

Alcohol, Cancer & Public Policy: *Evidence, Interventions & Challenges*

Norman Giesbrecht, Ph.D.

**Centre for Addiction and Mental Health
Toronto, Ontario, Canada**

Alcohol Risk and Chronic Disease: Making the Link

*Guelph, Ontario
January 21, 2009*



Goals

1. Highlight public health risks/damage associated with alcohol consumption
2. Summarize recent evidence on alcohol as a contributing cause to several types of cancer
3. Note challenges in reducing alcohol-related cancer – at the population level
4. Outline essential components of an effective response.

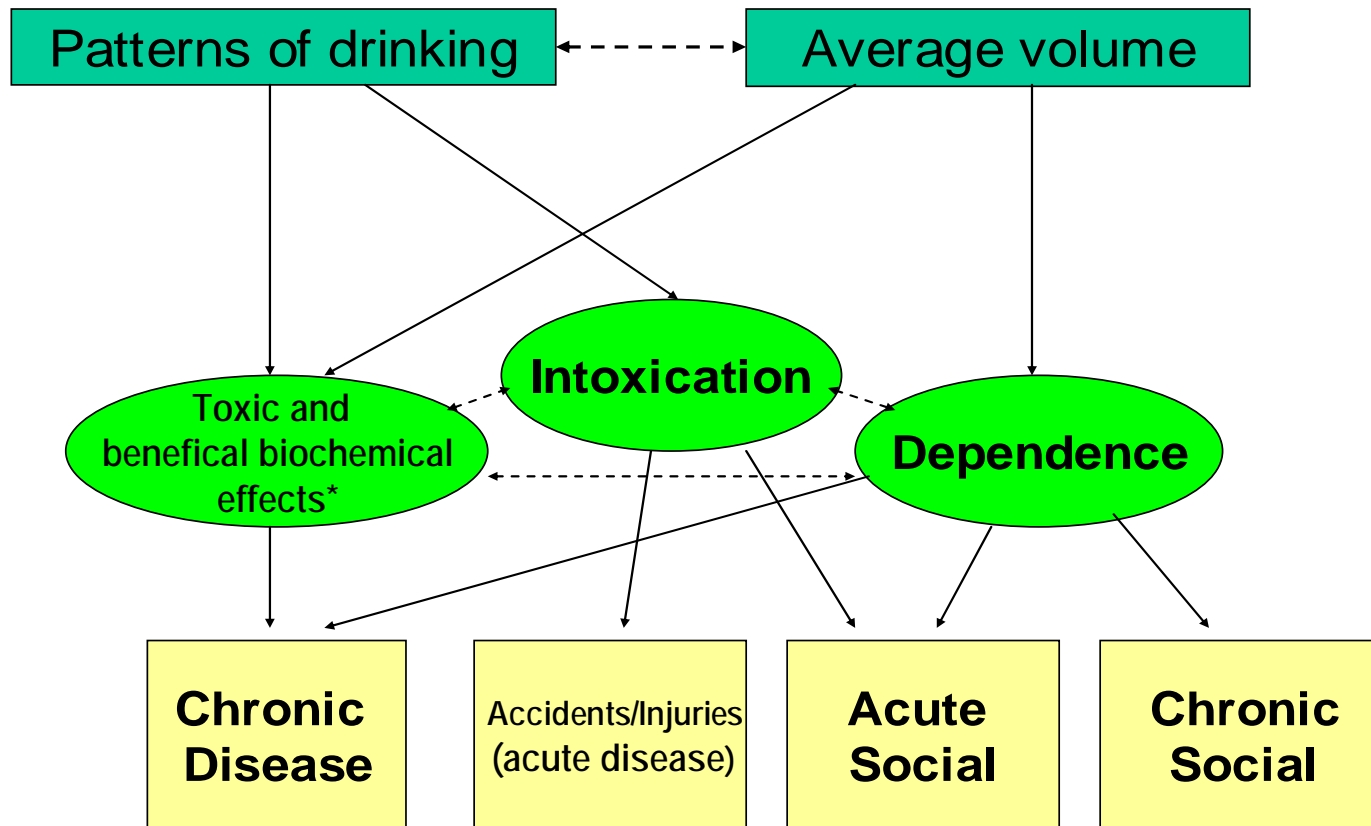
1. Why consider Alcohol?

Harmful Effects of Alcohol Consumption - 3 Dimensions

Three important mechanisms explain alcohol's ability to cause medical, psychological, and social harm:

- Average volume of consumption
- Patterns of drinking
- Drinking that occurs outside of meals

Causal model of alcohol consumption, intermediate mechanisms, and long-term consequences



Source: T. Babor et al. 2003

* Independent of intoxication or dependence

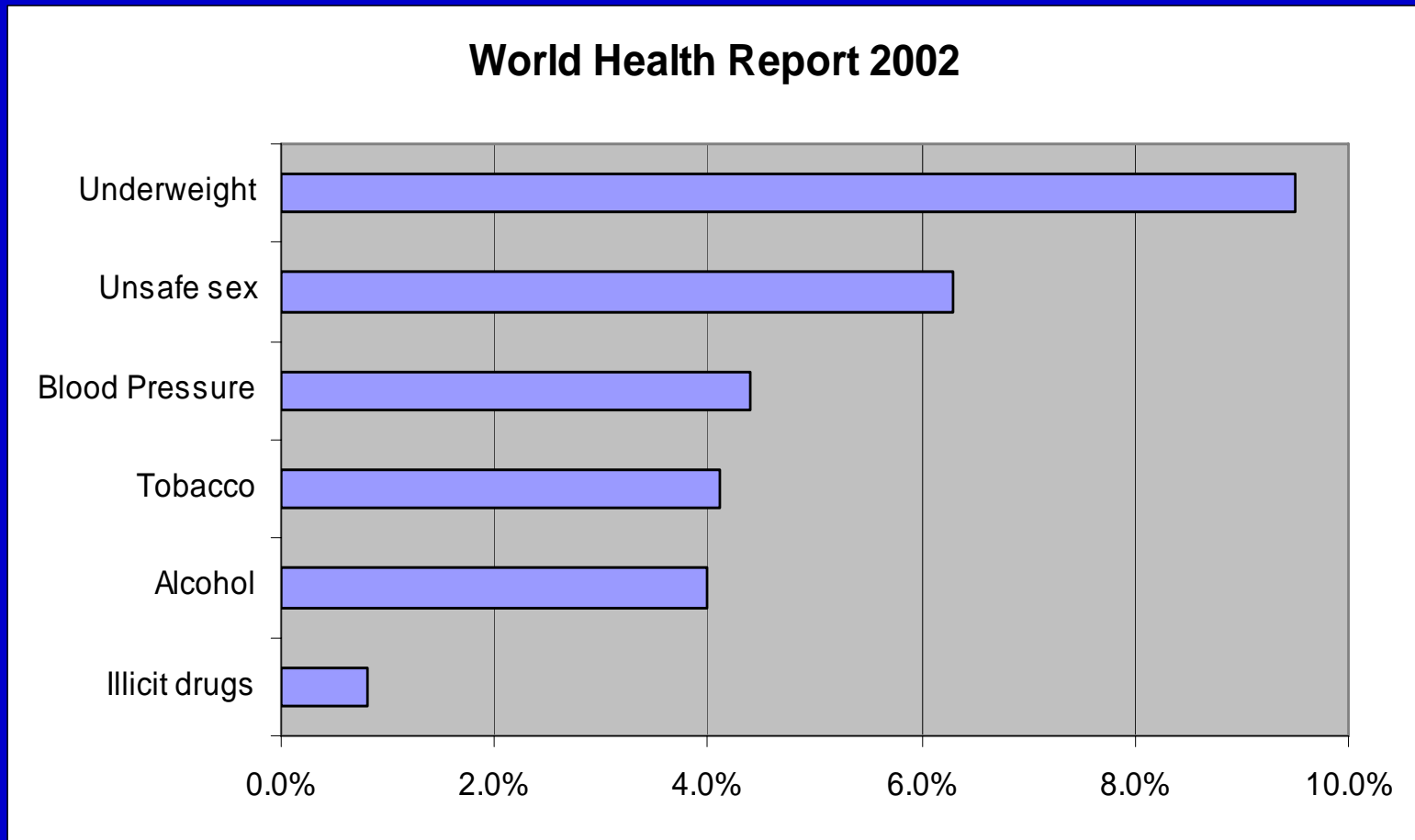
Major alcohol-related health conditions contributing to morbidity and mortality

