# Chronic Diseases in Canada

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# Capture-Recapture: Reconnaissance of a Demographic Technique in Epidemiology

*Debra J Nanan and Franklin White*

## Abstract

*The objective of this paper is to review capture-recapture (CR) methodology and its usefulness in epidemiology. Capture-recapture is an established and well-accepted sampling tool in wildlife studies, and it has been proposed as a cost-effective demographic technique for conducting censuses. However, the application of CR in the field of epidemiology requires consideration of relevant factors such as the nature of the condition under surveillance, its case definition, patient characteristics, reporting source and propensity for misdiagnosis and underdiagnosis. The use of CR in epidemiology has expanded over the last 10 years and no doubt will continue to be adopted. Although it has a role in public health surveillance, a more traditional approach to disease monitoring seems more advantageous in certain instances.*

***Key words:*** *Capture-recapture; epidemiologic methods; population surveillance*

## Introduction

A necessary component of the development and implementation of effective public health strategies in the prevention and control of disease is adequate and accurate information on when, where, how and who is affected. Epidemiology is the study of patterns of disease occurrence in human populations in terms of time, place and persons, and the factors that influence these patterns.[1] Observing and monitoring health and behaviour trends requires a surveillance system that captures useful data on those persons correctly identified with the characteristic under study and from which a descriptive epidemiologic profile can be formed. With this information, priorities can be identified and groups targeted for specific interventions based on their profile. It also allows for evaluation of interventions and the best use of resources in the management of the condition. This process relies on accurate identification of the condition (and its various stages) and a valid, reliable surveillance system with complete and accurate monitoring in a timely fashion.

A concern with any surveillance system is the quality of the data collected, including the degree of ascertainment of affected individuals. Although some diseases and/or their risk factors may have a high prevalence in a population, the number of reported cases may greatly underestimate the number of persons with the condition. This may be due to a variety of reasons, e.g. poorly defined criteria for diagnosis, missed diagnosis, poorly designed surveillance systems, lack of awareness of the need to report or lack of health-seeking behaviour by those with the disease and/or risk factor.

Therefore, to determine the usefulness of any surveillance system, there must be some way of assessing the quality of the data and completeness of ascertainment. One approach that attempts to accomplish this is the capture-recapture (CR) method.

## Capture-Recapture Methodology

### History

The basic methodology has been applied in different scientific areas and has a long history. It was first introduced by ecologists as a means of estimating the size of wildlife populations.[2–4] In demography, it has been used to adjust for undercounting in population censuses and to estimate birth and death rates and the extent of registration in developing countries.[5]

***Author References***

*Debra Nanan*, School of Public Health, George Washington University, Washington, DC, USA
*Franklin White*, Program Co-ordinator, Non-communicable Diseases, Pan American Health Organization, Regional Office of the World Health Organization, 525 Twenty-third Street NW, Washington, DC, USA  20037-2895

The US censuses have utilized similar approaches to estimate the undercount known to occur with the decennial censuses. The census in 1950 was the first to use the CR approach, referred to as the "dual system estimation," to evaluate the undercount.[6] The principle is as follows: after the census has been carried out, a second, more thorough sample, called the "post-enumeration survey" (PES), is performed and matched to the census records; statistical techniques are used to adjust for matching errors, omissions and erroneous enumerations, such as duplications. Although all subgroups of the population are missed to some degree, relative under-enumeration of particular minority groups and the poor is greater than for whites.

In 1990 a PES was conducted and matched to the 1990 US census. Although the methodology has provided revised estimates, the US Secretary of Commerce has opposed the application in spite of its statistical validity (1991), a decision upheld by the Supreme Court (1996) in the face of a suit filed by the City of New York (1980) to use the method and thereby increase the city's federal entitlements.[7]

A new strategy for estimating population size is being proposed by the US Census Bureau for the 2000 census, using statistical sampling and analysis (employing CR techniques) that would correct for the undercount and reduce the costs associated with door-to-door surveys; it also cites the fact that the US population is too large and too mobile for physical counts. However, the House Committee on Government Reform and Oversight is against the change, apparently from fear of reapportionment of House of Representative seats once undercount corrections are made.

There are two methods of applying CR: using two individual data sources or using at least three individual data sources (multiple source approach).

### Two-Sample Approach

There are four basic assumptions underlying the CR approach.[8]

- *Closure:* The population under study is closed, i.e. no changes in births, deaths, immigration or emigration during the sampling process (demographic closure).

- *Independence:* The sources are independent of one another, i.e. the probability of appearing on one list is not affected by the probability of being on another.

- *Homogeneity:* All individuals in the defined population under study have equal probabilities of being observed (captured) in any sample.

- *Perfect matching:* Individuals identified in one source can be perfectly matched to another source without error, i.e. no mismatches or non-matches.

As used in wildlife studies, the basic CR principle is as follows: sequential independent samples of animals are captured at different stations; the animals are tagged and allowed to mix with those still untagged; and estimation of the size of the population is based on the number of animals caught in successive samplings and the proportion of those caught that are tagged.

An example of the two-sample approach to estimate population size is given below.[2]

- First sample: 1000 animals are captured and tagged, and allowed to remix with the population.

