman & Kallmen, 2002; Seale et al., 2002; Worrall et al., 2002; Delva et al., 2004; Flanagan et al., 2004; Geisner et al., 2004; Parry et al., 2005.
Results	Contrasting results were found, and issue of whether to set different guideline levels for men and women is contentious. (1) BAC levels: body weight and compositions for women attain a given BAC level at a lower amount of alcohol than men, but differences in post-drinking performance are mixed. (2) Injury at a given BAC level: emergency department studies show that most injuries involved men rather than women – almost 2/3 of patients with alcohol-related injury are men. Men's behavior is on average more risky than women's at a given level of drinking. (3) Drinking pattern and risk of injury – based on analysis of 2004 National Drug Strategy Household Survey (2005) – women have lower risk of hazardous behavior while drinking at each level of drinks and this is generally true in all age groups.
Limitations of this literature	Evidence concerning the risk of alcohol-related injury is largely based on self-reporting (i.e., may lead to overestimation/underestimation of effects); variability in terms of individual metabolism and timing of drinking on a single occasion affect the blood alcohol concentration (BAC) from a given number of drinks; tendency towards hazardous or delinquent behavior varies between individuals and with age and sex/gender; the setting in which the drinking takes place can affect the level of risk of injury (e.g., if travel is necessary after drinking).

B/ Calculation of harm from single occasions of drinking	
Source(s)	To assess the association between alcohol-related injury and levels of drinking on a single occasion, the following datasets from peer-reviewed published studies were re-analyzed by authors of papers using reported alcohol use prior to injury categorized in terms of single-drink increments: i. A large Australian dataset on emergency department admissions for alcohol-related injury (N=1,770). Peer-reviewed publication: Stockwell T, McLeod R, Stevens M et al (2002). Alcohol consumption, setting, gender and activity as predictors of injury: a population-based case-control study. *J Stud Alcohol* 63: 372–79. ii. Emergency department data from the Gold Coast (N=488). Peer-reviewed publication: Watt K, Purdie D, Roche A et al (2004). Risk of injury from acute alcohol consumption and the influence of confounders. *Addiction* 99: 1262–73. iii. Data from WHO 10-site international study of emergency department alcohol-related admissions (N=4,320). Peer-reviewed publication: Borges G, Cherpitel C, Orozco R et al (2006) Multicenter study of acute alcohol use and non-fatal injuries: data from the WHO Collaborative Study on Alcohol and Injuries. *Bull World Health Org* 84(6): 453–60.
Results from 3 datasets	From all 3 datasets, a similar risk curve was associated with emergency department presentation for an alcohol-related injury. A greater increase in risk of injury was found after four standard drinks on a single occasion than after lower numbers of drinks. In comparison to results from breath-tests in the WHO study, underreporting by injury patients of how much they had consumed may have produced an apparent threshold of around 4 drinks.
Limitations/Strengths	A variety of methods have been used for assessing the risk of injury from different levels of alcohol consumption and definitive methods of determining risk have not been established. As stated under Guideline 1, some of the methodologies employed may overestimate risk. However, these studies provide the best available evidence on which to base calculations for risk of alcohol-related injury.

DIETARY GUIDELINES FOR AMERICANS

Guideline Title	Dietary Guidelines for Americans
Organization	U.S. Department of Agriculture and U.S. Department of Health and Human Services
Date	2010
Country	United States of America
Focus of guideline and relevant sections	Guidelines intended for Americans age 2 years and older; Chapter 3 foods and food components to reduce (incl. alcohol)
Guideline development summary	This is the seventh edition of the Dietary Guidelines for Americans; they form the basis for nutrition policy in Federal food, education and information programs. The Guidelines are intended for Americans ages 2 years and older, including those at risk of chronic disease. In the first stage of Guideline development, an external scientific Advisory Committee is appointed to conduct an analysis of new scientific information on diet and health and to prepare a report summarizing its findings. Following its completion, the report is made available to the public and Federal agencies for comment. The second stage of guideline development is the production of the policy document. In the third and final stage, the two departments tasked with the production of the Guidelines develop messages and materials communicating the key findings to the public.
Quality rating (using AGREE II tool)	Reviewer #1 (SK) Overall assessment: 6/7 Scope & Purpose – 19/21 Stakeholder involvement – 20/21 Rigour of development – 47/56 Clarity of presentation – 17/21 Applicability – 16/28 Editorial independence – 11/14 Recommended for use – Yes, with modification	Reviewer#2 (SM/IP Team) Overall assessment: 6/7 Scope & Purpose – 93% Stakeholder involvement –91.7% Rigour of development –70.1% Clarity of presentation –81.5% Applicability –44.4% Editorial independence –83.3% Recommended for use – Yes, with modification
Definition of American Standard Drink	14 g/18 ml of alcohol, which is equivalent to 12 oz of regular beer; 5 oz of wine (12.5% alcohol) or 1.5 oz of 80-proof distilled spirits
Dietary Guidelines alcohol consumption recommendations	For adults of legal drinking age who choose to drink alcohol, consume it in moderation. Avoid alcohol in certain situations that can put you at risk.
What is moderate drinking?	Defined as up to 1 drink per day for women and up to 2 drinks per day for men
What is heavy or high-risk drinking?	Defined as the consumption of more than 3 drinks on any day or more than 7 drinks per week for women; more than 4 drinks on any day or more than 14 drinks per week for men.
What is binge drinking?	Defined as the consumption within 2 hours of 4 or more drinks for women, and 5 or more drinks for men.

Guideline Methods	
Systematic Review methods	The Dietary Guidelines Advisory Committee generated a list of topic areas to explore. The PICO method was used to conduct the systematic reviews and six searches were performed for alcohol and health outcomes. Only 5 systematic reviews are related to our PICO question (i.e., pregnancy/breastfeeding and alcohol was excluded). The relationship between alcohol intake and the following health outcomes are described below: weight gain; cognitive decline with age; coronary heart disease; bone health; and unintentional injury. To refine the evidence search for each question, the Committee limited the reviews to studies with greater methodological rigour and only conducted systematic reviews of observational prospective studies and randomized control trials. There were two exceptions: (1) alcohol intake and unintentional injury because cross-sectional or case control studies are of equal or better validity; and (2) alcohol intake related to CHD, only systematic reviews and meta-analyses were used since the review found several recent studies. After the evidence was selected and critically appraised, evidence tables and summaries for all included studies were completed. The final step in the systematic review process was the development and grading of a 'conclusion' statement based on the body of scientific evidence evaluated. Each subcommittee deliberated on each conclusion statement and grade, and these were brought forward to the full Committee for consideration and discussion. The conclusion statements were integrated with results from food modeling analyses, reviews of reports from expert groups, dietary intake analyses, presentations by expert consultants, established nutrition science knowledge, and/or expert opinion of the Committee and broader scientific community to inform the development of the Committee's 'implications' statements that lay out the overarching conclusion that the Committee has drawn about the question.
Inclusion criteria	Age, health status of subjects, study setting, number of subjects per study arm (i.e., a min of 10 subjects typically), attrition rate (i.e., typically less than 20%), characteristics of the intervention, outcome measures and timing of measures, and study design. All searches were limited to human studies, developed countries, English language and peer-reviewed publications.
Exclusion criteria	Unpublished data, including conference proceedings and abstracts were not included.
Search period	Date range was chosen depending on whether the systematic review was designed to update 2005 Dietary Guidelines, update a comprehensive systematic review or address a new question.
Databases searched	PubMed/Medline, Cochrane Database of Systematic Reviews for all questions. Other databases searched as dictated by question topic. Electronic searches were augmented by hand searches of references from primary and review articles, as well as articles identified by committee members.
Search terms	A variety of search terms and key words were used, including subject headings such as MeSH and thesauri terms.
Five systematic reviews are described below including the relationships between alcohol consumption and bone health; cognitive decline; coronary heart disease; unintentional injury; and weight gain.	
(1) What is the relationship between alcohol intake and bone health? Conclusion: Moderate evidence suggests a J-shaped association between alcohol consumption and incidence of hip fracture; there was a suggestion that heavy or binge drinking was detrimental to bone health**.	
Quality Rating	Moderate
Search period	January 1 1995 to June 9 2009
Search terms	"Ethanol"[MeSH] OR "alcohol drinking" [MeSH] OR "alcohol beverages"[MeSH] AND "bone density"[MeSH] OR "fractures, bone" [MeSH] OR "bone diseases" [MeSH]
Inclusion criteria	Human subjects, English language, International, sample size (min. of 10 subjects per study arm), dropout rate (less than 20%), adults of legal

	drinking age (21 years or older), subjects – healthy, those with elevated disease risk, those diagnosed with the highly prevalent chronic disease (CHD/CVD, hypertension, Type 2 DM, osteoporosis, osteopenia, and obesity) and breast cancer, colon cancer and/or prostate cancer.
Exclusion criteria	Medical treatment or therapy, diseased subjects (exceptions noted above), hospitalized patients, malnourished/third-world populations/disease incidence not relative to US population, animal studies, in vitro studies, articles not peer reviewed, cross-sectional study design.
Search results	Total hits from all database searches = 132. Total articles reviewed = 21. Number of primary studies identified = 0. Number of review articles identified = 1. Number of articles reviewed but excluded = 1.
Article(s) included for evidence analysis	Berg, K.M., Kunins, H.V., Jackson, J.L., Nahvi, S., Chaudry, A., Harris, K.A. Jr., Malik, R., Arnsten, J.H. (2008). Association between alcohol consumption and both osteoporotic fracture and bone density. *Am J Med,* 121(5): 406-418.
Study details	33 studies (experimental, cohort or case-control designs) among white/European/American adults

Results from literature	• Meta-analysis (n=13 studies) showed a J-shaped relationship between alcohol consumption and hip fracture.
	  -Compared with abstainers, a decreased risk of hip fracture was found among persons consuming up to 0.5 drinks per day (RR = 0.84 [95% CI, 0.70-1.01]) and persons consuming from >0.5-1.0 drinks per day (RR=0.80 [95% CI, 0.71-0.91]).
	  -Those consuming more than one to two drinks per day did not differ from abstainers (RR=0.91 [95% CI, 0.76-1.09]) and persons consuming more than two drinks per day had an increased risk (RR=1.39, [95% CI, 1.08- 1.79]).
	 • Four cohort studies involving men and women greater than 50 years of age followed for 12 to 20 years, found a linear relationship between femoral neck bone density and alcohol consumption.
	 • Three cohort studies looked at effect of alcohol consumption and fracture of forearm/wrist; 2 found no significant association and 1 found women consuming 1.8 drinks per day or more had a higher risk of wrist fracture compared with abstainers (RR=1.38, 95%CI: 1.09-1.74).
	 • Two cohort studies looked at alcohol and risk of vertebral fracture; 1 found no significant association, 1 found increased odds of fracture among men who consumed more than 0.3 drinks/day compared with abstainers (adj. OR = 4.61, 1.19-17.90).