(Alcohol has been linked with over 60 diseases or conditions)

- **Cancers**
- **Neuropsychiatric conditions**
- **Cardiovascular conditions**
- **Gastrointestinal conditions**
- **Maternal and perinatal conditions**
- **Acute toxic effects**
- **Unintentional injuries**
- **Self-inflicted injuries**
- **Violence**

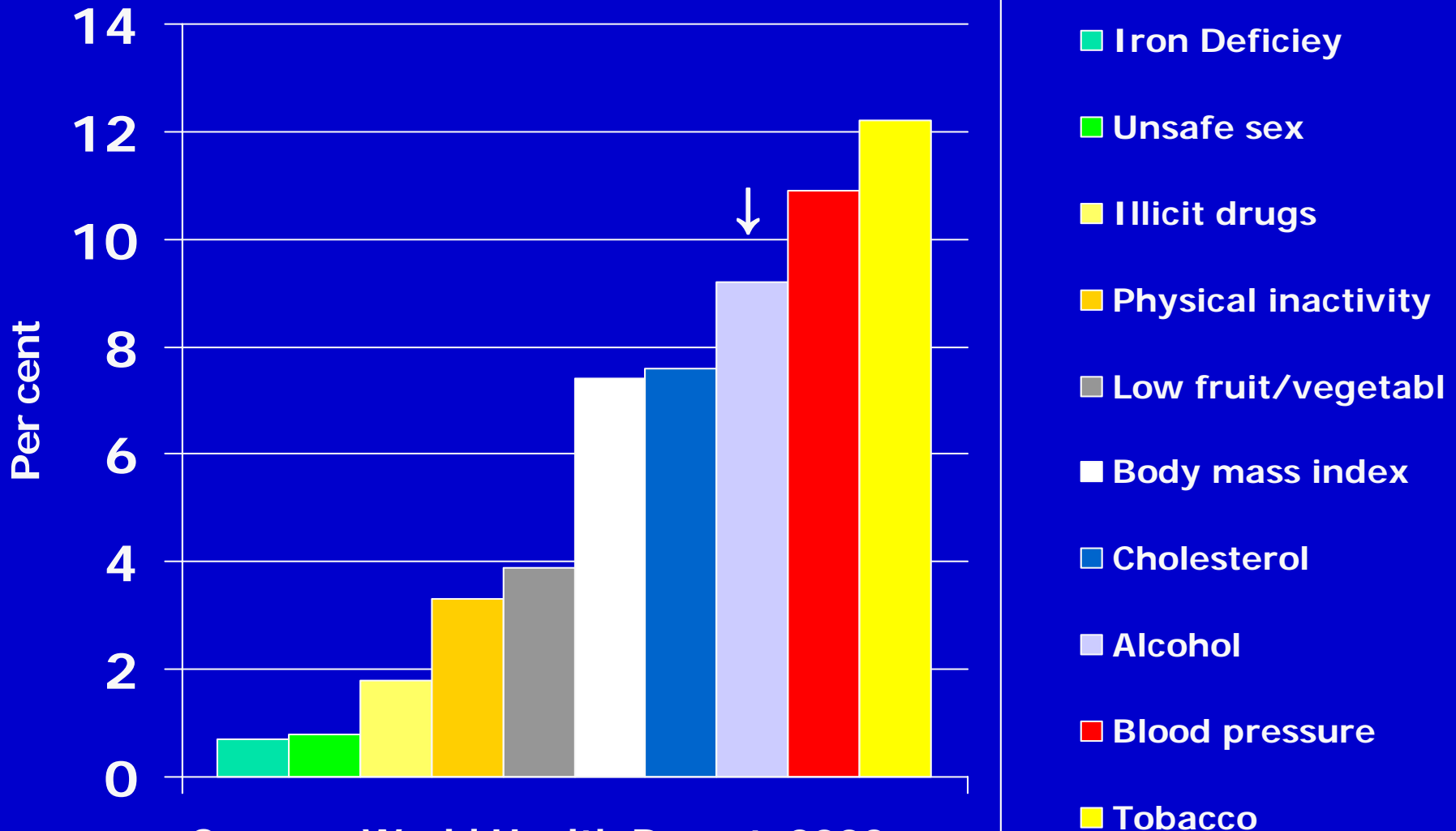
Source: T. Babor et al. (2003, p. 64) and E. Gutjahr et al. (2001)

WHO STUDY

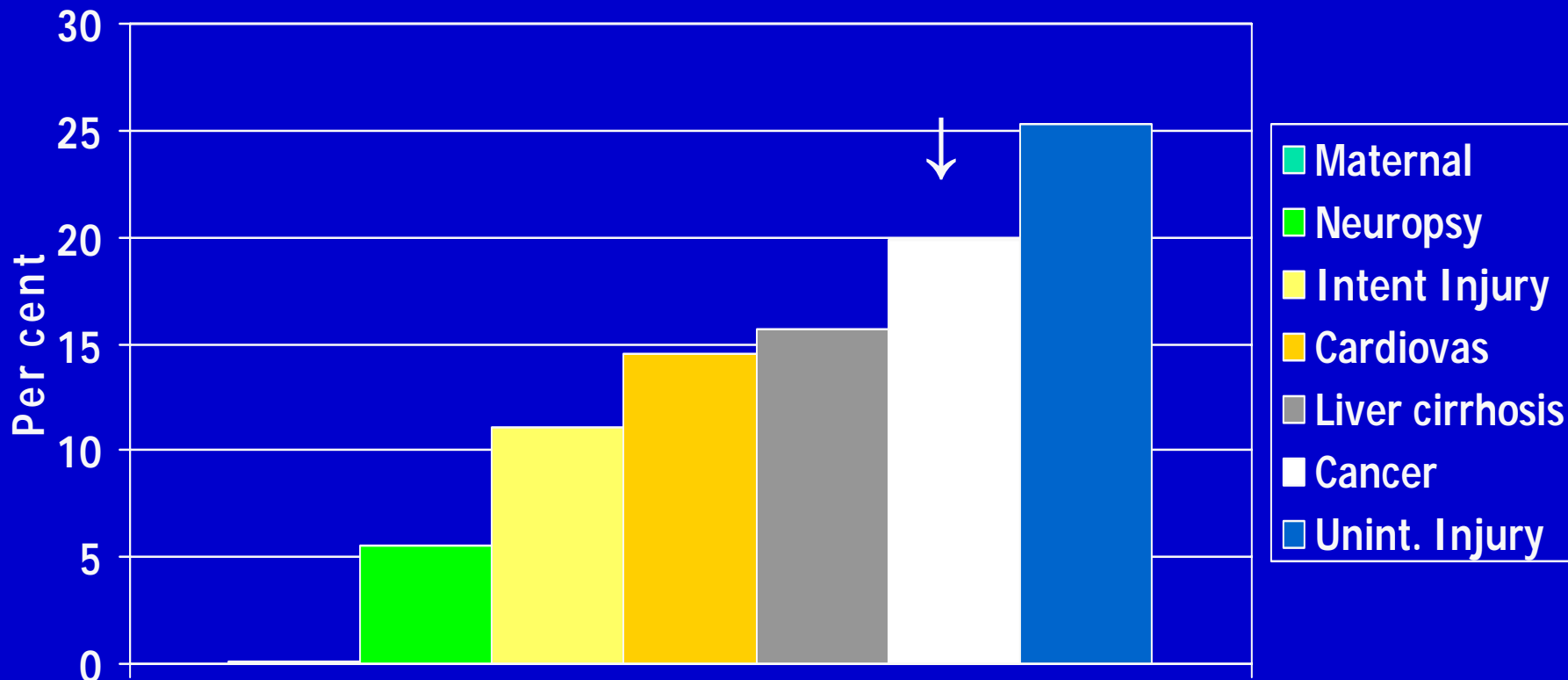


Percent of Disability-Adjusted-Life Years of 26 risk factors considered, world-wide, 2002