- Second sample: 500 animals are recaptured, of which 450 are found to be untagged and 50, tagged.

- The capture probability, $p$, is estimated from the second sample by $p$, which is $50/500 = 0.1$.

- Assuming the capture probability is the same for the two samples, an estimate of the total population, $\hat{N} = 1000/0.1 = 10,000$. (Extending to include more than two samples would improve the precision of $\hat{N}$.)

In general, most estimation methods appear to be very sensitive to the breakdown of certain assumptions: they are not "robust." Even with wildlife populations, the traditional assumption that all members of a given population are equally "catchable" on all occasions is now recognized to rarely hold, and much work has been done in recent years to allow the assumption to be relaxed, leading to the construction of models that allow for variation in the capture probabilities. The three major sources of variation are these.[2]

- Capture probabilities that vary by time

- Capture probabilities that vary by behavioural responses

- Capture probabilities that vary by the individual (heterogeneity among individuals)

### Multiple Source Approach

With three sources, $2^3$ cells (subgroups) are obtained, denoting the number of possible combinations by which observations may be recorded simultaneously from each of the three sources, e.g. an observation may be reported by sources 1 and 3, but not by the second source. With $k$ sources, there are $2^k$ cells. In any cross-classification there will be one cell where no observations are recorded, corresponding to those individuals who have not been recorded by any source. The objective is to estimate the number of observations in this missing cell, which is then used to estimate the total population size.

The multiple source approach is more flexible, allowing consideration of variables that may influence reporting, and can identify reporting patterns for the different sources. The assumption of closure of the population still applies. However, the assumption of independence can be dropped, and interdependence among data sets can be accounted for by using Bernoulli census and log-linear modelling techniques to assess source dependencies.

The Bernoulli census approach plots all possible pairwise comparisons of two-sample estimates; if dependence between a pair of sources is suspected, they may be merged and treated as a single source.[9] With the

log-linear modelling approach, models are fitted to the $2^k$ contingency table (described above); an estimate may be derived from a model that best fits the data or from calculating a weighted estimate by combining results from different models.[10,11]

The effects of heterogeneity among individuals, which produces apparent dependence, can sometimes be reduced by stratifying the population of interest by any known factor thought likely to influence the capture probabilities, although one must ensure sufficient observations in each cell (see below); another approach is to use a model that accounts for the heterogeneity (e.g. logistic regression).[12,13]

With human populations, matching involves the use of identifiers common to sources (e.g. birth date, name, race). Probabilistic record linkage makes it feasible and efficient to link large databases in a statistically justifiable manner, while addressing the problem of matching two files under conditions of uncertainty. Automated linkage of records is accomplished by the use of statistical packages, which also account for matching errors.[14] These include general record linkage packages, such as GLIM, and more specialized software, such as GIRLS.[12,15,16] Where the issue of confidentiality arises, such as with human immunodeficiency virus disease, this may limit the ability to match if sufficient useful variables are not available.

One disadvantage of using multiple sources is the need for a sufficient number of observations in each cell; if data are sparse, the estimate will be unreliable. In some instances, it may be advantageous to pool sources; this, however, may result in the loss of useful ("overlap") information.

## Current Applications In Epidemiology

In epidemiology, "being caught in a sample" is replaced by "appearing on a list." These "lists" are represented by the information sources or surveillance systems. Routine databases can be used as sources, e.g. disease registries, hospital discharge data, death certificates, medical prescriptions. Where the surveillance system relies on voluntary reporting (often the case), there is very likely some form of bias in the system. With respect to human populations, the primary assumption of independence seems unlikely. For example, persons identified as injection-drug users on one list are more likely to appear on rehabilitative treatment lists if cases are referred for treatment once identified.[17]

The assumption of homogeneity is also questionable in human populations. Variations in ascertainment among sources are often determined by factors such as source, severity of illness, quality of care, legal requirements for reporting and patient characteristics. That is, determinants exist that increase the likelihood that a person with a given condition is diagnosed and appears on a particular list. For example, it is more likely that persons with a lower income will use public sector health services than persons who can afford private sector health services (which are less likely to comply with reporting requirements).

As a result of violation of these assumptions, the two-sample approach is rarely used with human populations. Nonetheless, the use of CR in epidemiology has expanded over the last 10 years.[18] Some of these uses are listed below (categorized by disease group).

- *Birth defects:* Studies related to birth defects (resulting from congenital rubella, cleft lip and cleft palate, spina bifida, Down's syndrome and fetal alcohol syndrome) applied CR techniques to correct for the number of incident or prevalent cases and completeness of reporting.

- *Cancer:* CR methods were used to estimate breast cancer screening sensitivity and false negative rates. Other studies employed CR to ascertain the completeness of cancer registries.

- *Drug use:* CR methods have been used in several prevalence studies and, in one instance, to estimate patterns of utilization of methicillin. The method was also used to correct for prevalence of intravenous drug use and to estimate population size of particular groups of users.

- *Infectious disease:* These studies were related to sexually transmitted diseases, especially acquired immunodeficiency syndrome. CR was used to estimate either or both prevalence and efficiency of the reporting systems.