Limitations of literature	Studies often combined moderate and heavier drinkers into one category, so they could not assess relative associations between alcohol consumption and bone density in moderate compared with heavy drinkers. Even though there is a positive effect of alcohol consumption on hip fracture and bone density, the exact range of beneficial alcohol consumption could not be determined.

(2) What is the relationship between alcohol intake and cognitive decline with age? Conclusion: Moderate evidence suggests that compared to non-drinkers, individuals who drink moderately have a slower cognitive decline with age (Grade=moderate). Although limited, evidence suggests that heavy/binge drinking is detrimental to age-related cognitive decline (Grade=limited).

Quality Rating	Moderate; Limited
Search period	January 1, 1995 to June 22, 2009
Search terms	"Ethanol"[MeSH] OR "Alcohol Drinking"[MeSH] OR "Alcoholic Beverages"[MeSH]) AND "Cognition Disorders"[MeSH]
Inclusion criteria	Human subjects, English language, international, sample size (min. 10 subjects per study arm), dropout rate (less than 20%), Adults of legal drinking age (21 years and older), subjects - healthy, those with elevated chronic disease risk, those diagnosed with the highly prevalent chronic diseases (CHD/CVD, hypertension, type 2 diabetes, osteoporosis, osteopenia and obesity) and those with breast cancer, colon cancer and/or prostate cancer.
Exclusion criteria	Medical treatment or therapy, diseased subjects (exceptions noted), hospitalized patients/malnourished/ third-world populations/ disease

	incidence not relative to US population (e.g., malaria), animal studies, in vitro studies, articles not peer reviewed, cross-sectional study design.						
Search results	Total hits from all database searches = 230; total articles reviewed = 37. Number of primary studies identified = 7. Number of review articles identified = 1. Number of articles reviewed but excluded = 29.						
Article(s) included for evidence analysis	*Systematic Review/Meta-analysis:* (1) Peters R, Peters J, Warner J, Beckett N, Bulpitt C. Alcohol, dementia and cognitive decline in the elderly: a systematic review. Age Ageing. 2008 Sep; 37(5): 505-512. *Primary Studies*: (1)Bond GE, Burr RL, McCurry SM, Rice MM, Borenstein AR, Larson EB. Alcohol and cognitive performance: A longitudinal study of older Japanese Americans. The Kame Project. The Kame Project. Int Psychogeriatr. 2005 Dec; 17(4): 653-668. (2)Deng J, Zhou DH, Li J, Wang YJ, Gao C, Chen M. A two-year follow-up study of alcohol consumption and risk of dementia. Clin Neurol Neurosurg. 2006 Jun; 108(4): 378-383. (3)Mehlig K, Skoog I, Guo X, Schütze M, Gustafson D, Waern M, Ostling S, Björkelund C, Lissner L. Alcoholic beverages and incidence of dementia: 34-year follow-up of the prospective population study of women in Goteborg. Am J Epidemiol. 2008 Mar 15; 167(6): 684-691. (4)Ngandu T, Helkala EL, Soininen H, Winblad B, Tuomilehto J, Nissinen A, Kivipelto M. Alcohol drinking and cognitive functions: findings from the Cardiovascular Risk Factors Aging and Dementia (CAIDE) Study. Dement Geriatr Cogn Disord. 2007; 23(3): 140-149. (5)Solfrizzi V, D'Introno A, Colacicco AM, Capurso C, Del Parigi A, Baldassarre G, Scapicchio P, Scafato E, Amodio M, Capurso A, Panza F; Italian Longitudinal Study on Aging Working Group. Alcohol consumption, mild cognitive impairment and progression to dementia.Neurology. 2007 May 22; 68 (21): 1,790-1,799. (6)Stott DJ, Falconer A, Kerr GD, Murray HM, Trompet S, Westendorp RG, Buckley B, de Craen AJ, Sattar N, Ford I. Does low to moderate alcohol intake protect against cognitive decline in older people? J Am Geriatr Soc. 2008 Dec; 56(12): 2, 217-2, 224. (7)Wright CB, Elkind MS, Luo X, Paik MC, Sacco RL. Reported alcohol consumption and cognitive decline: The Northern Manhattan study. Neuroepidemiology. 2006; 27(4): 201-207.						
Source	Peters et al., 2008.						
Study Design	Systematic Review/Meta-analysis, N=23 studies						
Quality Rating	Positive						
Location	Primarily Europe/North America						
Outcome	Evaluating evidence for relationship between incident cognitive decline or dementia in elderly and alcohol consumption						
Results	-In older people, small to moderate amounts of alcohol consumption were associated with decrease in dementia and Alzheimer's disease incidence. -Small amounts of alcohol may be protective against dementia (RR = 0.63, 95% CI: 0.53 to 0.75) and Alzheimer's disease (RR=0.82, 95% CI: 0.50 to 1.35) or cognitive decline (RR=0.89, 95% CI: 0.67 to 1.17). -Evidence is strongest for wine consumption, but not conclusive.						
Strengths/ Limitations	Limitations: Studies varied, with differing lengths of follow-up, measurement of alcohol consumption, inclusion of true abstainers and assessment of potential confounders. Due to the heterogeneity in the data, these findings should be interpreted with caution.						
Source	Bond et al., 2005	Deng et al., 2006	Mehlig et al., 2008	Ngandu et al., 2006	Solfrizzi et al., 2007	Stott et al., 2008	Wright et al., 2006
Quality Rating	Neutral	Neutral	Neutral	Neutral	Positive	Neutral	Positive
Location	United States	China	Sweden	Finland	Italy	Ireland, Scotland,	United States

						Netherlands	
Design	Prospective cohort study	Prospective cohort study	Prospective cohort study	Prospective cohort study	Prospective cohort study	Prospective cohort study	Prospective cohort study
Exposure or Outcome	Longitudinal relationship between alcohol consumption and cognitive performance	Relationship between alcohol intake and dementia	Frequency of alcohol intake related to dementia over time.	Relationship between alcohol consumption in mid-life and dementia later on.	Impact of alcohol consumption on the incidence of mild cognitive impairment and its progression to dementia.	Investigated whether low to moderate alcohol intake was protective against cognitive decline in older people.	Examined the effect of alcohol intake on cognitive performance over time in a younger, multi-ethnic, community-based sample
Duration	8 years	2 years	34 years	21 years	3.5 years	3.2 years	Mean follow-up of 2.2 years
Population	Japanese American older adults (N=1,624)	Seniors (60 years and older) living in China (N=2,632)	Women between ages 18-35 in 1968/69 (N=1,462)	Participants in Cardiovascular Risk Factors, Aging and Dementia (CAIDE) study (N=1,341 at follow-up)	Italian participants aged 65 to 84 (N=1,445)	Men and women aged 70 – 82 years with vascular risk factors or vascular disease (N=5,804)	Men and women participating in Northern Manhattan Study (multi-ethnic cohort) (N=1,428)
Results	Current alcohol consumers (N=480) scored significantly higher (p<0.05) on the Cognitive Abilities Screening Instrument (mean rate of change of 1.22 CASI units) than past consumers or abstainers (N=1,144, mean rate of change of -3.77 CASI units)	- Light to moderate drinking associated with a significantly decreased risk of dementia, compared with non-drinking, while excessive drinking related to an increased risk of dementia. - Light to moderate intake of wine/liquor related with a	- Wine was protective for dementia (Hazard Ratio = 0.5, 95%CI: 0.4-0.8). -Association strongest among women who consumed wine only (HR=0.3, 95%CI: 0.1-0.8). - Protective association of wine stronger among smokers. - Consumption of spirits at	- Participants who did not drink alcohol at mid-life had poorer performance in episodic memory, psychomotor speed and executive function in later life, compared with infrequent and frequent drinkers - Late-life drinkers had poorer psychomotor speed and executive function.	- Moderate drinkers with mild cognitive impairment who consumed less than one drink a day of wine showed significantly lower rate of progression to dementia than non-drinkers (HR =0.15; 95% CI: 0.33 - 0.77). - No significant associations were found between any levels of drinking	-Results showed cognitive performance was better for female drinkers than non-drinkers for all cognitive tests over the 3.2-year follow-up. - No statistically significant differences were found in baseline cognitive function between male drinkers and non-drinkers. - The rate of	-Results showed a positive relationship between reported alcohol intake and cognition. - Drinking less than one drink a week (p=0.09), between one drink weekly up to two drinks daily (p=0.001), and more than two drinks daily (p=0.003) were associated with less cognitive decline compared