Leading risk factors for disease in established economies (% total Disability Adjusted Life Years - DALYs)

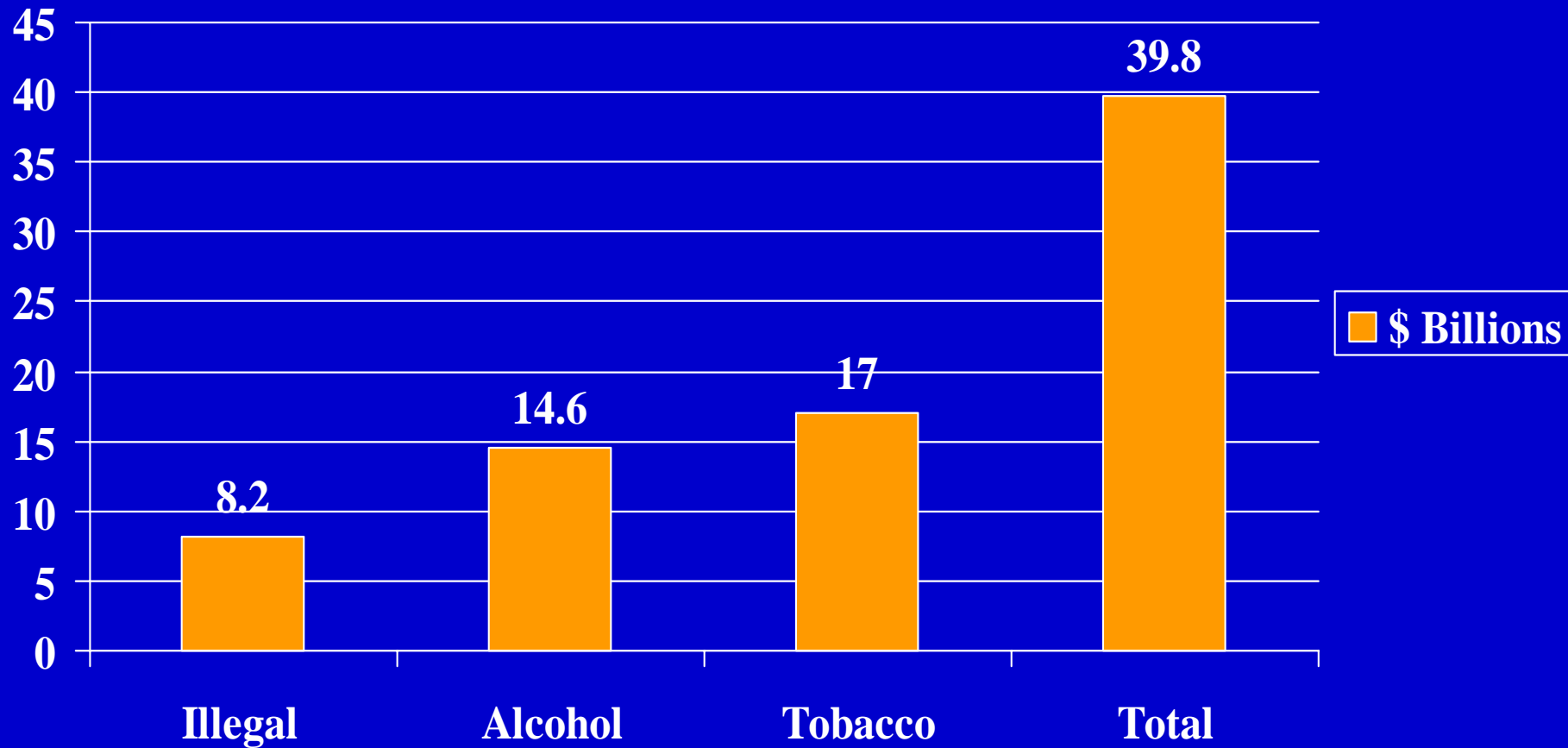


Proportion of net deaths due to different disease categories attributable to alcohol consumption in the World in 2002



Source: J. Rehm, J. Patra, D. Baliunas, S. Popova, M. Roereceke, B. Taylor, 2006

Costs attributable to substance abuse in Canada, 2002



Source: Canadian Centre on Substance Use. J. Rehm, D. Baliunas, S. Brochu et al. 2006

Damage from Alcohol

- On a global basis, alcohol is estimated to account for 4% of total disability-adjusted life years (DALYs) – and almost equal to tobacco
 - In developed countries alcohol is just below tobacco and blood pressure
 - It is higher than
 - cholesterol,
 - body mass index,
 - low fruit and vegetable intake,
 - physical inactivity and
 - illicit drugs
 - Is a contributing cause to over 60 diseases or conditions

2. Alcohol and Cancer

What is carcinogenicity?

The ability to cause cancer

Carcinogens – cancer causing agents, may be:

- Physical – e.g. ionizing radiation, -X rays
- Chemical – e.g., asbestos, tobacco smoke
- Genetic – i.e. inherited predisposition e.g. BRCA 1 and 2

Source: A.B. Miller, The Carcinogenicity of Alcohol Consumption, at a forum on *Alcohol, Cancer and Public Policy*, October 31, 2007, Toronto.

What is cancer?

- The uncontrolled growth of cells, which may spread locally or to other parts of the body (metastasize)
- Carcinomas – cancers epithelial and glandular organs
- Sarcomas – cancers of fibrous tissue and bone
- Some carcinomas are caused by alcohol

Source: A.B. Miller, The Carcinogenicity of Alcohol Consumption, at a forum on *Alcohol, Cancer and Public Policy*, October 31, 2007, Toronto.

A word about mechanisms (1/2)

Various factors may contribute to development of alcohol-associated cancer, including the actions of acetaldehyde, the first and most toxic metabolite of alcohol metabolism.

Source: H.K. Seitz & P. Becker (2007) *Alcohol, Research & Health* 30 (1):38-44,44-47.

A word about mechanisms (2/2)

- Acetaldehyde itself is a cancer-causing substance in experimental animals and reacts with DNA to form cancer-promoting compounds.
- In addition, highly reactive, oxygen-containing molecules that are generated during certain pathways of alcohol metabolism can damage the DNA
- Ethanol may also stimulate carcinogenesis by inhibiting DNA methylation and by interacting with retinoid metabolism

Standard Drink of Alcohol in Canada

- *Beer 341 mL or 12 oz of 5% strength*
- *Distilled Spirits 43 mL or 1.5 oz of 40% strength*
- *Wine: 142 mL or 5 oz of 12% strength*

All contain about 13.6 grams of ethanol

Squamous-cell carcinoma of oral cavity, pharynx, larynx, and oesophagus

- Mid 1950s: Causal relation has been noted since then
- 1961: carcinogenic effect of alcohol independent of smoking, and replicated since then
- 1970s: Synergism between alcohol intake and smoking reported
- A fairly consistent dose-response relationship between alcohol consumption and risk of cancer in the upper aerodigestive tract for non-smokers
- Linear correlation with both duration and amount of alcohol consumption – how long one is drinking and how much alcohol is consumed.

Table 4. Estimated effects of alcohol and tobacco^a on aerodigestive cancer risks

Tobacco consumption (cig/day)	Cancer types	Alcohol consumption (drinks/day)		
		0	>0-4	4+ ^b
0	Oropharynx	1 ^d	1.5	7.2
	Pharynx	1	1.7	12.6
	Larynx	1	1.4	4.5
	Esophagus ^c	1	1.4	4.2
>0-30	Oropharynx	1.3	2.0	9.7
	Pharynx	1.3	2.3	16.7
	Larynx	1.8	2.4	7.9
	Esophagus	1.4	1.8	5.6
30+ ^b	Oropharynx	2.9	4.5	21.2
	Pharynx	2.8	4.8	35.6
	Larynx	7.7	10.6	34.6
	Esophagus	3.1	4.1	12.7

^a Category midpoints were used for the estimation of OR.