- *Injuries:* CR provided ascertainment-adjusted estimates of dog bite injuries, terrain vehicle injuries, sports injuries and motor vehicle fatalities. The method was also used to evaluate the cost-effectiveness of various source combinations.

- *Insulin-dependent diabetes mellitus:* Currently, most registries use this procedure for checking the degree of ascertainment and providing ascertainment-adjusted rates.

- *Others:* CR methods have also been applied to estimate the incidence or prevalence of hemophilia, myocardial infarction, Huntington's disease and mental disease. Other areas of CR usage in epidemiology include the size of the homeless population, the number of children dependent on medical support, evaluation of the effectiveness of surveillance systems for monitoring abortion mortality, infections among hospitalized patients and vaccine-associated paralytic poliomyelitis.

Currently, several large multinational projects are under way with CR as a design component.[19] Examples of these large-scale studies are listed below.

- World Health Organization's Multinational Project for Childhood Diabetes, where 155 registries in over 70 countries monitor insulin-dependent diabetes mellitus in children (the DiaMond project)

- Global Lower Extremity Amputation (LEA) Study to enable comparisons between and within countries across the world and over time on the incidence of LEA
- Global Spine and Head Injury Project to monitor incidence of head injuries in over 20 countries
- Taiwan Head Injury Project to determine and compare incidence of head injury in Taipei City and a rural district

## Discussion

Assessment of a single source or multiple source databases for a specific condition is generally performed to evaluate data quality and the level of ascertainment. The usefulness of the CR approach is that it attempts to account for deficiencies that may exist in a single source approach. However, neither single nor multiple source ascertainment will account for those persons not identified as a case, e.g. missed diagnosis, incorrect diagnosis, poorly defined criteria or lack of seeking health care. Although the method can account for false negatives, there is the possibility of false positives that are not identified by the CR technique. The method thus relies on a standardized case definition with high sensitivity and specificity. For example, systemic lupus erythematosus is a poorly defined disease. There is a higher likelihood that false positives will occur, resulting in overestimation.

Use of a log-linear model entails the selection of the most appropriate model, given the actual data.[20] Models have been constructed to describe matching errors and can be used when errors are expected to occur during record linkage due to mismatches and non-matches. However, the ability to match will depend on the quality of the data and the availability of unique identifiers.

Even with perfect matching and good sensitivity and specificity, the information on those with the condition relates to individuals who have been reported and thus may represent a selective group and not the entire population. How far the results can be extrapolated will depend on varying factors, e.g. the characteristics of those reported, the timeliness of reporting or the nature of the condition.

## Conclusion

In designing studies, the investigator must be aware of the basic underlying assumptions and make the correct transition from model assumptions to the real world of human populations. With this in mind, there appears to be two main roles for CR in public health.

- To assess the degree of ascertainment of a given condition using a particular source
- To augment/adjust for the degree of ascertainment by using a multiple source model

Where multiple sources exist, the application of CR methods may provide a saving in time, effort and expense compared with using the traditional field survey to determine ascertainment. New information may be gathered on the use of services by subgroups and the interaction effects. As neither the true value of the parameter to be estimated nor the correct assumptions about capture probabilities are known, whatever estimate is computed from the selected model should be accompanied by confidence limits to give an idea of its reliability. In practice, this has resulted in wide confidence intervals that raise doubts regarding the reliability of the estimate and the realistic nature of the model.

The CR approach holds continuing promise for its application to epidemiologic surveillance. However, even though CR is a valuable method for enhancing existing surveillance data, there is an ongoing need to strengthen more "traditional" surveillance systems and data collection sources. This involves such activities as improving and validating case definitions, promoting diagnosis and reporting, developing information systems and training in the use of health records. In the final analysis, the usefulness of CR in surveillance must be evaluated in terms of its public health utility.

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# Estimating the Economic Costs of the Abuse of Tobacco, Alcohol and Illicit Drugs: A Review of Methodologies and Canadian Data Sources

*Bernard CK Choi, Lynda Robson and Eric Single*

## Abstract

*The study of economic costs of substance abuse, namely, abuse of tobacco, alcohol and illicit drugs, can provide important information for setting good public health policies. This review paper provides a list of previous cost studies of substance abuse, compares the cost categories considered by various methodologies and describes an inventory of data sources for obtaining relevant information for cost studies. Investigators will find this paper useful as an introduction to the literature in this area, for designing a list of cost categories to consider in a particular study and for identifying relevant data sources.*

***Key words:*** *Alcohol; Canada; data sources; drugs; economic cost; methodology; substance abuse; tobacco*

## Introduction

There is a need for estimates of the economic costs of substance abuse.[1–4] It has been well established that the use of alcohol, tobacco and other drugs involves a large number of adverse health and social consequences. In most countries, there is a specific national policy for the regulation of these psychoactive substances. Because the justification for special regulation is the economic and social costs, and also because economic policy instruments are used in the regulation of these substances, it makes good sense to have sound estimates of the economic costs of substance abuse.

This paper reviews and summarizes the methodologies suggested by a number of recently published papers in both the medical and economic literature on the costs of substance abuse. It provides concepts and background knowledge to investigators who are interested in estimating these costs.