		decreased risk of dementia compared to non-drinkers, while light-to-moderate intake of beer associated with a significantly higher risk of dementia than non-drinkers.	baseline associated with slightly increased risk of dementia (HR=1.5, 95%CI: 1.0 – 2.2).		and the incidence of mild cognitive impairment in non-cognitively impaired individuals vs. non-drinkers.	cognitive decline was similar for drinkers and non-drinkers for all cognitive tests, except for MMSE, which declined significantly less in female drinkers than non-drinkers.	to never drinkers.
Strengths/ Limitations of literature	*Limitations:* - Since the study enrolled individuals free of dementia at baseline, the sample is not representative of cognitive decline among older adults in general. - Relatively short follow-up time of 8 years.	*Limitations:* - Short follow-up duration of 2 years. - Limited number of dementia cases might restrict the power of the study. - Due to the heterogeneity in the data, these findings should be interpreted with caution.	*Strengths:* - Large cohort. - Several measurements made over time. *Limitations:* - Lack of information about the amount of intake of the different alcoholic beverages. - Possible underreporting of alcohol intake.	*Strengths*: - Population-based data with high participation rate. - Information on alcohol intake was included both midlife and late life intake. - The change in drinking frequency was also able to be associated with cognitive function. - Data on several domains of cognitive function was available. *Limitations:* - Self-reporting of intake. - Assumed subjects were cognitively intact at midlife	*Limitations:* - Short follow-up, cognitive changes not likely to be extensive in such a short time.	*Limitations:* - Drinking habits were recorded only at study baseline, and information on lifetime alcohol consumption was not available. - No information was presented on the type of alcohol consumed. - Short follow-up.	*Limitations:* - Differences between study populations may not have been adequately controlled for in analyses. - Cognitive function was assessed only over the phone. - Although alcohol type was included in the intake measure, any potential differences among beer, wine and liquor were not explored.

				assessment. - Other factors that are associated with drinking and cognitive ability may impact outcome.			

(3) What is the relationship between alcohol intake and coronary heart disease? Conclusion: Strong evidence consistently demonstrates that compared to non-drinkers, individuals who drink moderately have a lower risk of coronary heart disease (CHD). Insufficient evidence was available to determine if drinking patterns were predictive of risk of CHD, although there was moderate evidence to suggest that heavy/binge drinking is detrimental.

Quality Rating	Strong; Insufficient.
Databases	Populations: Healthy, those with elevated chronic disease risk, those diagnosed with the highly prevalent chronic diseases (CHD/CVD, hypertension, Type 2 diabetes, osteoporosis, osteopenia and obesity) and those with breast cancer, colon cancer and/or prostate cancer.
Search period	January 1, 1995 through June 8, 2009
Search terms	"Cardiovascular Diseases"[MeSH] OR "Heart Diseases"[MeSH] OR "Stroke"[MeSH] AND "Ethanol"[MeSH] OR "Alcohol Drinking"[MeSH] OR "Alcoholic Beverages"[MeSH] "Stroke"[MeSH] AND "Ethanol"[MeSH] OR "Alcohol Drinking"[MeSH] OR "Alcoholic Beverages"[MeSH]
Inclusion criteria	Human subjects, English language, international, sample size (min. of 10 subjects per study arm), dropout rate (less than 20%), adults of legal drinking age (21 years and older).
Exclusion criteria	Medical treatment/therapy, diseased subjects (exceptions noted), hospitalized patients, malnourished/third-world populations or disease incidence not relative to US population (e.g., malaria), animal studies, in vitro studies, articles not peer reviewed, cross-sectional study design.
Search results	Total hits from all electronic database searches: 100. Total articles identified to review from electronic databases: 23. Number of primary articles identified: 0. Number of review articles identified: 6. Total number of articles identified: 6. Number of articles reviewed but excluded: 17.
Article(s) included for evidence analysis	(1) Bagnardi V, Zatonski W, Scotti L, La Vecchia C, Corrao G. Does drinking pattern modify the effect of alcohol on the risk of coronary heart disease? Evidence from a meta-analysis. J Epidemiol Community Health. 2008 Jul; 62 (7): 615-619. (2) Britton A, McKee M. The relation between alcohol and cardiovascular disease in Eastern Europe: Explaining the paradox. J Epidemiol Community Health. 2000 May; 54 (5): 328-332. (3) Cleophas TJ. Wine, beer and spirits and the risk of myocardial infarction: A systematic review. Biomed Pharmacother. 1999 Oct; 53 (9): 417-423. (4) Corrao G, Rubbiati L, Bagnardi V, Zambon A, Poikolainen K. Alcohol and coronary heart disease: A meta-analysis. Addiction. 2000 Oct; 95 (10): 1, 505-1, 523. (5) Di Castelnuovo A, Rotondo S, Iacoviello L, Donati MB, De Gaetano G. Meta-analysis of wine and beer consumption in relation to vascular risk. Circulation. 2002 Jun 18; 105 (24): 2, 836-2, 844. (6) Rimm EB, Williams P, Fosher K, Criqui M, Stampfer MJ. Moderate alcohol intake and lower risk of coronary heart disease: Meta-analysis of effects on lipids and haemostatic factors. BMJ. 1999 Dec 11; 319 (7224): 1, 523-1, 528.

Source	Bagnardi et al., 2008	Britton et al., 2000	Cleophas, 1999	Corrao et al., 2000	Di Castelnuovo et al., 2002
Quality rating	Positive	Neutral	Neutral	Positive	Positive
Study design	Meta-analysis: 6 studies (4 cohort, 2 case control)	Systematic review: 6 studies (3 case control)	Meta-analysis: 20 international studies (8 cohort/ 12 prospective cohort)	Meta-analysis: 43 cohort studies, eight case-control studies	Meta-analysis: 6 international studies
Health outcome	Drinking pattern, defined by the frequency of drinking days as well as drinking intensity per drinking occasion, modified the effect of alcohol intake on the risk of CHD.	Relationship between heavy drinking and irregular (binge) drinking and sudden cardiovascular mortality.	Relationship between MI and consumption of different types of alcoholic beverages, at low and high doses.	Relationship between alcohol consumption and risk of CHD.	Relationship between wine or beer consumption and CVD.
Location	Europe and North America	Europe and the United States	Not specified	Not specified	Not specified
Population	Adult males and females	Adult males	Adult males and females	Adult males and females	Adult males and females
Results	- Compared with those who abstained from alcohol, regular heavy drinkers had a decreased risk of CHD (RR=0.75, 95%CI: 0.64 – 0.89) and heavy irregular or binge drinkers had an increased risk (RR=1.10, 95%CI: 1.03-1.17). - Dose-response relationship between amount of alcohol and CHD risk also differed between regular and irregular heavy drinkers (p<0.047).	- Considerable evidence that binge drinkers are at increased risk of cardiac arrhythmias and sudden cardiac death. - A causal relationship is biologically plausible and the effects of binge drinking are quite different from those seen with regular, moderate and even heavy drinking.	- Small doses of alcohol associated with decreased risk of mortality and CHD, while >5 drinks per day increased risk of mortality; wine, beer, and spirits were equally beneficial.	- Results from all 51 studies showed that a protective effect was evident up to 90g per day (RR=0.94, 95%CI: 0.90-1.00), with harmful effects evident at 113 g per day (RR=1.08, 95%CI: 1.00-1.16). - For females, protective effect evident up to 31g per day (RR=0.93, 95%CI: 0.87-1.00) and harmful effects evident at 52g per day (RR=1.12, 95%CI:1.00-1.26). - For males, protective effect evident up to 87g	- From 13 studies, the RR of vascular disease associated with wine consumption was 0.68 (95%CI: 0.59-0.77) relative to non-drinkers and 10 studies supported a J-shaped relationship between different amounts of wine intake and vascular risk. - From 15 studies, RR of vascular disease associated with moderate beer

	- A J-shaped curve seen for irregular drinkers. - For people who consumed alcohol > two days a week, a protective effect was seen.			per day (RR=0.94, 95%CI: 0.88-1.00) and harmful effects evident at 114g per day (RR=1.09, 95%CI:1.00-1.19).	consumption was 0.78 (95%CI: 0.70-0.86). However, NS relationship between different amounts of beer intake and vascular risk.
Strengths/ Limitations of literature	- This meta-analysis was tightly controlled and conducted; high quality study. - Limitations: small number of studies included.	Not provided	- Search terms not described. - No analysis of study quality or validity.	- This study was extremely thorough.	Not provided

(4) What is the relationship between alcohol intake and unintentional injury? Conclusion: Strong evidence demonstrates that drinking in excess of current guidelines increases the risk of unintentional falls, motor vehicle crashes and drowning. When alcohol is consumed in moderation, the evidence for risk of unintentional injury is less well established for activities such as driving, swimming and athletic participation, but abstention from alcohol is the safest.