^b Midpoints for the upper categories: 55 cigarettes per day and 9.5 drinks per day.

^c SCC and mixed cell type.

^d Reference category.

Aerodigestive cancer – smoking and tobacco consumption

- The previous slide shows that for smokers who are non drinkers, the risk increases with tobacco consumption
- For non-smokers who are drinker, the risk increases with alcohol consumption
- For heavy smokers and heavy drinkers the risk is dramatically higher

Cancer of the Upper Digestive Tract

- Many studies have consistently shown that regular alcohol consumption is associated with an increased risk for cancers of the oral cavity, pharynx, larynx, and the esophagus.
- Daily consumption of around 50 g of ethanol increases the risk of these cancers two to three times, compared with the risk in non-drinkers.

Liver cancer

- Studies provide strong evidence that the consumption of alcohol is an independent risk factor for primary liver cancer.
- Cirrhosis and other liver diseases often occur before the cancer becomes manifest and patients with these disorders generally reduce their alcohol intake.
- Therefore, the effect of alcohol consumption on the risk for liver cancer is difficult to quantify

Alcohol and Breast Cancer

- A meta-analysis has shown a strong positive dose-response relationship; that is, risk increases with increase in average consumption
- 10 gm ethanol per day found to increase risk by 9%, while 30-90 grams showed 41% increase in risk compared with abstainers
- For every 12 grams/day there is a 7-10% increased risk of breast cancer in women

Source: Bagnardi et al. 2001; Ellison et al. 2001;
Ridolfo et al. 2001; Smith-Warner et al., 1998

Breast Cancer

- More than 100 epidemiological studies that assessed the association between alcohol consumption and breast cancer in women consistently found an increased risk with increasing alcohol intake.
- A pooled analysis of 53 studies on more than 58,000 women with breast cancer showed that daily consumption of about 50 g of alcohol is associated with a relative risk of about 1.5 compared with that in non-drinkers.
- Even for regular consumption of about 18 g of alcohol per day, the increase in relative risk is statistically significant.

Example: Pooling project on breast cancer

- 322,647 women followed for up to 11 years in 6 studies in Canada, the Netherlands, Sweden and the United States.
- All completed a food frequency questionnaire, including information on alcohol consumption
- 4,335 women developed breast cancer

Source: A.B. Miller, *The Carcinogenicity of Alcohol Consumption*, at a forum on *Alcohol, Cancer and Public Policy*, October 31, 2007, Toronto.

Pooling project: risk of breast cancer per amount of alcohol consumed

Grams alcohol/day	Relative risk
None	1.0
>0-<1.5	1.07 (1.0-1.2)
1.5-<5.0	0.99 (0.9-1.1)
5.0-<15.0	1.06 (1.0-1.2)
15.0-<30.0	1.16 (1.0-1.4)
30.0-<60.0	1.41 (1.2-1.7)
≥ 60.0	1.31 (0.9-2.0)

Source: A.B. Miller, The Carcinogenicity of Alcohol Consumption, at a forum on *Alcohol, Cancer and Public Policy*, October 31, 2007, Toronto.

The degree of risk of alcohol consumption for Breast cancer

- Women who drink on average 3 or more alcoholic drinks a day increase their risk of breast cancer by about 50%
- Women who drink 1-2 alcoholic drinks a day increase their risk of breast cancer by about 10%

Source: A.B. Miller, The Carcinogenicity of Alcohol Consumption, at a forum on *Alcohol, Cancer and Public Policy*, October 31, 2007, Toronto.

Alcohol, tobacco & breast cancer

- Comparison of 53,515 women with invasive breast cancer and 95,067 controls from 53 studies.
- Relative risk of breast cancer was 1.32 at 35-44 grams/day and 1.46 for 45+ grams/day – compared with women reporting that they did not drink
- When analysis focused on non-drinkers, smoking was not associated with breast cancer: 22,255 women with breast cancer and 40,832 controls
- Smoking has little or no independent effect on the risk of developing breast cancer

Source: Collaborative Group on Hormonal Factors in Breast Cancer (2002)
British Journal of Cancer, 87 (11): 1234-1245.

Alcohol & breast cancer: Plausible mechanisms

- Plausible biological pathways include alcohol's effect on levels of estrogens, cell membrane integrity and cell-to-cell communication, inhibition of DNA repair, and congener effect.

Source: M.G. Jain, R. G. Ferrence, J.T. Rehm et al. (2000) *Breast Cancer Research & Treatment*, 64 (2): 201-209.

- Alcohol use may increase breast cancer risk at least partially through an effect on sex steroid levels
 - Based on 17,357 Dutch participants of a European project who consumed more than 25 grams/day had higher levels of estrone, estradiol, dehydroepiandrosterone sulfate and higher estrone/estradiol and estrone/androstenedione compared with non drinkers.

Source: N.C. Onland-Moret, P.H. Peeters, Y.T/ van der Schouw et al. (2005), *Journal of Clinical Endocrinology & Metabolism* 90 (3): 1414-1419.

Colorectal cancer

- Alcohol consumption and colorectal cancer has been investigated in more than 50 prospective and case-control studies.
- Relative risk of about 1.4 for colorectal cancer with regular consumption of about 50 g of alcohol per day, compared with non-drinkers.
 - Based on pooled results from 8 cohort studies and data from recent meta-analyses

Example: European Prospective Investigation of Cancer (Ferrari et al, 2007)

478,732 participants (70% women) from 10 countries, completed detailed dietary questionnaire (including data on alcoholic beverage consumption) and were followed for >6 years

Source: A.B. Miller, The Carcinogenicity of Alcohol Consumption, at a forum on *Alcohol, Cancer and Public Policy*, October 31, 2007, Toronto

Effect of lifetime alcohol consumption on colorectal cancer risk

Grams alcohol/day	Relative risk
None	1.0
>0-4.9	1.0 (0.7-1.3)
5.0-<15.0	1.05 (0.9-1.2)
15.0-<30.0	1.07 (0.9-1.3)
30.0-<60.0	1.23 (1.0-1.6)
≥ 60.0	1.98 (1.5-2.7)

Source: A.B. Miller, The Carcinogenicity of Alcohol Consumption, at a forum on *Alcohol, Cancer and Public Policy*, October 31, 2007, Toronto

The degree of risk of alcohol consumption for Colon and Rectum cancer

- Women and men who drink on average 3 or more alcoholic drinks a day increase their risk of colon and rectum cancer by about 40%

Source: A.B. Miller, *The Carcinogenicity of Alcohol Consumption*, at a forum on *Alcohol, Cancer and Public Policy*, October 31, 2007, Toronto

Effect of lifetime alcohol consumption on colorectal cancer risk

This translates into an average 9% increase in risk for every drink consumed/day

The risk is higher for cancer of the rectum and distal colon (left sided) than for proximal (right sided) colon cancer

Source: A.B. Miller, The Carcinogenicity of Alcohol Consumption, at a forum on *Alcohol, Cancer and Public Policy*, October 31, 2007, Toronto

Lung Cancer

- There is a strong correlation between the use of tobacco and the consumption of alcohol.
- Many studies have reported an increased risk for lung cancer associated with alcohol drinking, but it is not generally possible to exclude residual confounding by smoking, by far the most important cause of lung cancer.
 - The findings from some of the studies that presented separate data on the risk for lung cancer in non-smokers suggest an increased risk with consumption of alcoholic beverages, but others do not.

Alcohol and Cancer: Inconclusive

- For other cancers a causal association is suspected -- such as cancers of the pancreas and lung
- Stomach cancer: significant increased risks – with alcohol consumption reported in some studies, but not in others.
- Bladder cancer: suggestive of no association although findings are not always consistent

Source: P. Boffetta, M. Hashibe. 2006. *Lancet Oncology*, v. 7.