For the purposes of this paper, substance abuse includes the excessive use of alcohol, tobacco and illicit drugs (ATD). Legal prescription drugs (pharmaceuticals) are not included. Abuse or misuse of pharmaceuticals is responsible for significant economic costs, but it is extremely difficult to obtain relevant information since very little research has been done on the abuse of prescription drugs.

The definition of substance abuse is rarely attempted in the literature, and those definitions that are available are not usually expressed in economic terms. Based on the definition of Collins and Lapsley,[1] our study defines substance abuse as any substance use that involves a net social cost additional to the resource costs of the provision of that substance. Thus, the costs include the complete set of problems associated with the use of psychoactive substances, rather than just those costs associated with physical dependence or heavy use.

## Previous Studies Estimating Economic Costs of Substance Abuse

As there are many published cost studies, it would be beyond the scope of this paper to review and compare them one by one. Therefore, only recently published review articles that established methods of cost estimation are

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**Author References**

*Bernard CK Choi*, Bureau of Cardio-Respiratory Diseases and Diabetes, Laboratory Centre for Disease Control, Health Canada, Tunney's Pasture, AL: 0602D, Ottawa, Ontario  K1A 0L2; Fax: (613) 954-8286; E-mail: Bernard_Choi@hc-sc.gc.ca; *and* Associate Professor, University of Toronto; *and* Adjunct Professor, University of Ottawa
*Lynda Robson*, Institute for Work and Health, Toronto, Ontario
*Eric Single*, Department of Public Health Sciences, University of Toronto, Toronto, Ontario

considered. We identified four such articles. Rice et al.[5] devised a list of economic costs for alcohol and drug abuse and mental illnesses in the US. Collins and Lapsley[1] proposed a methodology to estimate the economic costs of drug abuse (ATD) in Australia. In another American setting, Manning et al.[6] estimated the costs of poor health habits (smoking, drinking and sedentary lifestyles). Finally, French et al.[7] suggested a conceptual framework to estimate the social costs of drug abuse.

We must point out that the last article[7] was a theoretical paper and did not review or establish methods of cost estimation. However, we included it in our study because of its unique and innovative contributions to the different categories of costs, such as the concept of avoidance behaviour costs for families, communities and victims of crime in terms of educational and public service efforts and programs.

A list of the cost studies and pertinent theoretical papers reviewed by the four above-mentioned articles is given in Tables 1A, 1B and 1C sorted by substance (alcohol, tobacco or illegal drugs) and year of publication, and then by alphabetical order of authors. In addition, several cost studies not reviewed by those four articles were also included, having been identified in a literature search. The tables are intended to be a resource tool for researchers in this domain.

## TABLE 1A

### Previous cost studies of alcohol, tobacco and illicit drugs reviewed by four major recent studies, or identified in literature search@: (A) ALCOHOL

| Author(s) | Year | R | C | M | F |
|---|---|---|---|---|---|
| Berry et al. | (1975)[8] | | X | | |
| Berry and Boland | (1977)[9] | X | | X | |
| Schramm | (1977)[10] | | X | | |
| Luce and Schweitzer | (1978)[11] | | | X | |
| Cruze et al. | (1981)[12] | X | | X | |
| Single | (1983)[13]@ | | | | |
| Ashton and Casswell | (1984)[14] | | X | | |
| Crawford and Ford | (1984)[15] | | X | | |
| Harwood et al. | (1984)[16] | X | | X | |
| Siegel et al. | (1984)[17] | | X | | |
| Chetwynd and Rayner | (1985)[18] | | X | | |
| McDonnell and Maynard | (1985)[19] | | X | | |
| US Dept of Transportation | (1986)[20] | | | X | |
| Crofton | (1987)[21] | | X | | |
| Gordis | (1987)[22] | | X | | |
| Holder | (1987)[23] | | X | | |
| Maynard et al. | (1987)[24] | | X | | |
| Parker et al. | (1987)[25] | | X | | |
| Alcohol and Drug Dependency Commission | (1988)[26]@ | | | | |
| Adrian | (1988)[27] | | X | | |
| Berger and Leigh | (1988)[28] | | X | | |
| Gorsky et al. | (1988)[29] | | X | | |
| Adrian et al. | (1989)[30]@ | | | | |
| Armstrong and Klatsky | (1989)[31] | | X | | |
| Heien and Pittman | (1989)[32] | | X | | |
| Manning et al. | (1989)[33,34] | | X | | |
| Maynard | (1989)[35]@ | | | | |