Quality Rating	Strong
Search period	January 1, 2004 to January 13, 2010
Search terms	(ethanol OR alcoholic OR alcohol's OR alcohol) AND ("unintentional injuries" OR "unintentional falls"); ("Wounds and Injuries"[MeSH] OR "Accidents"[MeSH:NoExp] OR "Accidental Falls"[mh] OR "Accidents, Home"[mh]) AND ("Alcohol Drinking/adverse effects"[MeSH]; ("Accidents"[majr:NoExp] OR "Accidental Falls"[majr] OR "Accidents, Home"[majr]) AND "Alcohol Drinking"[majr]); ("Ethanol"[MeSH] OR "Alcoholic Beverages"[Mesh]) AND ("Accidents"[majr:NoExp] OR "Accidental Falls"[majr] OR "Accidents, Home"[majr]); ("Ethanol"[majr] OR "Alcohol Drinking"[majr] OR "Alcoholic Beverages"[majr]) AND (drowning[mh] OR Accidents, Occupational"[majr])
Population	Healthy, those with elevated chronic disease risk, those diagnosed with the highly prevalent chronic diseases (CHD/CVD, hypertension, type 2 diabetes, osteoporosis, osteopenia and obesity) and those with breast cancer, colon cancer and/or prostate cancer.
Inclusion criteria	Human subjects, English language, international, sample size (min. 10 subjects per study arm), dropout rate (less than 20%), adults of legal drinking age (21 years and older).
Exclusion criteria	Medical treatment or therapy, diseased subjects (exceptions noted), malnourished/ third-world populations/ disease incidence not relative to US population (e.g., malaria), animal studies, in vitro studies, articles not peer reviewed.
Search results and strategy	Total hits from all electronic database searches: 372. Total articles identified to review from electronic databases: 30. Number of primary articles identified: 17. Number of review articles identified: 4. Total number of articles identified: 21. Number of articles reviewed but excluded: 9.
Article(s) included for evidence analysis	*Systematic review/Meta-analyses:* (1) Driscoll TR, Harrison JA, Steenkamp M. Review of the role of alcohol in drowning associated with recreational aquatic activity. Inj Prev. 2004 Apr; 10(2): 107-113. (2) González-Wilhelm L. Prevalence of alcohol and illicit drugs in blood specimens from drivers involved in traffic law offenses. Systematic review

of cross-sectional studies. Traffic Inj Prev. 2007 Jun; 8(2): 189-198.

(3) Cherpitel CJ. Alcohol and injuries: A review of international emergency room studies since 1995. Drug Alcohol Rev. 2007 Mar; 26(2): 201-214.

(4) Kool B, Ameratunga S, Jackson R. The role of alcohol in unintentional falls among young and middle-aged adults: A systematic review of epidemiological studies. Inj Prev. 2009 Oct; 15(5): 341-347.

Primary Studies:

(1) Bedford D, O'Farrell A, Howell F. Blood alcohol levels in persons who died from accidents and suicide. Ir Med J. 2006 Mar; 99(3): 80-83.

(2) Driscoll TR, Harrison JE, Steenkamp M. Alcohol and drowning in Australia. Inj Control Saf Promot. 2004 Sep; 11(3): 175-181.

(3) Hall AJ, Bixler D, Helmkamp JC, Kraner JC, Kaplan JA. Fatal all-terrain vehicle crashes: Injury types and alcohol use. Am J Prev Med. 2009 Apr; 36(4): 311-316.

(4) Hingson RW, Edwards EM, Heeren T, Rosenbloom D. Age of drinking onset and injuries, motor vehicle crashes, and physical fights after drinking and when not drinking. Alcohol Clin Exp Res. 2009 May; 33(5): 783-790.

(5) Hingson RW, Zha W. Age of drinking onset, alcohol use disorders, frequent heavy drinking, and unintentionally injuring oneself and others after drinking. Pediatrics. 2009 Jun; 123(6): 1, 477-1, 484.

(6) Johnston JJ, McGovern SJ. Alcohol-related falls: An interesting pattern of injuries. Emerg Med J. 2004 Mar; 21(2): 185-188.

(7) Kool B, Ameratunga S, Robinson E, Crengle S, Jackson R. The contribution of alcohol to falls at home among working-aged adults. Alcohol. 2008 Aug; 42(5): 383-388.

(8) Kurzthaler I, Wambacher M, Golser K, Sperner G, Sperner-Unterweger B, Haidekker A, Pavlic M, Kemmler G, Fleischhacker WW. Alcohol and benzodiazepines in falls: An epidemiological view. Drug Alcohol Depend. 2005 Aug 1; 79(2): 225-230.

(9) Levy DT, Mallonee S, Miller TR, Smith GS, Spicer RS, Romano EO, Fisher DA. Alcohol involvement in burn, submersion, spinal cord, and brain injuries. Med Sci Monit. 2004 Jan; 10(1): CR17-CR24.

(10) McDonald AJ 3rd, Wang N, Camargo CA Jr. US emergency department visits for alcohol-related diseases and injuries between 1992 and 2000. Arch Intern Med. 2004 Mar 8; 164(5): 531-537.

(11) McLean R, Connor J. Alcohol and injury: A survey in primary care settings. N Z Med J. 2009 Sep 25; 122(1, 303): 21-28.

(12) Mukamal KJ, Mittleman MA, Longstreth WT Jr, Newman AB, Fried LP, Siscovick DS. Self-reported alcohol consumption and falls in older adults: Cross-sectional and longitudinal analyses of the cardiovascular health study. J Am Geriatr Soc. 2004 Jul; 52(7): 1, 174-1, 179.

(13) Rehm J, Patra J, Popova S. Alcohol-attributable mortality and potential years of life lost in Canada 2001: Implications for prevention and policy. Addiction. 2006 Mar; 101(3): 373-384.

(14) Sorock GS, Chen LH, Gonzalgo SR, Baker SP. Alcohol-drinking history and fatal injury in older adults. Alcohol. 2006 Nov; 40(3): 193-199.

(15) Watt K, Purdie DM, Roche AM, McClure R. Acute alcohol consumption and mechanism of injury. J Stud Alcohol. 2006 Jan; 67(1): 14-21.

(16) Watt K, Purdie DM, Roche AM, McClure RJ. Risk of injury from acute alcohol consumption and the influence of confounders. Addiction. 2004 Oct; 99(10): 1, 262-1, 273. Erratum in: Addiction. 2004 Oct; 99(10): 1, 366.

(17) Yoonhee C, Jung K, Eo E, Lee D, Kim J, Shin D, Kim S, Lee M. The relationship between alcohol consumption and injury in ED trauma patients. Am J Emerg Med. 2009 Oct; 27(8): 956-960.

Source(s)	Driscoll et al., 2004	Gonzalez-Wilhelm, 2007	Cherpitel, 2007	Kool et al., 2009
Quality Rating	Neutral	Neutral	Neutral	Positive
Study design	Systematic review; N=65 studies	Systematic review; N=31 studies	Systematic review; N=56 studies	Systematic review; N=8 studies

Health outcome	Role of alcohol in drowning and recreational aquatic activity	Role of alcohol in driving, road traffic accidents	Emergency room studies on alcohol and injury	Risk of falls associated with acute and usual alcohol consumption among young and middle-aged adults
Location	Mostly US, Australia	International	International	International
Results	- About 30% - 40% of people on boats drink alcohol while on board, men tend to drink more and behave in higher risk aquatic activities in association with drinking than women. - Persons with a blood alcohol level of 0.10 g/100 ml have about 10 times the risk of death associated with recreational boating compared with persons who have not been drinking. - Alcohol probably contributes to between 10% and 30% of all recreational drowning deaths.	- Alcohol was the predominant substance, with prevalence of 22-57.1% in studies of fatally injured drivers, 20-26% in studies of drivers who survived road traffic accidents, 88.1 -95.5% in studies of drivers primarily suspected of driving under influence of alcohol and 25.8-49.2% in studies of drivers primarily suspected of driving under the influence of drugs. - Alcohol appears to be the predominant substance, but among drivers primarily suspected of driving under the influence of drugs (DUID), cannabinoids are more prevalent.	- Injured patients are more likely to be positive for BAC and report drinking within six hours prior to injury than non-injured patients. - The magnitude of the association substantially increased for violence-related injuries compared to non-violence related injuries.	- Proportion of fall subjects who had been drinking within six hours of event ranged from 14%-53%; acute alcohol use accounted for at least a three-fold increase in unintentional fall risk. - Modest evidence of a dose-response relationship between injury and acute alcohol use. - Association between usual alcohol use and fall risk was inconclusive.
Strengths/ Limitations of literature	*Limitations:* - Overall quality of the studies varied considerably. - Most of the studies had missing blood alcohol values. - Confounding factors complicate the relationship between intoxication and impairment (e.g., polydrug use).	*Limitations:* - Lack of standardization of variables makes it difficult to calculate prevalence.	*Strengths:* - This review represents a broader range of ER studies than that reported previously. *Limitations:* - Original number of studies identified not clear. - Majority of studies did not account for substance use other than alcohol. - Injured patients drawn from ER samples are not representative.	*Limitations:* - Confounding was not adequately considered in a number of studies. - Some studies were compromised by potential recall and other measurement biases. - Wide range of measures used to calculate alcohol consumption. - There is insufficient evidence to determine an association between usual alcohol use and fall risk in this age group.
Source(s)	Bedford et al., 2006	Driscoll et al., 2004	Hall et al., 2009	
Quality Rating	Neutral	Neutral	Neutral	

Study Design	Retrospective cohort study	Retrospective cohort study	Retrospective cohort study	
Location	Ireland	Australia	United States	
Population	N=129 deaths; Coroner's records from 2001-2001	N=6,259 total deaths; Review of death in the National Coroners Information System from July 200 – June 2001	N=112 fatal ATV crashes; Cases identified through the Health Statistics Center of the West Virginia Department of Health and Human Resources for death certificates from 2004 – 2006	
Results	- Of the 55 who died in road traffic accidents, 22 (40%) had positive BACs. - Of the 31 who died as a result of suicide, 16 (55.5%) had positive BACs. - Of the 11 who died in house fires, the mean BAC was 225.2mg per 100ml. - None of those who died as a result of an industrial or farming accident had alcohol detected in their blood.	- Alcohol contributed to approx. 19% of these fatal drowning incidents (25% for recreational aquatic activity, 16% for incidental falls into water and 12% for drowning due to suicide) with blood alcohol levels for these cases ranging from 0.020g per 100ml to 0.375 per 100ml. - The estimated all-ages proportion of unintentional drowning attributed to alcohol was 17% (using >0.10 g per 100 ml as cut-off).	- Of 104 92.9% decedents with toxicologic testing, 60 (57.7%) were positive for either alcohol or drugs of abuse. - Regardless of type of crash (traffic vs. non-traffic), 51 (49%) of decedents were positive for alcohol and of those 88% had BACs>0.08.	
Source	Hingson et al., 2009	Johnston & McGovern, 2004	Kool et al., 2008	Kurtzhaler et al., 2005
Quality Rating	Neutral	Negative	Neutral	Neutral
Study Design	Cross-sectional study	Prospective cohort study	Population-based case-control study	Case-control study
Location	United States	Ireland	New Zealand	Austria
Population	N=4,021 completed survey; current/former drinkers, aged 18-39	- Total of 351 healthy adults presenting to the Ulster Hospital between November 2001 and July 202 with fall injuries were included in the analysis. - N=113 had consumed alcohol and 238 had not, based on appearance and BACs were measured for 47 patients giving	- Total of 335 cases, mean age 45.9 years; 353 controls, mean age 44.6 years - BAC only available for cases - Cases identified through each of three trauma admitting hospitals for region and Coroner's office, and controls comprised random sample of people from General	- Total of 615 cases, mean age 64.8; total of 996 controls, mean age 40.5 years. - Cases were patients admitted to the emergency room injured by falls overs a 12-month period, and controls were patients admitted for accidents of other causes.