Authors affiliated with the International Agency for Research on Cancer.
IARC Monographs Volume 96, 6-13 February 2007. Report of Working Group.
C. Pelucchi, C. La Vecchia 2009 *European J. of Cancer Prevention* 18 (1): 62-68.

Alcohol & Cancer -- Linear & Dose-related

- Relationship between pattern of drinking and alcohol is linear and dose-related
- Average consumption of 25g/day associated with the following cancers: pharynx, esophagus, larynx, colon, rectum, stomach, liver, oral cavity and breast cancer in women
- Strongest relationships evident for cancers of the oral cavity, pharynx, esophagus & larynx

Source: English et al., 1995; Single et al. 1999; Bagnardi et al. 2001; etc.

Recommendation No. Alcohol Drinks

Limit Alcohol Drinks

Public Health Goal

- Proportion of the population that drink more than the recommended limit be reduced by one-third every 10 years

Personal Recommendation

- If alcoholic drinks are consumed, then limit consumption to no more than two drinks a day for men and one drink a day for women

Source: Michael Marmot slide presentation, based on: *Food, Nutrition and Physical Activity, and the Prevention of Cancer: A Global Perspective*. World Cancer Research Fund & American Institute for Cancer Research, 2007

3. What are the challenges?

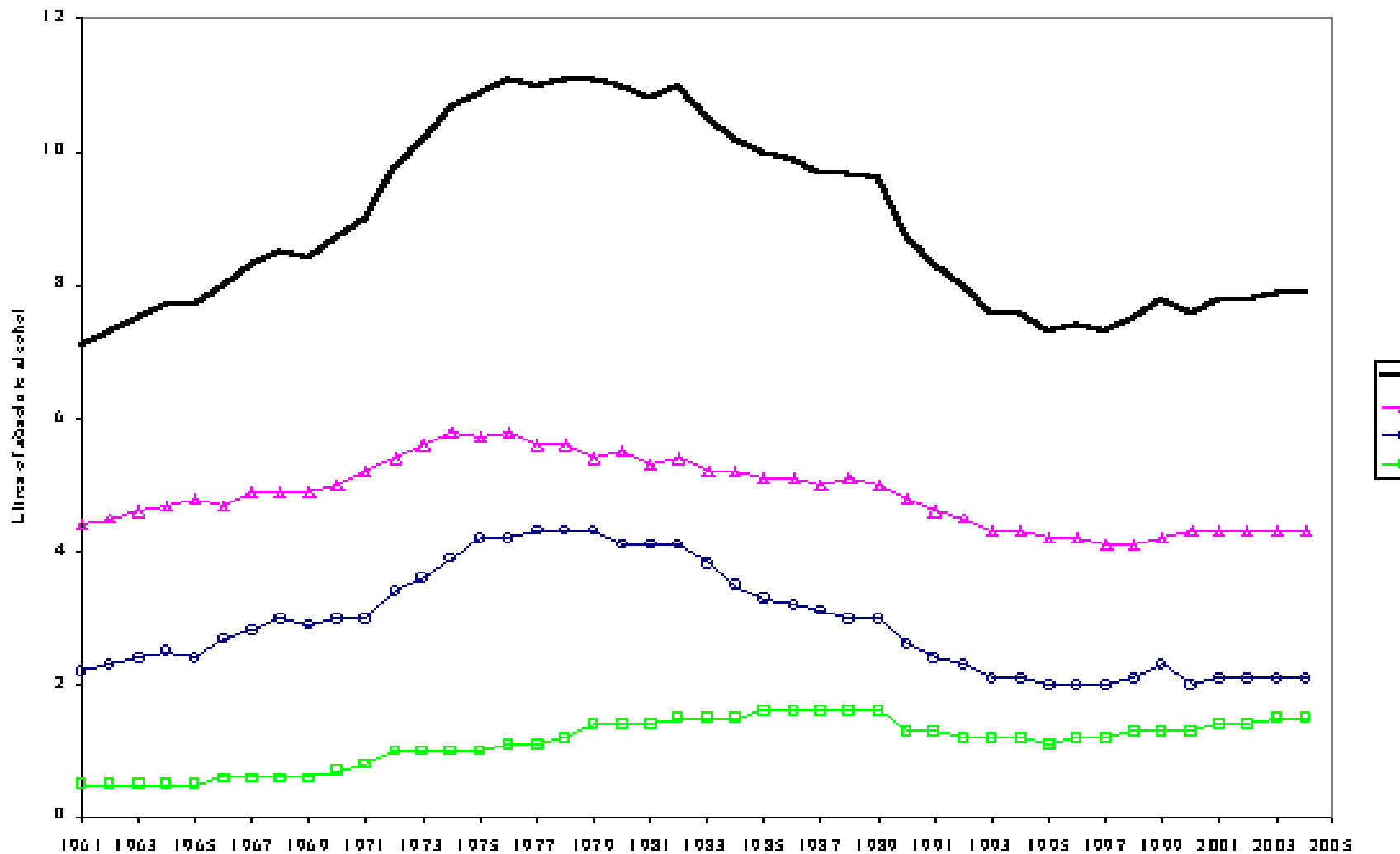
EROSION OF ALCOHOL CONTROL

- Greater access: higher density of alcohol outlets, longer hours, more diversification
- 'Social responsibility' narrowly defined
- Goals of alcohol retailing – e.g., generate more revenue & serve 'best customers'
- The most effective interventions to manage alcohol problems are being devalued or eroded - such as price and outlet density controls

INCREASE IN ALCOHOL MARKETING

- Deregulation of advertising
- Voluntary guidelines have little or no impact in controlling inappropriate marketing of alcohol
- Extensive marketing at stores and beyond – media, internet
- A drug with significant contributions to disease and damage – about equal to tobacco globally – is increasingly and commonly treated like an ordinary commodity

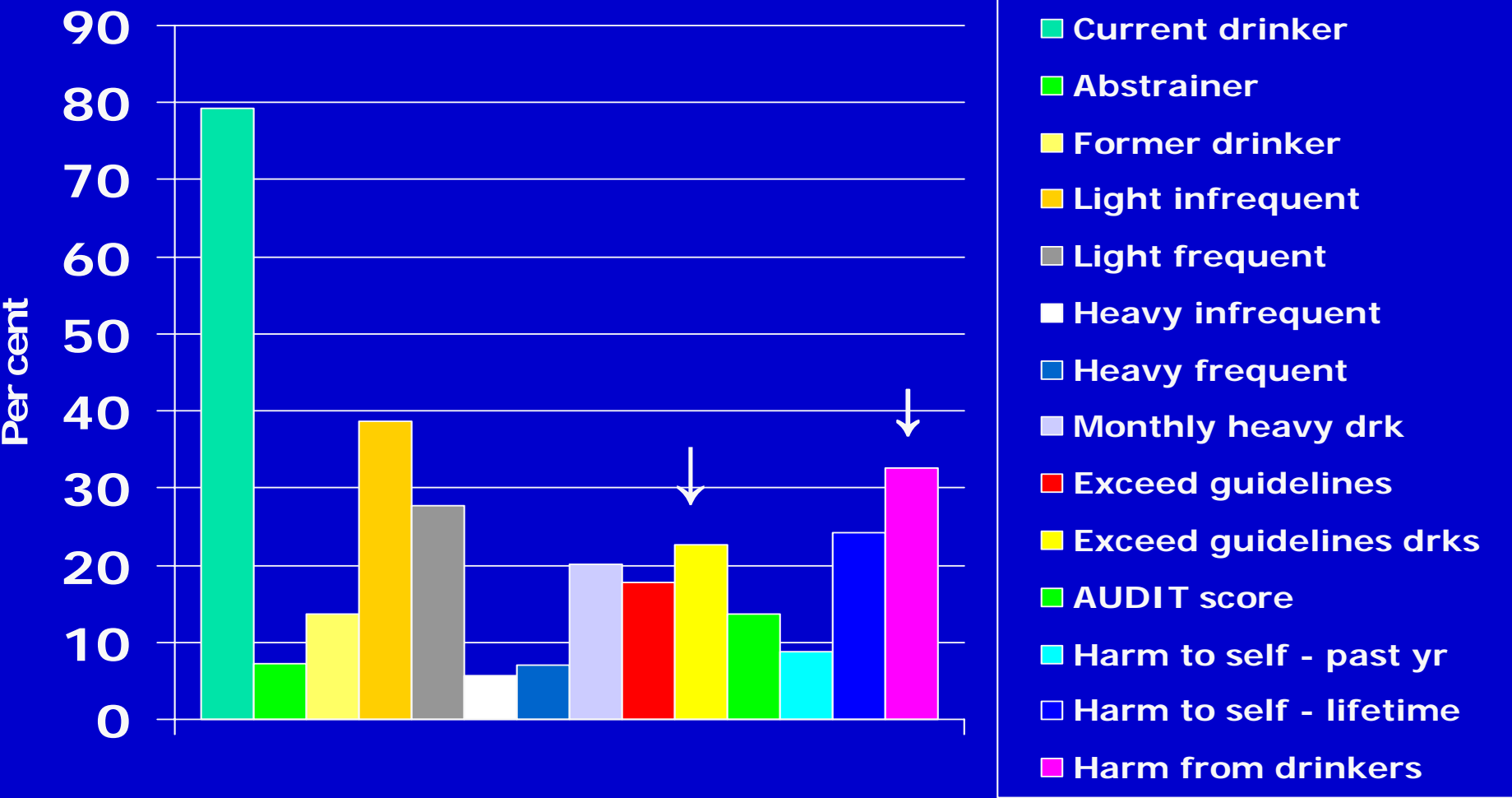
Figure 2 – Per capita alcohol consumption, in litres of absolute alcohol, Canada, aged 15+ (1961-2004)