| Author(s) | Year | R | C | M | F |
|---|---|---|---|---|---|
| Pratt and Tucker | (1989)[36] | | X | | |
| Richardson | (1989)[37] | | X | | |
| Thornton et al. | (1990)[38]@ | | | | |
| Rice et al. | (1991)[39]@ | | | | |
| Shultz et al. | (1991)[40]@ | | | | |
| Liu | (1992)[41]@ | | | | |
| Adams et al. | (1993)[42] | | | | |
| Heien and Pittman | (1993)[43]@ | | | | |
| McCarthy et al. | (1993)[44]@ | | | | |
| Nakamura et al. | (1993)[45]@ | | | | |
| Rice | (1993)[46]@ | | | | |
| Woodside et al. | (1993)[47]@ | | | | |
| Maynard and Godfrey | (1994)[48]@ | | | | |
| Normand et al. | (1994)[49]@ | | | | |
| Richardson and Crowley | (1994)[50]@ | | | | |
| Saskatchewan Health | (1994)[51]@ | | | | |
| Fox et al. | (1995)[52]@ | | | | |
| Jones et al. | (1995)[53]@ | | | | |
| Levy and Miller | (1995)[54]@ | | | | |
| Salomaa | (1995)[55]@ | | | | |
| Collins and Lapsley | (1996)[136]@ | | | | |
| Humphreys and Moos | (1996)[56]@ | | | | |
| McKenna et al. | (1996)[57]@ | | | | |
| Single et al. | (1996)[3]@ | | | | |
| Xie et al. | (1996)[58]@ | | | | |
| Lehto | (1997)[59]@ | | | | |

R = Rice et al. (1990)[5]
C = Collins and Lapsley (1991)[1]
M = Manning et al. (1991)[6]
F = French et al. (1991)[7]

| TABLE 1B | | | | |
|---|---|---|---|---|
| **Previous cost studies of alcohol, tobacco and illicit drugs reviewed by four major recent studies, or identified in literature search@: (B) TOBACCO** | | | | |
| Author(s) | Year | R | C | M | F |
| Oakes et al. | (1974)[60] | | | X | |
| Atkinson and Townsend | (1977)[61] | | | X | |
| Luce and Schweitzer | (1978)[11] | | | X | |
| WHO | (1979)[62] | | X | | |
| Forbes and Thompson | (1982)[63] | | X | X | |
| Yach | (1982)[64] | | X | | |
| Forbes and Thompson | (1983)[65] | | X | X | |
| Kristein | (1983)[66] | | X | X | |
| Leu and Schaub | (1983)[67] | | | X | |
| Rice and Hodgson | (1983)[68] | | | X | |
| Warner | (1983)[69] | | X | | |
| Collishaw and Myers | (1984)[70] | | X | | |
| Leu | (1984)[71] | | | X | |
| Oster et al. | (1984)[72] | | X | X | |
| Leu and Schaub | (1985)[73] | | | X | |
| Ockene | (1985)[74] | | X | | |
| Office of Technology Assessment | (1985)[75] | | | X | |
| Sachs | (1985)[76] | | X | | |
| Vogt and Schweitzer | (1985)[77] | | | X | |
| National Research Council (US) | (1986)[78] | | | X | |
| Rice et al. | (1986)[79] | | | X | |
| Schelling | (1986)[80] | | X | | |
| Stoddart et al. | (1986)[81] | | | X | |
| US Dept of Health and Human Services | (1986)[82] | | | X | |
| Wright | (1986)[83] | | | X | |
| Western Australia Health Dept | (1987)[84] | | X | | |
| Maynard et al. | (1987)[24] | | X | | |
| Choi and Nethercott | (1988)[85]@ | | | | |
| Gray et al. | (1988)[86]@ | | | | |
| Shimizu et al. | (1988)[87] | | X | | |
| Swank et al. | (1988)[88] | | X | | |
| Hauswald | (1989)[89]@ | | | | |
| Jackson et al. | (1989)[90] | | X | | |
| Kaplan et al. | (1989)[91] | | X | | |
| Kristein | (1989)[92] | | X | | |
| Manning et al. | (1989)[33] | | X | X | |
| Markandya and Pearce | (1989)[93] | | X | | |
| Maynard | (1989)[35]@ | | | | |
| Rivo et al. | (1989)[94]@ | | | | |

| TABLE 1B *continued* | | | | |
|---|---|---|---|---|
| Author(s) | Year | R | C | M | F |
| Shoven et al. | (1989)[95] | | | X | |
| Wassilak et al. | (1989)[96]@ | | | | |
| Davis et al. | (1990)[97]@ | | | | |
| Gorsky et al. | (1990)[98]@ | | | | |
| Lippiatt | (1990)[99] | | X | | |
| Raynauld and Vidal | (1990)[100]@ | | | | |
| Smith et al. | (1990)[101] | | X | | |
| Spiegel and Cole | (1990)[102]@ | | | | |
| Ellemann-Jensen | (1991)[103]@ | | | | |
| Shultz et al. | (1991)[104]@ | | | | |
| Chudy et al. | (1992)[105]@ | | | | |
| Cummings et al. | (1992)[106]@ | | | | |
| Hodgson | (1992)[107]@ | | | | |
| Kendall | (1992)[108]@ | | | | |
| Phillips et al. | (1992)[109]@ | | | | |
| Raynauld and Vidal | (1992)[110]@ | | | | |
| Choi | (1993)[111]@ | | | | |
| Williams and Franklin | (1993)[112]@ | | | | |
| Adams | (1994)[113]@ | | | | |
| Bartlett et al. | (1994)[114]@ | | | | |
| CDC | (1994)[116]@ | | | | |
| Li et al. | (1994)[117]@ | | | | |
| Chen et al. | (1995)[118]@ | | | | |
| Easton | (1995)[119]@ | | | | |
| Fox et al. | (1995)[52]@ | | | | |
| Watson et al. | (1995)[121]@ | | | | |
| Welch et al. | (1995)[122]@ | | | | |
| Choi and Pak | (1996)[2]@ | | | | |
| Collins and Lapsley | (1996)[136]@ | | | | |
| Doran et al. | (1996)[123]@ | | | | |
| Emont | (1996)[124]@ | | | | |
| Lynch and Hopkins | (1996)[125]@ | | | | |
| McGhan and Smith | (1996)[126]@ | | | | |
| Schumacher | (1996)[127]@ | | | | |
| Single et al. | (1996)[3]@ | | | | |
| Xie et al. | (1996)[58]@ | | | | |
| Aligne and Stoddard | (1997)[128]@ | | | | |
| Kaiserman | (1997)[4]@ | | | | |
| Stoddard and Gray | (1997)[129]@ | | | | |