		consent.	and Maori electoral rolls in the region.	
Results	- 38% of drinkers had ever been a driver in a motor vehicle crash and 14% of those drivers were in accidents that occurred after they had been drinking, 34% reported ever being in a physical fight and 64% of them were in fights that occurred after drinking, 27% were ever accidentally injured, and 50% of them were injured after drinking. - The odds of experiencing motor vehicle accidents or injuries when not drinking were significantly elevated among early onset drinker.	- Significant difference in pattern of injury between those who had consumed alcohol and those who had not (p<0.001) and significant difference between groups in the Injury Severity Scores (z=-2.5, p<0.001). - For those who consumed alcohol, severity and pattern correlated with alcohol concentration at the time of injury. - Patients with an alcohol concentration <2 g/l had mostly soft tissue limb injuries (58%), 2 - 2.5 g/l had mostly significant limb fractures (55%) and >2.5 g/l had mostly significant head injuries (90%).	- Consumption of ≥ two standard alcoholic drinks in preceding six hours relative to none was associated with significantly increased risk of fall-related injury (for 2 standard drinks: OR=3.7, 95%CI: 1.2-10.9; for ≥ 3 drinks: OR=12.9, 95%CI: 5.2-31.9). - 20% of unintentional falls at home may be attributable to consumption of ≥ two drinks in preceding 6 hours.	- Of the 615 cases, 22% tested positive for alcohol, 55% tested positive for benzodiazepines and 1.5% tested positive for both substances. - Significant number of males tested positive for alcohol than females (40.2% vs. 7.6%). - Percentage of both male and female patients who had consumed alcohol at the time of accident decreased significantly with age, across all age groups (p<0.001). - Consumption of alcohol was more likely in patients hurt by sudden fall (males 49.7%, females 18.9%) than in age-matched sample of patients involved in accidents of other causes (males 20.6%, females 3.1%, p<0.001).
Sources	Levy & Mallonee et al., 2004	McDonald et al., 2004	McLean et al., 2009	Mukamal et al., 2004
Quality Rating	Neutral	Neutral	Neutral	Neutral
Study Design	Cross-sectional study	Trend Study	Cross-sectional survey	Trend Study
Population	Data from 1988 to 1992 on 11, 376 persons were obtained from a statewide, population-based injury surveillance system in Oklahoma.	Data from the National Hospital Ambulatory Medical Care Survey from 1992 through 2000	N=317 men and women, aged 16 – 84 years who were admitted to three primary care facilities over a two-month period	N=5,841 participants from the Cardiovascular Health Study; men and women over 65 years of age.
Location	United States	United States	New Zealand	United States
Results	Fire burns: - Mean alcohol involvement significantly increased among	- During these nine years, there were an estimated 68.6 million (95%CI: 65.6 to 71.7 million)	- 17% of people aged 16 years consumed an alcohol drink in the six hours prior to injury.	*Cross-sectional analysis*: Prevalence of frequent falls was highest in abstainers and lowest in participants

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persons killed than among survivors (30.7% vs. 11.0%, x^2 =101.1, p<0.001). - Alcohol involved in higher percentage of fatal non-work-related unintentional cases (32.5%) and non-work-related unintentional injuries (11.7%) than when alcohol not involved. - Alcohol-involved burn victim was >5 times as likely to die as a non-alcohol-involved fire burn victim (p<0.001). Submersions: - Alcohol-involved submersion cases were two times more likely to be fatal (31.0%) than non-alcohol involved cases (6.2%)(x^2 =43.0, p<0.001). Spinal cord injuries: - Among non-fatal spinal cord injuries, alcohol involved nearly twice as high in intentional (48.4%) than non-intentional (25.8%) Traumatic brain injury: - 38.5% of fatal and 42.3% of non-fatal cases involved alcohol.	emergency department visits attributable to alcohol, a rate of 28.7 (95%CI: 27.1 to 30.3%) per 1,000 US. - Number of alcohol-related visits increased 18% during the nine-year period. - Emergency department visit rates were highest for those who were aged 30-49 years, male and black.	- Of this group, 36% had moderate intake of alcohol and 64% a hazardous intake (p=0.002). - Greater proportion of women (24%) had been drinking prior to injury than men (11%) (p=0.005).	who consumed 14 or more drinks per week (P=0.06). *Longitudinal analysis*: - No difference was found between abstainers and light to moderate drinkers in their risk of falls during follow-up. - Consumers of 14 or more drinks per week had a significantly higher risk of falls than abstainers in adjusted analyses (odds ratio=1.25, 95% CI: 1.03 to 1.52, P=0.07). - The hazard ratio for incident falls associated with consumption of 14 or more drinks per week was 1.20 (95% CI: 0.97 to 1.47) for white participants and 1.51 (95% CI: 0.78 to 2.91) for black participants. - No interactions were found in participants younger or older than 75, men or women, or participants whose reported physical activity or gait speed were above or below the median level (p>0.2 for all).
Source	Rehm et al., 2006	Sorock et al., 2006	Watt et al., 2004	Watt et al., 2006
Quality Rating	Neutral	Neutral	Neutral	Positive
Study Design	Cross-sectional study	Case-control study	Case-control study	Cross-sectional study
Population	N=13,090; final N=47% response rate	Total of 1,735 cases, aged ≥ 55 years selected from 1993 National	N=488 patients who were treated at emergency dept for injury and	N=1205 patients approached, 789 were eligible and 593 were included

	Age ≥15 years Randomly drawn sample from data taken from Canadian Addiction Survey (2003/04)	Mortality Follow-Back survey, which provided national estimates of alcohol usage and demographic information among people who died from injuries. Total of 13,381 controls aged 55 years selected from the 1992 National Longitudinal Alcohol Epidemiologic survey, which provided national estimates of alcohol usage for the general public.	were interviewed, as well as N=488 population matched controls	in analysis; ≥15 years of age.
Location	Canada	United States	Australia	Australia
Results	- On average, men consumed more alcohol than women and alcohol consumption decreased with age. - The overall average age for an alcohol-attributable death was 45.9 years for men and 58.8 years for women. - 3,892 alcohol-attributable deaths were estimated accounting for 3,313 deaths among men and 579 among women. - Among deaths caused by alcohol, the three biggest contributors were unintentional injuries, malignant neoplasms and digestive diseases. - Cirrhosis of the liver, motor vehicle accidents, suicides/self-inflicted injuries, oesophageal cancer and	- Drinking appeared to be associated with suicide more so than with motor vehicle crashes and falls. - Drinking in the last year was associated with a 70% increase in the risk of death from a motor vehicle crash or fall. - Drinking in the last year was associated with a 60% increase in the risk of suicide. - Drinking increased the risk of suicide more for women than for men; the adjusted OR for women drinkers versus nondrinkers was 2.5 (95% CI: 1.67-3.68); for men the OR was 1.3 (95% CI: 1.00-1.65).	- After controlling for all demographic and situational variables, there was an injury risk of 1.9% for males (OR=1.019, 95% CI: 0.963-1.079) and 65.7% for females (OR=1.657; 95% CI: 0.75-3.660) for every 10 grams of alcohol consumed (ns). - Drinking beer (OR=1.86, 95%CI: 0.9-3.9), spirits (OR=3.05, 95% CI: 1.1-82), or a combination (OR=3.16, 95% CI: 1.1-8.8) of beverages increased risk of injury compared to not drinking any alcohol in the 6 hours prior to injury; drinking wine reduced injury risk (ns). - There was an inverse association between regular consumption of any amount of alcohol and risk of injury.	- After controlling for relevant confounding variables, neither quantity nor type of alcohol was significantly associated with injury mechanism. - However, drinking setting (i.e., licensed premise) was significantly associated with increased odds of sustaining an intentional versus unintentional injury (OR = 2.79, 95% CI= 1.4-5.6); injury through being hit by/against something versus other injury types (OR = 2.59, 95% CI = 1.4-4.9). - Compared with unintentionally injured patients, those with intentional injuries were significantly more likely to report drinking in a licensed premise in the 6 hours prior to injury than to report not drinking alcohol (OR=2.79, 95% CI=1.4-5.6).

	cardiac arrhythmias constituted the largest alcohol-attributable categories. - Potential Years of Life Lost rate for Canada for deaths due to alcohol was 769 per 100,000 for men and 203 per 100,000 for women aged zero to 80+ years. - A high PYLL rate for men was observed, indicating higher levels of premature mortality among men compared to women.			
Source	Yoonhee et al., 2009			
Quality Rating	Neutral			
Study design	Case-control; N=407 patients			
Location	South Korea			
Results	- Head Abbreviated Injury Scale (AIS) score was significantly higher in intoxicated patients (1.1+1.7) compared to control patients (0.6+1.2), P<=0.008. - Mortality was significantly higher in intoxicated patients than in sober ones (6 deaths (5.7%) vs. 5 deaths, (2.0%), P=0.003). - There was a significantly higher number of intoxicated patients with severe injuries (21% intoxicated vs. 11.7% sober, P=0.023), and specifically with severe head injuries (head AIS >3) (25.7% intoxicated versus 13.3% sober, p=0.004). - Length of ICU admission was significantly higher in intoxicated patients (1.9+4.6 days) compared with sober patients (0.7+2.6 days). - Injury severity tended to increase in patients with BAC levels less than 200 mg/dL, decrease in patients with BAC levels between 200 and 25 mg/dL, and increase again in patients with BAC levels 250 mg/dL or higher.			