Key: Top line is total consumption, 2nd is beer, 3rd is spirits, 4th is wine

Source: Statistics Canada (2004). *The control and sale of alcoholic beverages in Canada.*

Overview of Patterns of Alcohol Use & Reported Harm, Canada, 2004 (N 13,909 respondents aged 15 and older)



Source : CCSA, 2004; Adlaf, Begin & Sawka, 2005; Demers & Poulin, 2005

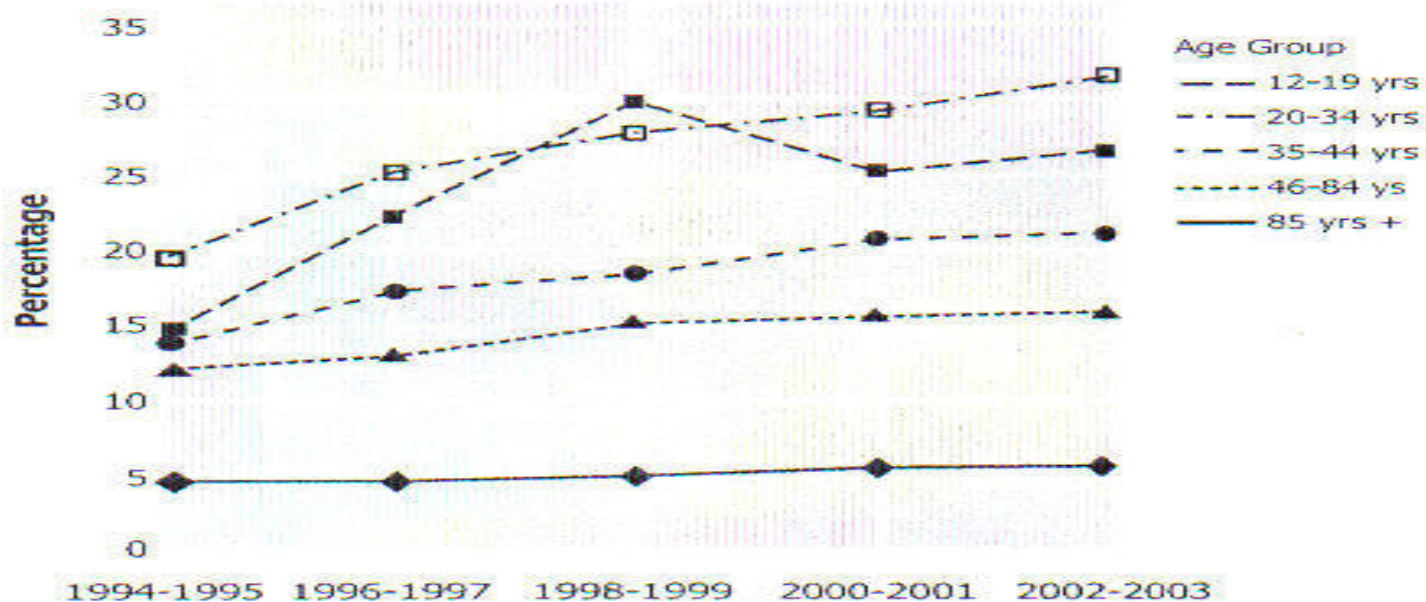
Figure 2: Age-standardized prevalence (Canada 1991) of heavy drinkers (5+ drinks on one occasion 12 or more times in the past year) 15 years and older, by sex, Canada, 1994-2003



Note: This figure presents the data in a different way than published on the website of Statistics Canada as it displays the rates of heavy drinkers among the total population, not among current drinkers.

Source: Haydon, et al (2005), based on data from Statistics Canada, National Population Health Survey and Canadian Community Health Survey

Figure 3: Percentage of heavy drinkers (5+ drinks at one occasion, 12 or more times in the past year) among current drinkers, Canada, 1994-2003



Source: Haydon, et al. (2005), based on data from Statistics Canada, National Population Health Survey and Canadian Community Health Survey

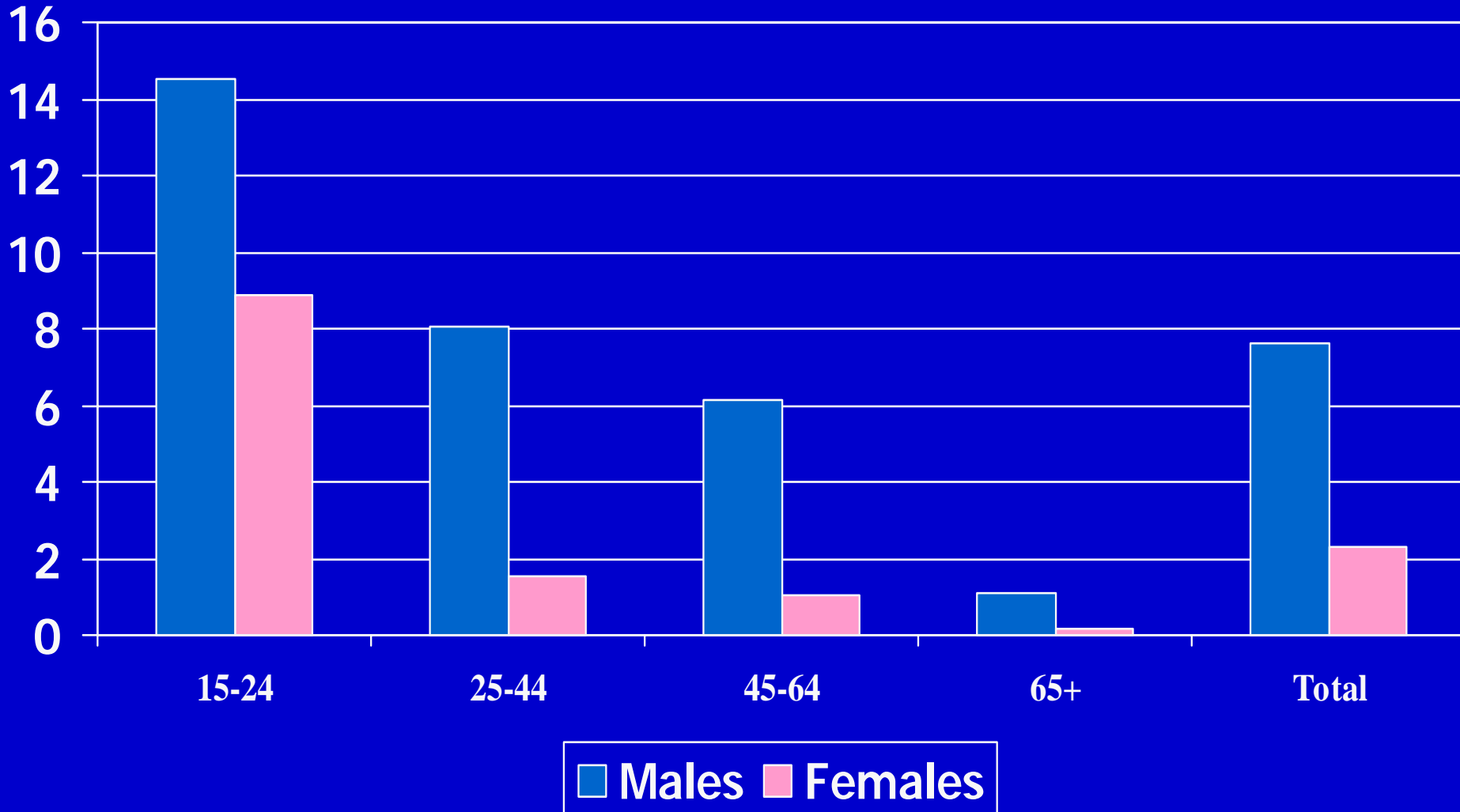
² The percentages refer to proportion of current drinkers, whereas Figure 2 provides information on heavy drinkers as percentage of the total population.