R = Rice et al. (1990)[5]
C = Collins and Lapsley (1991)[1]
M = Manning et al. (1991)[6]
F = French et al. (1991)[7]

## Differences among Previous Studies

Previous cost studies have differed in their point of view, the types of costs included and the basic methodology employed. These differences are briefly outlined below, illustrating the types of decisions that must be made at the outset of a cost study.

A major distinction among cost studies is what viewpoint the study takes. Among the major review articles, the ones by Rice et al.,[5] Collins and Lapsley[1] and French et al.[7] took society's point of view; therefore all costs, both internal (costs borne by the substance user and possibly their family) and external (costs borne by those not using the substance), were included. The cost to society resulting from premature mortality, estimated by the value of foregone production, was incorporated in these studies. Transfers within society, such as social welfare payments, were not included because society's total resources did not change as a result of these transfers; the resources were simply redistributed. On the other hand, the costs of administering transfer payments attributable to substance abuse were included because this portion of administrative costs were resources that would not have been consumed in the absence of substance abuse.

In contrast, the review by Manning et al.[6] considered only the costs that were external to substance users and their families. Thus, in this case, loss of wages due to premature mortality was considered as an internal cost and therefore excluded, whereas transfers from non-users to users via collectively financed programs (such as pension plans and group life insurance) were included.

A third point of view often of interest is that of the government. This is the viewpoint considered in most budgetary impact analyses, such as the one included in the Collins and Lapsley report.[1] Such studies consider revenue from excise taxes, customs duties and income taxes, in addition to costs to health care and justice systems.

Another primary difference among previous studies has been whether costs alone were considered or whether costs and benefits (i.e. net costs) were considered. Cost-of-illness studies—a major type of cost studies—estimate only the costs of substance use.[5,7,12,16,140–142] This encompasses direct costs, where payment is made and resources are consumed (e.g. cost of hospital services, motor vehicle damage, justice services), and also indirect costs, where potential resources are foregone through premature mortality or absence from work. Since cost-of-illness studies assess only the costs of substance use, they have been criticized for being of limited usefulness.[143,144] In contrast, the frameworks used by Collins and Lapsley[1] and Manning et al.[6] considered not only the costs, but also the economic benefits of substance use. For example, premature mortality decreases hospital and nursing home expenditures.

Many studies, such as those of Rice et al.[5] and Manning et al.,[6] calculated only tangible costs, i.e. costs that could be valued in the marketplace. However, an economic evaluation is more complete if there is an explicit estimation of intangible costs, such as the cost of pain and suffering.[7,79] Such costs are difficult to evaluate quantitatively, but French et al.[7] suggested that utility valuation methods could be used, such as the quality-of-life method. Collins and Lapsley[1] actually attempted an explicit calculation of various intangible costs in their review.

A third way in which cost studies can differ fundamentally is in their choice of a "prevalence-based" model[1,5] or an "incidence-based" model.[6] In the former model, the costs resulting from past and present substance abuse are determined for a given year, based on the prevalence of mortality, morbidity and other relevant factors in that year. For example, Rice et al.[5] determined costs based on the prevalence of hospitalization, crime, disability, etc. in the year of study that could be attributed to substance abuse. Mortality costs were also based on the

prevalence of mortality in the same year, although they were valued as the present value of all future earnings of the deceased (i.e. the "human capital approach").

In another prevalence-based approach, the "demographic approach" (pioneered by Collins and Lapsley[1]), a hypothetical population free of substance abuse is constructed for the year of interest (i.e. a larger and healthier population) and the difference in production, health care usage, nursing home care, etc. between the actual and hypothetical populations is estimated. In terms of mortality costs, the human capital approach addresses the question "What does substance abuse today cost the economy this year and into the future?", while the demographic approach asks, "What has substance abuse in the past cost the economy this year?" Thus, the human capital and demographic approaches are complementary, not contradictory.[145] The drawback of prevalence-based models is that, by measuring costs in the present year, they reflect the historical use of a substance. This is illustrated especially in the case of tobacco, which has a long delay between use and consequences. However, because of their simpler data requirement, prevalence-based models have been more widely adopted than incidence-based models.