(5) What is the relationship between alcohol intake and weight gain? Conclusion: Moderate evidence suggests that moderate drinking is not associated with weight gain. However, heavier consumption over time is associated with weight gain.

Quality Rating	Moderate
Search period	November 1, 1994 to May 11, 2009
Search terms	("Ethanol"[MeSH] OR "Alcohol Drinking"[MeSH] OR "Alcoholic Beverages"[MeSH]) AND ("Body Mass Index"[MeSH] OR "Waist-Hip Ratio"[MeSH] OR "Body Fat Distribution"[MeSH] OR Obesity[MeSH] OR overweight[MeSH] OR "Weight Gain"[MeSH] OR lipogenesis[MeSH]) AND "English and humans"[Filter] AND "Cohort Studies"[MeSH]
Population	Adults of legal drinking age (21 years and older), healthy, those with elevated chronic disease risk, those diagnosed with the highly prevalent chronic diseases (CHD/CVD, hypertension, type 2 diabetes, osteoporosis, osteopenia and obesity) and those with breast cancer, colon cancer and/or prostate

	cancer.		
Inclusion criteria	Human subjects, English language, international, sample size (min. subjects per study arm), dropout rate (less than 20%).		
Exclusion criteria	Medical treatment or therapy, diseased subjects (exceptions noted), hospitalized patients, malnourished/third-world populations/ disease incidence not relative to US population (e.g., malaria) animal studies, in vitro studies, articles not peer reviewed, cross-sectional study design		
Search results and strategy	Total hits from all electronic database searches: 518. Two studies found through handsearching. Total articles identified to review from electronic databases: 54. Number of primary articles identified: 8. Number of review articles identified: 0. Total number of articles identified: 8. Number of articles reviewed but excluded: 46.		
Article(s) included for evidence analysis	(1) Flechtner-Mors M, Biesalski HK, Jenkinson CP, Adler G, Ditschuneit HH. Effects of moderate consumption of white wine on weight loss in overweight and obese subjects. Int J Obes Relat Metab Disord. 2004 Nov; 28(11): 1, 420-1, 426. (2) Koh-Banerjee P, Chu NF, Spiegelman D, Rosner B, Colditz G, Willett W, Rimm E. Prospective study of the association of changes in dietary intake, physical activity, alcohol consumption, and smoking with a nine-year gain in waist circumference among 16, 587 US men. Am J Clin Nutr. 2003 Oct; 78(4): 719-727. (3) Liu S, Serdula MK, Williamson DF, Mokdad AH, Byers T. A prospective study of alcohol intake and change in body weight among US adults. Am J Epidemiol. 1994 Nov 15; 140(10): 912-920. (4) Sammel MD, Grisso JA, Freeman EW, Hollander L, Liu L, Liu S, Nelson DB, Battistini M. Weight gain among women in the late reproductive years. Fam Pract. 2003 Aug; 20(4): 401-409. (5) Sherwood NE, Jeffery RW, French SA, Hannan PJ, Murray DM. Predictors of weight gain in the Pound of Prevention study. Int J Obes Relat Metab Disord. 2000 Apr; 24(4): 395-403. (6) Tolstrup JS, Halkjaer J, Heitmann BL, Tjønneland AM, Overvad K, Sørensen TI, Grønbaek MN. Alcohol drinking frequency in relation to subsequent changes in waist circumference. Am J Clin Nutr. 2008 Apr; 87(4): 957-963. (7) Wannamethee SG, Field AE, Colditz GA, Rimm EB. Alcohol intake and eight-year weight gain in women: A prospective study. Obes Res. 2004 Sep; 12(9): 1, 386-1, 396. (8) Wannamethee SG, Shaper AG. Alcohol, body weight, and weight gain in middle-aged men. Am J Clin Nutr. 2003 May; 77(5): 1, 312-1, 317. PMID: 12716687.		
Primary Studies	Flechter-Mors et al., 2004	Koh-Banerjee et al., 2003	Liu et al., 1994	Sammel et al ., 2003
Quality Rating	Neutral	Positive	Neutral	Neutral
Study Design	Randomized Control Trial	Prospective cohort study	Cross-sectional study	Prospective cohort study
Population	N=40 overweight/obese men and women; mean age 48.1 years	N=16,587 healthy male health professionals with CVD, cancer or diabetes; aged 40-75 years	N=7,320 adults who participated in the first NHANES	N=336 African American and Caucasian women who participated in the Penn Study of Ovarian Aging over a four-year period
Health Outcome	3-month 1500kcal weight loss intervention; subjects randomly assigned to a white wine group (10% of total energy derived from white wine) or a grape	Lifestyle characteristics; BMI; waist-to-hip ration; alcohol consumption	Weight change; lifestyle characteristics	Evaluate correlates of weight gain in women aged 35 to 47 years

	juice group (10% of total energy derived from grape juice)			
Location	Germany	United States	United States	United States
Results	- All subjects achieved significant body weight loss. - Weight loss in the grape juice group and white wine groups was 3.75 (+0.46) kg and 4.73 (+0.53) kg respectively, with a non-significant difference.	-Alcohol consumption remained fairly constant over time, at an overall average of approx. 11.5 - 14.9g per day. - Non-significant associations observed between change in total alcohol consumption in nine-year 'waist' gain.	- Prospectively, both men and women drinkers tended to gain less weight than did non-drinkers (P=0.006 for trend in women, P=0.11 for trend in men). - Drinkers had more stable weight over the 10-year follow-up period. - Drinkers were less likely to have major weight gain or loss (gaining or losing 10kg or more) than were non-drinkers.	- Alcohol consumption among subjects did not affect risk of substantial weight gain (p=0.784). - Subjects who gained ≥ 10lbs drank an average of 7.3 drinks per week (SD±15.2). - Those who did not gain ≥10 lbs drank an average of 8.5 drinks per week (SD±19.0).
Study Limitations	- The study did not adequately explain actual timing of data collection (in the body composition measures). - Study supported by grants from Deutsche Weinakademie GmbH and Forum Wein und Gesundheit (both wine-related organizations).	- None noted. - However, alcohol consumption and 'waist' change were self-reported.	- Alcohol intake was self-reported. - Recall bias likely. - Alcohol intake and body weight may have fluctuated over the follow-up periods.	- Inability to accurately assess portion size or validate dietary data is a significant confounding factor. - Exclusion of 23% of sample due to "poor participation or insufficient hormone data" at the four-year follow-up.
Primary Studies	Sherwood et al., 2000	Tostrup et al., 2008	Wannamethee et al., 2003	Wannamethee et al., 2004
Quality Rating	Positive	Neutral	Neutral	Positive
Study Design	Prospective study (within an RCT)	Prospective cohort study	Prospective cohort study	Prospective cohort study
Population	N=826 women and 218 men	N=43,543 male and female participants from the Diet, Cancer and Health Study	N=6,832 middle-aged male participants of the British Regional Heart Study	N=49,324 female RNs from the Nurses' Health Study II who reported weight in 1991 to 1999
Health Outcome	Weight gain prevention project with three year follow-up	Baseline alcohol intake related to 5-year waist change and abdominal obesity	Alcohol and body weight	Examine prospectively the relationship between alcohol and 8-year weight gain in women.
Location	United States	Denmark	United Kingdom	United States
Results	- Over three years of observation, the average weight gain of the study group	- Drinking frequency was inversely associated with changes in waist circumference in women	- Age-adjusted mean BMI and the prevalence of men with a high BMI at baseline (≥ 28 kg/m2) increased	- A non-linear relationship was seen between alcohol and weight gain of >5kg in all women.

	was between 1.36 and 1.81kg. -.Mean changes in weight and percentage energy from alcohol over three-year period: - Female (N=759) +1.76 (6.7) kg body weight +0.30 (3.7)% energy from alcohol - Males (N=198) +1.69 (5.4) kg body weight +0.88 (4.0)% energy from alcohol - Changes in body weight, total energy intake, fat intake, and alcohol intake were significantly different from zero (P<0.05) for both men and women.	(P for linear trend < 0.0001) and was unassociated with changes in waist circumference in men (P for linear trend = 0.15). - Drinking frequency was unassociated with major 'waist' loss but was inversely associated with major waist gain: ORs among men ranged from 0.97 (95% CI: 0.73 to 1.28) for never drinking, to 0.79 (95% CI: 0.69 to 0.9) for drinking 7 days of the week. - Results for women were similar (P for trend < 0.0001). - For major 'waist' gain, the odds for major waist gain were highest in the light or nondrinkers	significantly from the light-moderate to the very heavy alcohol intake group even after adjustment for potential confounders. - After 5 years of follow-up, stable and new heavy drinkers (including very heavy drinkers of ≥ 30 g/day) showed the greatest weight gain and had the highest prevalence rates of high BMI.	- Compared with non-drinkers, adjusted relative odds of weight gain according to gram per day consumption were: -0.94 (95%CI: 0.89-0.99) for 0.1-4.9g -0.92 (95%CI: 0.85-0.99) for 5-14.9g -0.86 (95%CI: 0.76-0.78) for 15-29.9g -1.07 (95%CI: 0.89-1.28) for ≥30g (p<0.0001) - However in African-American women, light drinking associated with increased odds of weight gain (OR=2.43, 95%CI: 1.22-4.82).
Limitations	- Discrepancy in female and male demographics and other variables might be based on recruitment measures. - Exclusion of any major chronic diseases may limit generalizability of this study's findings. - Limited measures of alcohol consumption (only FFQ used).	- Large population-based study. - Most data based on self-report. - Alcohol drinking frequency only measured at baseline. - Waist circumference measured in 2 different areas at baseline by technicians and at follow-up by participants themselves, although authors note that the measurements were highly correlated. - 35% participation rate	- Alcohol intake and weight was self-reported at year five. - Alcohol intake at baseline validated through blood sampling. - Authors note that findings cannot be generalized to women.	- The major limitation of this study relates to the outcome measurements. - All weight outcomes were relying on self-reported data. - Because the exposure (alcohol consumption) was also self-reported data, it is likely to have dependent bias meaning that the reporting of exposure and outcome may depend on each other.