³ Defined as having 5 or more drinks on one occasion, 12 or more times in the past year.

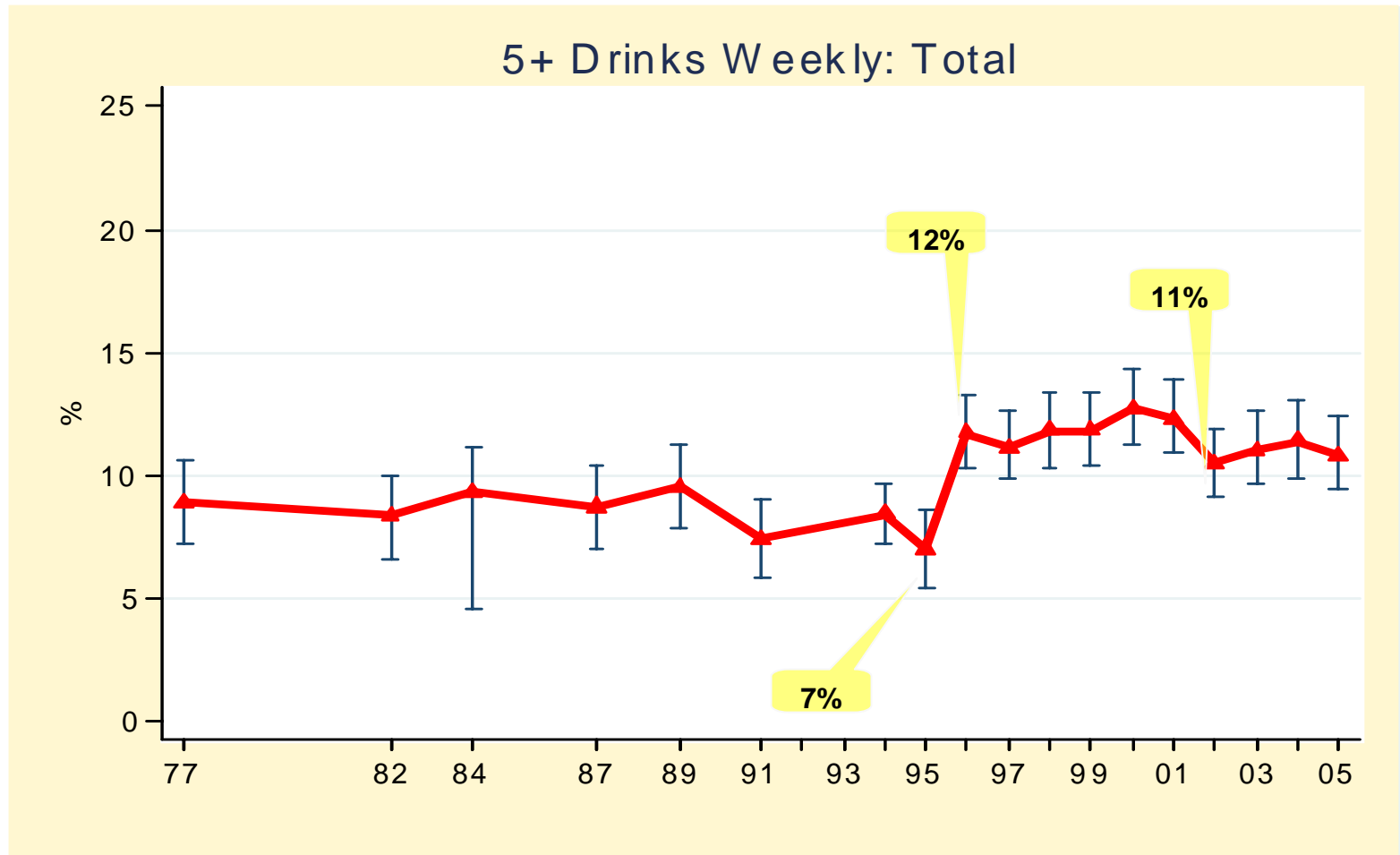
Consumed 5+ drinks on an Occasion Weekly % of respondents, Canada 2004

N: men = 5,592, women = 7,949

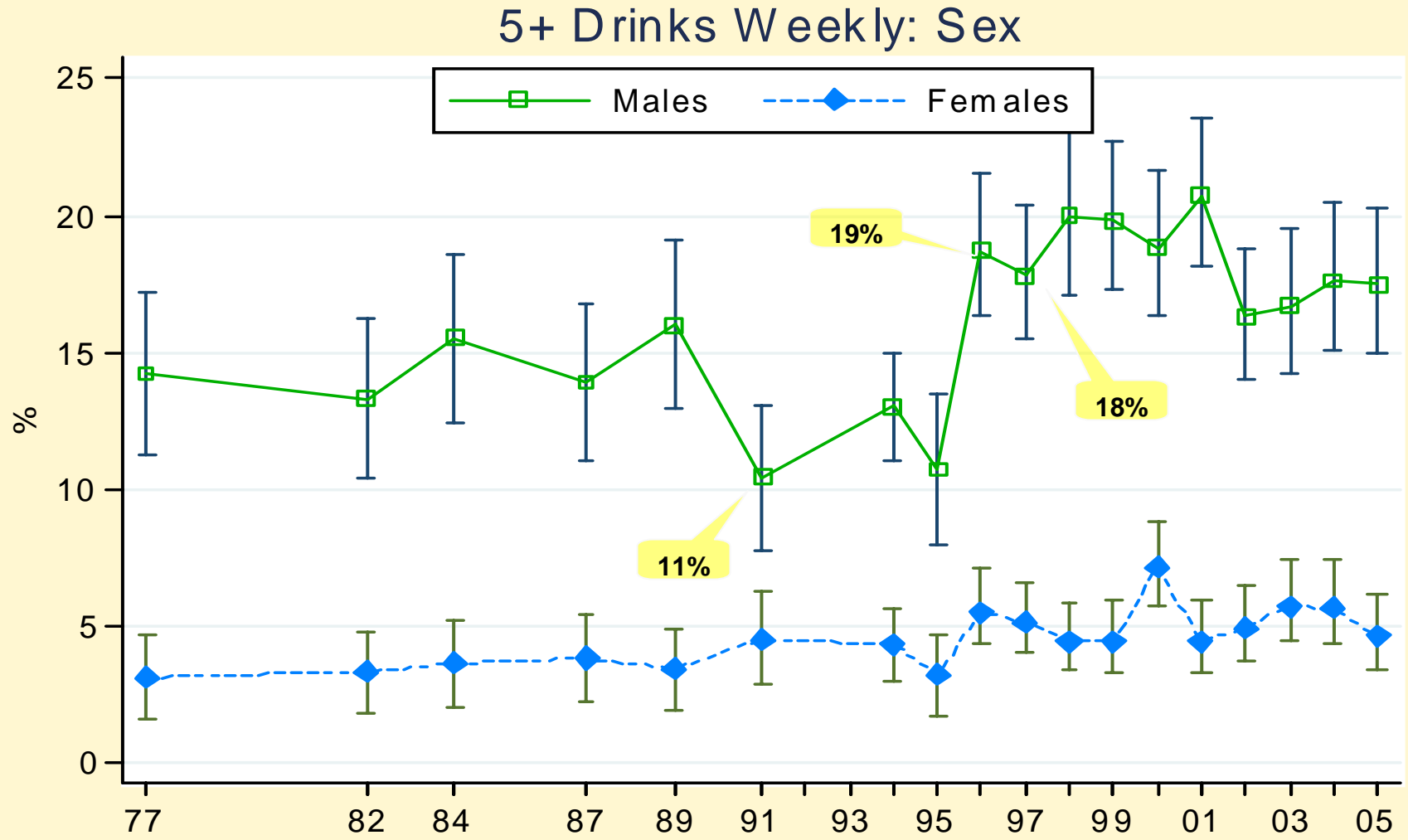
(Source: CAS & Giesbrecht, Rehm, Adlaf, Patra, Ialomiteanu & Flynn, 2007)