In contrast to the prevalence-based model, an incidence-based model estimates the present value of the lifetime costs of present substance use patterns. Thus, it can be used to predict the future effect of changes in current substance use patterns and, as such, is generally of greater interest to policy makers.[146] The disadvantages of incidence-based models are that they are very sensitive to as yet unknown technological, demographic, medical and other changes, and that they require sophisticated data.

The terms "private cost" and "social cost" are also used in the literature, although no universally accepted definitions are available. It is generally agreed that private costs, which are the costs the user must pay, are the same as internal costs. Many authors, such as Markandya and Pearce,[93] and Collins and Lapsley,[1] define social costs as those that are neither private nor internal. It must be noted, however, that the exact meaning of social costs must be made explicit, since some authors (such as Ellemann-Jensen,[103] French et al.[7] and Manning et al.[6]) define social costs as the sum of internal (costs incurred by the individuals engaging in the activity) and external costs (costs to others).

## Cost Categories Used in Existing Review Studies

As discussed above, different methods have been used for cost estimation of substance abuse in the four major review studies identified. A comparison of the cost categories considered by these reviews is outlined in Tables 2A, 2B and 2C. These categories are classified as direct costs (expenditures or resources used as a direct result of ATD abuse), indirect costs or intangible costs (generally unquantifiable). The inclusion (indicated with an "X" in the

tables) or exclusion of each cost category provides a rough idea of its relative importance within the methodology used by each of the reviews.

Some of these reviews suggested that cost estimations should be classified as core or related costs,[1,5] and internal or external costs.[6] Collins and Lapsley[1] defined private,

### TABLE 2A

### Cost categories for abuse of alcohol, tobacco and illicit drugs (ATD) used in four major recent reviews: (A) DIRECT COSTS

| Cost categories | R | C | M | F |
|---|---|---|---|---|
| 1. Hospitalization | X | X | X | X |
| 2. Physician visits | X | X | X | X |
| 3. Crime-related costs[a] | X | X | X | X |
| 4. Motor vehicle crashes[b] | X | X | X | X |
| 5. Nursing home stay | X | X | X | |
| 6. Property and forest fires[c] | X | X | X | |
| 7. Specialty institutions[d] | X | X | | X |
| 8. Professional services (other than physicians)[e] | X | X | | X |
| 9. Prescription drugs for treatment | X | X | | X |
| 10. Medical and health services research | X | X | | |
| 11. Program administration[f] | X | | X | |
| 12. Administrative costs of private insurance to treat ATD disorders | X | | X | |
| 13. Direct costs related to AIDS due to drug abuse (treatment) not already included elsewhere | X | | | X |
| 14. Costs of abused substances | | X | X | |
| 15. Prevention programs[g] | | X | | X |
| 16. Ambulance costs[h] | | X | | X |
| 17. Training costs for physicians and nurses | X | | | |
| 18. Fetal alcohol syndrome[i] | X | | | |
| 19. Customs and immigration | | X | | |
| 20. Extra neonatal care (neonatal complications caused by mothers' smoking) | | | X | |
| 21. Neonatal disorders and complications related to drug abuse | | | | X |
| 22. Home care (care of ATD user) | | | | X |
| 23. Household help (care of house) | | | | X |
| 24. Counselling, retraining and re-education | | | | X |
| 25. Special equipment for rehabilitation (e.g. wheelchairs) | | | | X |
| 26. Employee assistance programs provided by employers for ATD-using employees | | | | X |
| 27. Drug testing in workplace | | | | X |

social, marginal, real and pecuniary costs, while French et al.[7] defined private, external and social costs, as well as economic transfers. These are all useful definitions and concepts; however, they are not used in Table 2 in order to simplify the framework.

| TABLE 2A *continued* | | | | |
|---|---|---|---|---|
| Cost categories | R | C | M | F |
| 28.  Avoidance behaviour costs[j] | | | | X |
| 29.  Group life insurance[k] | | | X | |
| 30.  Widow's bonus from husband dying at age 60–79[l] | | | X | |
| 31.  Extra disability pension due to retirement for health reasons[m] | | | X | |
| 32.  Payroll taxes on earnings that finance medical, sick leave, disability, group life insurance and retirement benefits[n] | | | X | |
| 33.  Insured cost of care for fetal alcohol syndrome | | | X | |

a   Includes public criminal justice system cost, corrections, drug traffic control expenses, private expenditure for legal defence, value of property destroyed in crimes due to ATD abuse
b   Includes legal and court proceedings, insurance administration, accident investigation, vehicle damage, traffic delay
c   Includes damage and cleaning of damaged goods. Fire injuries and deaths are considered under morbidity and mortality.
d   Includes treatment centres other than hospitals, and alcohol, tobacco or drug correctional facilities
e   Includes psychologists, social workers, nurses, physical and occupational therapists, pharmacists, technicians, etc.
f   ATD-related programs and social welfare programs
g   Screening, education programs and mass media campaigns to inform the public about the hazards of ATD abuse
h   Includes other transportation to health care providers
i   Treatment, rehabilitation and long-term care services for physical and mental deficiencies of children born of mothers who drank during pregnancy
j   Avoidance behaviour by families, communities and victims of crime, e.g. educational and public service efforts, law enforcement, community-based programs, family-based activities, support services, business and residential security systems, business and residential relocations, insurance, community watch programs
k   Death benefits provided by employers, usually not adjusted for habits and reduced to zero at retirement
l   When wife outlives male pensioner and her social security pension increases if she never worked
m   Non-smokers receive less in disability pension than do smokers since smoking is causally related to disability retirement.
n   Paid as taxes, premiums, payroll deductions and employer contributions