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BOOK CHAPTER – The global burden of alcohol consumption (Chapter Four)

Book Title	Alcohol No Ordinary Commodity – Research and Public Policy (Second edition)		
Authors	Thomas Babor, Raul Caetano, Sally Casswell, Griffith Edwards, Norman Giesbrecht, Kathryn Graham, Joel Grube, Linda Hill, Harold Holder, Ross Homel, Michael Livingston, Esa Osterberg, Jurgen Rehm, Robin Room, Ingeborg Rossow		
Date	2010		
Country	United States		
Publisher	Oxford University Press		
Overall Quality Rating (using text/book appraisal tool)	Reviewer #1 (SK) = Strong	Reviewer #2 (EA) = Moderate	Reviewer #3 (PB) = Strong
Relevant chapter related to topic	Chapter 4: The global burden of alcohol consumption		
Objectives of the chapter	The chapter describes a range of alcohol-related consequences in three different frames: 1) The role of alcohol in the global burden of disease and disability 2) Alcohol and all-cause mortality 3) The relation of alcohol to specific causes of death and disease		
Studies included	Research evidence derived from 2 types of evidence: 1) meta-analytic reviews and key studies that examined and compared individual outcomes across a large sample of cases (individual level); and 2) studies based on population (aggregate level) time-series analyses.		
Summary of Evidence	▪ Evidence from meta-analytic reviews summarized in terms of: 1) the effects of total volume of alcohol consumed; 2) moderate drinking; 3) drinking pattern; 4) plausible biological mechanisms; and 5) interactions with factors that mediate or moderate the relationship between alcohol and the condition. ▪ Evidence from population time-series analyses was also used if available.		

All-cause Mortality	Dimensions of alcohol consumption*				
	Volume of alcohol	**Moderate drinking**	**Patterns of drinking**	**Biological mechanisms**	**Interactions**
Evidence from meta-analytic reviews (individual level)	▪ Linear relationship between average volume of alcohol consumed and all-cause mortality for male adults aged < 45 years. -Men: RR=1.09 (95%CI: 0.93-1.27) at >0-10g/day; RR=1.40 (95%CI: 1.18-1.68) at >10-20g/day; RR=1.78 (95%CI: 1.43-2.22) at >20-30g/day; RR=1.89 (95%CI: 1.41-2.54) at >30-40g/day; RR=2.86 (95%CI: 2.13-3.84) at >40-70g/day; RR=2.04 (95%CI: 1.14-3.65) at >70-110g/day (Rehm, Gmel, et al., 2001; Rehm, Gutjar et al., 2001). ▪ J-shaped relationships for both genders ≥ 45 years; however, females experience deleterious effects at lower levels of alcohol consumption. -Women: RR=0.87 (95%CI: 0.84-0.89) at >0-10g/day; RR=1.01 (95%CI:	▪ Beneficial effects on CHD and ischemic stroke; but detrimental effects on many other chronic diseases.	▪ Inverse relationship between the beneficial effects of alcohol and the number and frequency of heavy drinking episodes.	Not described	▪ Factors such as sex and age influence the effect of alcohol on all-cause mortality.

	0.99-1.04) at >10-30g/day; RR=1.40 (95%CI: 1.34-1.47) at >30-50g/day; RR=1.43 (95%CI: 1.34-1.53) at >50g/day. -Men: RR=0.85 (95%CI: 0.83-0.87) at >0-10g/day; RR=0.80 (95%CI: 0.78-0.82) at >10-20g/day; RR=0.91 (95%CI: 0.89-0.94) at >20-30g/day; RR=0.96 (95%CI: 0.93-1.00) at >30-40g/day; RR=1.04 (95%CI: 1.01-1.07) at >40-70g/day; RR=1.27 (95%CI: 1.23-1.31) at >70-110g/day; RR=1.46 (95%CI: 1.33-1.60) at >110g/day (Rehm, Gutjahr & Gmel, 2001).

Evidence from population time-series analyses	▪ The limited evidence available does not show the biologically plausible beneficial effect.				
Breast Cancer	**Dimensions of alcohol consumption**				
	Volume of alcohol	**Moderate drinking**	**Patterns of drinking**	**Biological mechanisms**	**Interactions**
Evidence from meta-analytic reviews (individual level)	▪ A clear dose-response relationship established – the more alcohol is consumed on average, the higher the risk. RR ⬆ by 7.1% for each ⬆10g/day (Hamajima et al., 2002).	▪ Significant detrimental effect. ▪ 1 drink/day on average was associated with increased risk. -RR=1.01 (SE=0.014) at <5g/day; RR=1.03 (SE=0.015) at 5-14g/day;	▪ Suggestive evidence of binge drinking relating to higher risks.	▪ Plausible hypotheses not fully clear.	▪ Likely interaction with estrogen, estradiol (pre- vs. post-menopausal women).

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	RR=1.13 (SE=0.028) at 15-24g/day; RR=1.21 (SE=0.036) at 25-34g/day; RR=1.32 (95%CI: 1.19-1.45) at 35-44g/day, RR=1.46 (95%CI: 1.33-1.61) at ≥45g/day (Hamajima et al., 2002).

Evidence from population time-series analyses	No studies available

	Dimensions of alcohol consumption				
CHD	**Volume of alcohol**	**Moderate drinking**	**Patterns of drinking**	**Biological mechanisms**	**Interactions**
Evidence from meta-analytic reviews (individual level)	▪ Beneficial effects for light to moderate consumption (this effect applies mainly to the age group of ≥ 45 years). -RR=0.80 (95%CI: 0.78-0.83) at 20g/day (Corrao et al., 2000). ▪ No pervasive evidence to show a beneficial effect, but there may have been an overestimated effect. -Alcohol consumption averted an estimated 7401 deaths (5162 men, 2239 in women)in Canada in 1992: 4205 deaths due to ischemic heart disease; 2965 deaths due to stroke;	▪ Beneficial effect confines to regular drinking (often with meals) without heavy drinking episodes.	▪ Detrimental relationship between irregular heavy drinking and coronary heart disease. -RR=1.05 (95%CI: 1.00-1.11) at 89g/day (Corrao et al., 2000).	▪ Evidence for mechanisms on blood lipids, blood coagulation and inflammation.	▪ No consistent interaction found.

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	183 deaths due to heart failure and other heart conditions; and 47 deaths from other causes (Single et al., 1999).				
Evidence from population time-series analyses	• Mixed results: most analyses have found no significant effect or weak relationship. • There may be no net protective effect at the population level from an increase in the level of consumption. • Effect depended on drinking patterns, with protective effects shown only in countries without high prevalence of heavy drinking occasions.				

	Dimensions of alcohol consumption				
Tuberculosis	**Volume of alcohol**	**Moderate drinking**	**Patterns of drinking**	**Biological mechanisms**	**Interactions**
Evidence from meta-analytic reviews (individual level)	• TB risk set at ≥40g alcohol per day (or by a clinical diagnosis of AUD) yielded a pooled RR = 3.50 (95%CI: 2.01-5.93). • After excluding 3 studies with largest standard errors, RR=2.94 (95%CI: 1.89-4.59) (Lonroth et al., 2008).	• Association between consumption of <40g alcohol per day and risk of TB not found.	• Effect for heavy drinking and alcohol abuse or dependence; however, regularity of drinking not yet clear.	• Two plausible hypotheses: - effect via the immune system - effect via social drift of alcoholics	• Poverty, nutritional status and co-infections significantly mediate the effect of alcohol on TB.
Evidence from population time-series analyses	No studies available.				

	Dimensions of alcohol consumption				
Diabetes	**Volume of alcohol**	**Moderate drinking**	**Patterns of drinking**	**Biological mechanisms**	**Interactions**
Evidence from meta-analytic reviews (individual level)	• The relationship is not clear but evidence suggests a beneficial effect of light to moderate drinking (narrative review:	• Suggestive evidence for a beneficial effect of light to moderate drinking.	Not described	• Evidence for plausible biological pathways.	Not described

	Ashley et al., 2000).				
Evidence from population time-series analyses	Not described				
Injuries/deaths motor vehicle accidents	**Dimensions of alcohol consumption**				
	Volume of alcohol	**Moderate drinking**	**Patterns of drinking**	**Biological mechanisms**	**Interactions**
Evidence from meta-analytic reviews (individual level)	▪ Volume of alcohol is related to risk of traffic crashes, but not clear if this effect is independent of drinking patterns.	▪ BAC of ≥40mg% (≈0.4 g pure alcohol/kg) is the threshold for negative effect of alcohol on subjective and psychomotor performance. ▪ Subjective feelings of being intoxicated occur as low as 0.25g pure alcohol/kg or BACs from 10 to 30mg% (Eckhardt et al., 1998).	▪ There is a strong effect of patterns. - **Increased** probability of driving while intoxicated when **an increased** frequency of drinking at bars/restaurants is reported. - The probability of driving after drinking increased from 0.367 to 0.440 with one standard deviation increase in frequency of drinking at bars/restaurants (Gruenewald et al., 1996). Midanik et al., 1996; Eckhardt et al., 1998; Rossow et al., 2001 data not shown here. - **Increased** probability of driving while intoxicated when younger: at age 21, the expected probability was 0.068; at age 50 this probability declined to 0.021 (Gruenewald et al., 1996).	▪ Ethanol affects many neuro-chemical systems directly. ▪ The interactions between and among these systems become important in the expression of ethanol's actions.	▪ Some evidence for adaptation or learning. ▪ The adverse effect on performance is less in experienced drinkers. ▪ Possible differences between beverages, but beverage preference may be a marker for other variables.
Evidence from population time-series analyses	▪ Fatal accident rates ↑ with increased per-capita consumption in many European countries. ▪ Interventions such as reducing legal BAC limits link to reductions in traffic crashes.				