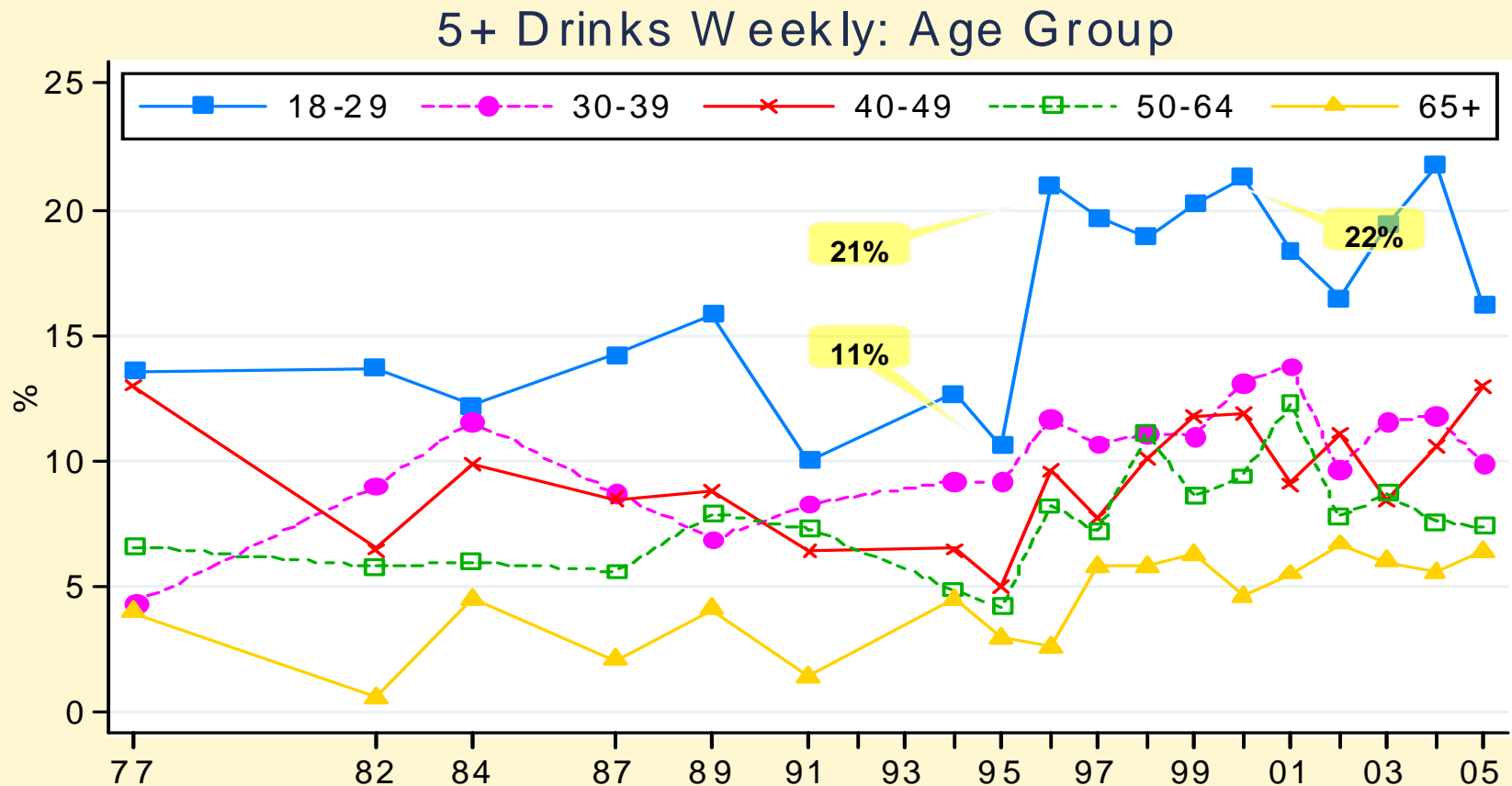
Weekly Heavy Drinking in the Past 12 Months, Ontario Adults, 1977-2005



Weekly Heavy Drinking in the Past 12 Months by Gender, Ontario Adults, 1977-2005



Weekly Heavy Drinking in the Past 12 Months by Age Groups, Ontario Adults, 1977-2005



Note: error bars are 95% confidence intervals
 Source: CAMH Monitor

Challenges of Public Health Responses

- Erosion of alcohol control systems
- Increase in alcohol marketing & promotion
- Major alcohol policy decisions are typically driven by market & retailing forces
- Increase in overall consumption & increase in high risk drinking
- Least effective interventions are often the most popular
- In light of evidence of burden from alcohol, current responses are far from adequate -- the large gap between evidence and prevention practice

4. An Effective Response (1/2)

- Implement both population level and focused interventions
 - Population level: policies, institutions, networks, structures
 - Focused interventions: high risk drinkers, problem drinkers, persons in treatment

An Effective Response (2/3)

Priority given to evidence-based interventions:

- An increase in the 'real price' of alcoholic beverages and a discontinuation of discount pricing and sale pricing.
- A ceiling and status quo on other types of availability – hours and day of sale, density of on-premise and off-premise outlets.
- Reduction in alcohol marketing and promotion, and including marketing that is especially attractive to youth.
- Increased access to brief interventions so that all high risk drinkers potentially can benefit.
- Active participation from public health community and partners

An Effective Response (3/3)

- Provide resources, broad base of support & sustainability
 - Have the resources to deliver sufficient prevention dose
 - Public health advocacy & leadership
 - NGO support and greater prominence to alcohol issues

Acknowledgements

This presentation is based, in part on the proceedings of the seminar entitled "Alcohol, Cancer and Public Policy" held in Toronto on October 31, 2007.

I especially wish to acknowledge some slides that are based on research or presentations by: Edward Adlaf, Thomas Babor, Tom Greenfield, Emma Haydon, Anca Ialomiteanu, Anthony Miller, Jayadeep Patra, Svetlana Popova & Jürgen Rehm.

Special thanks to all who contributed to the planning of this forum and funding that made it feasible.

The views and opinions expressed are those of the presenter and do not necessarily reflect those of the persons acknowledged.

Contact information

Norman Giesbrecht, Ph. D.

Senior Scientist

Public Health & Regulatory Policy Section

Social, Prevention & Health Policy Research Dept.

Centre for Addiction and Mental Health 33 Russell St.

Toronto, Ontario, Canada M5S 2S1 Fax: 416 595-6899

email: norman_giesbrecht@camh.net

www.camh.net

www.toronto.ca/health/resources/tcp.acp_seminars.htm