Suicide	Dimensions of alcohol consumption				
	Volume of alcohol	**Moderate drinking**	**Patterns of drinking**	**Biological mechanisms**	**Interactions**
Evidence from meta-analytic reviews (individual level)	▪ Linear relationship between consumption level and risk of suicidal behaviour. **-Increased** risk for heavy drinkers and alcohol abusers (Andreasson et al., 1988); AAF= 20-30% for suicide (Rossow, 2000).	▪ No protective effect but slightly increased risk.	▪ Increased risk of attempted suicide with ↑ frequency of drunkenness. ▪ Stronger association with frequency of drunkenness than consumption level. -OR = 2.36 of suicide attempt/ideation for those who drank to the point of intoxication on half of their drinking days compared to those who never became intoxicated (Dawson, 1997).	▪ Plausible hypotheses: social disintegration, social losses and mental illness suggested as intermediate factors.	▪ Psychiatric co-morbidity increases the risk of suicidal behavior among alcohol abusers. ▪ Cultural norms may also affect the relationship.
Evidence from population time-series analyses	▪ Suicide rates ↑ with increased per-capita consumption, but the strength of the association varies considerably among countries; with a stronger association in countries where intoxication is more prominent.				
Violence	Dimensions of alcohol consumption				
	Volume of alcohol	**Moderate drinking**	**Patterns of drinking**	**Theoretical underpinnings**	**Interactions**
Evidence from meta-analytic reviews (individual level)	▪ Linear relationship between consumption level and risk of involvement in violent incidents. ▪ Increased risk among alcohol abusers/heavy drinkers -AAF = 25-60% (Rossow, 2000).	▪ No protective effect but a slightly increased risk with moderate drinking.	▪ Increased risk of violent events with increasing frequency of intoxication. -OR=1.00 at 1 drink/month (0.015oz); OR=1.01 (95%CI: 1.01-1.02) at 1 drink per week (0.075oz); OR= 1.10 (95%CI: 1.07-1.14) at 1 drink/day (0.50oz);	▪ Probable underlying mechanisms but no detail provided.	▪ The relationship between alcohol and violence moderated by individual and environmental characteristics.

	▪ Heavy drinkers are more likely to be the victims of violence.		OR=1.22 (95%CI: 1.15-1.30) at 2 drinks/day (1.00oz); OR=1.67 (95%CI: 1.44-1.93) at 5 drinks/day (2.5oz) (Dawson, 1997).		
Evidence from population time-series analyses	▪ Rates of reported violence and homicides rates increase with increased per-capita consumption. However, the strength of the association varies considerably among countries; with a stronger association in countries where intoxication is more prominent.				
Divorce/Marital problems	**Dimensions of alcohol consumption**				
	Volume of alcohol	**Moderate drinking**	**Patterns of drinking**	**Theoretical underpinnings**	**Interactions**
Evidence from meta-analytic reviews (individual level)	▪ Causal relationship between alcohol consumption and marital problems is weak (Fu & Goldman, 2000). ▪ No dose-response relationship found (Fu & Goldman, 2000).	▪ No relationship found.	▪ Impact of alcohol consumption on marital relation related to heavy drinking or alcohol abuse/dependence, but not to drinking patterns beyond that (Leonard & Rothbard, 1996).	▪ No theory specified	▪ Probable mediation by marital satisfaction, marital function and marital aggression.
Evidence from population time-series analyses	▪ Divorce rates increase with increased per-capita consumption as found in one study. ▪ Rates of domestic violence also increase with increased per-capita consumption.				
Child Abuse	**Dimensions of alcohol consumption**				
	Volume of alcohol	**Moderate drinking**	**Patterns of drinking**	**Theoretical underpinnings**	**Interactions**
Evidence from meta-analytic reviews (individual level)	▪ Higher risk of indicators of child abuse in families with heavy drinking caretakers ▪ Insufficient research to suggest the relationship between drinking level and risk of child abuse	▪ No relationship found	▪ The impact of alcohol consumption on child abuse has been linked to heavy drinking or alcohol abuse/dependence.	▪ No theory specified	▪ Probable interactions with family resources and functioning.

Evidence from population time-series analyses	▪ A weak and positive but not statistically significant association between per-capita consumption and physical abuse of children in an analysis of Swedish data.				
Work-related problems	**Dimensions of alcohol consumption**				
	Volume of alcohol (the following effects have not always been clearly linked to volume and alcohol in general)	**Moderate drinking**	**Patterns of drinking**	**Theoretical underpinnings**	**Interactions**
Evidence from meta-analytic reviews (individual level)	▪ Absenteeism due to illness, disciplinary suspension, resulting in loss of productivity ▪ Turnover due to premature death, disciplinary problems or low productivity ▪ Inappropriate behaviour resulting in disciplinary procedures ▪ Theft and other crime ▪ Poor co-worker relations and low company morale.	▪ Some indication of negative effects related to moderate drinking.	▪ Intoxication and heavy drinking occasions related to work problems even after control of volume. ▪ Alcohol abuse and dependence linked to many work problems.	▪ Diverse and weak theoretical underpinnings.	▪ Factors found to be interacting with alcohol in producing work problem can be broadly classified into: individual factors, environmental factors, and work-related factors. ▪ No protective effect of alcohol found at any level.
Evidence from population time-series analyses	No studies available.				

Global burden of disease attributable to alcohol consumption by major disease category in 2004 (DALYs, in thousands)‡

Disease	Men (%)	Women (%)	Total (%)
Total alcohol-related burden 'caused' in DALYs	61 881 (100)	11 349 (100)	73 231 (100)
Neuropsychiatric disorders	23 265 (37.6)	3417 (30.1)	260682 (36.4)
Unintentional injuries	15 694 (25.4)	2910 (25.6)	18 604 (25.4)
Intentional injuries	6639 (10.7)	1021 (9.0)	7660 (10.5)
Cardiovascular diseases	5985 (9.7)	939 (8.3)	6924 (9.5)
Cirrhosis (liver)	5502 (8.9)	1443 (12.7)	6945 (9.5)
Cancer	4732 (7.6)	1536 (13.5)	6268 (8.6)
Diabetes Mellitus	0	28 (0.3)	28 (0.3)
Total alcohol-related burden 'prevented' in DALYs	-1075 (100)	-1246 (100)	-2321 (100)
Cardiovascular diseases	-837 (77.8)	-1145 (91.9)	-1981 (85.4)
Diabetes mellitus	-238 (22.2)	-101 (8.1)	-340 (14.6)
All alcohol-related DALYs	60 806 (100)	10 104 (100)	70 910 (100)
All DALYs	799 536	730 631	1 530 168
Percentage all net DALYs attributable to alcohol	7.6%	1.4%	4.6%

* Please note that the format of this data extraction table was derived from the book chapter in "Alcohol: No Ordinary Commodity" (2nd edition).

**Disability-adjusted life-years (DALYs) – combines years of life lost to premature death with years of life lost due to disability to estimate the burden of disease in a given country. Disability is indirectly calculated from morbidity.

‡Data source: Rehm et al., 2009

Appendix J: Applicability & Transferability Worksheet

Factors	Questions	Notes
Applicability (feasibility)		
Political acceptability or leverage	• 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? ○ *For example, are there reasons to do the program that relate to increasing the profile and/or creative a positive image of public health?* • Will the public and target groups accept and support the intervention in its current format?	

Social acceptability	• Will the target population find the intervention socially acceptable? Is it ethical?
	    ○ *Consider how the program would be perceived by the population.*
	    ○ *Consider the language and tone of the key messages.*
	    ○ *Consider any assumptions you might have made about the population. Are they supported by the literature?*
	    ○ *Consider the impact of your program and key messages on non-target groups.*	

Available essential resources (personnel and financial)	• 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?
	    ○ *Consider: in-kind staffing, supplies, systems, space requirements for staff, training, and technology/administrative supports.*
	
	• Are the incremental health benefits worth the costs of the intervention?
	    ○ *Consider any available cost-benefit analyses that could help gauge the health benefits of the intervention.*
	    ○ *Consider the cost of the program relative to the number of people that benefit/receive the intervention.*	

Organizational expertise and capacity	• 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)? o *Consider organizational capacity/readiness and internal supports for staff learning.*	
Transferability (generalizability)		
Magnitude of health issue in local setting	• 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? o *Consider the Comprehensive Health Status Report, and related epidemiological reports.*	
Magnitude of the "reach" and cost effectiveness of the intervention above	• Will the intervention appropriately reach the priority population(s)? o What will be the coverage of the priority population(s)?	
Target population characteristics	• 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? o *Consider if there are any important differences between the studies and the population in Peel (i.e., consider demographic, behavioural and other contextual factors).*	
Proposed Direction (after considering the above factors):		