R = Rice et al.(1990)[5]
C = Collins and Lapsley (1991)[1]
M = Manning et al. (1991)[6]
F = French et al. (1991)[7]

| TABLE 2B<br><br>Cost categories for abuse of alcohol, tobacco and illicit drugs (ATD) used in four major recent reviews: (B) INDIRECT COSTS | | | | |
|---|---|---|---|---|
| Cost categories | R | C | M | F |
| 1.  Morbidity costs: income loss due to ATD abuse[o] | X | X | X | X |
| 2.  Related productivity losses[p] | X | X | X | X |
| 3.  Mortality costs: present value of lifetime earnings[q] | X | | | X |
| 4.  Foregone consumption[r] | | X | | |
| 5.  Reduced property values in drug-ridden communities | | | | X |

o   Value of goods and services lost by individuals unable to perform their usual activities or to perform them at a level of full effectiveness due to disability, absenteeism, etc.
p   Loss of innocent lives and work time caused by passive smoking and drunk-driving accidents, lost work time for crime victims, productivity loss for individuals incarcerated for a criminal offence and for heroin and cocaine addicts who engage in criminal activities rather than legal employment, time spent to care for family members because of their ATD abuse
q   Current monetary value of future output lost due to premature death
r   Reduction in consumption resulting from ATD abuse-induced deaths, which is a net resource benefit to society, considered as a negative cost

| TABLE 2C<br><br>Cost categories for abuse of alcohol, tobacco and illicit drugs (ATD) used in four major recent reviews: (C) INTANGIBLE COSTS | | | | |
|---|---|---|---|---|
| Cost categories | R | C | M | F |
| 1.  Homelessness associated with ATD abuse | X | | | X |
| 2.  Pain and suffering of victims and the rest of the community | | X | X | |
| 3.  Value of lost life to the deceased (estimated by willingness to pay to avoid death) | | X | | |
| 4.  Loss of consumption by prematurely deceased | | X | | |
| 5.  ATD abuse-related pain and suffering[s] | | | | X |
| 6.  Family disruptions[t] | | | | X |
| 7.  Community disruptions[u] | | | | X |

s   Depression, isolation, heightened anxiety, loss of companionship, loss of job, physical disability, reduced self-esteem, resentment
t   Parent-child conflicts, spousal conflicts, separation, divorce, marital violence, child abuse
u   Safety problems, fear for personal safety, fear of property loss, community conflicts

## Inventory of Existing Data Sources in Canada

Researchers conducting a cost study are initially faced with the central question of where to find relevant data. Thus, an inventory of possible data sources for cost studies would be extremely valuable. Because of our particular expertise and experience with the Canadian system, we have created an inventory of data sources available in Canada. We considered a similar inventory for various countries to be beyond the scope of this paper because of the size, complexity and differences of such data systems.

Table 3 identifies the Canadian cost studies we used to set up the inventory (Tables 4A, 4B and 4C) of the various data sources in Canada on alcohol, tobacco and drugs. All of these studies evaluated only tangible costs.

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### TABLE 3

### Canadian cost studies used for Table 4

| Study | Substance |
|---|---|
| Forbes and Thompson (1983) | Tobacco[65] |
| Collishaw and Myers (1984) | Tobacco[70] |
| Choi and Nethercott (1988) | Tobacco[85] |
| Adrian (1988) | Alcohol[27] |
| Alcohol and Drug Dependency Commission (Nfld) (1988) | Alcohol[26] |
| Adrian et al. (1989) | Alcohol[30] |
| Adrian et al. (1989) | Drugs[130] |
| Kendall (1992) | Tobacco[108] |
| Raynauld and Vidal (1992) | Tobacco[110] |
| Coordinated Law Enforcement Unit (BC) (1992) | Drugs[133] |
| Saskatchewan Health (1994) | Alcohol and Drugs[51] |
| Choi and Pak (1996) | Tobacco[2] |
| Single et al. (1996) | Alcohol, Tobacco and Drugs[3] |
| Kaiserman (1997) | Tobacco[4] |

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### TABLE 4A

### Data sources used by Canadian researchers for estimating tangible costs of alcohol, tobacco and drug (ATD) abuse: (A) BACKGROUND INFORMATION

| Researchers | Source of data |
|---|---|
| **1. Population structures by age and sex** | |
| Forbes and Thompson (1983)[65] | Statistics Canada (1979)[147] |
| Kendall (1992)[108] | Statistics Canada: 1986 Census of Canada |
| Single et al. (1996)[3] | Statistics Canada (1994)[148] |
| **2. Percentage of population exposed to risk of ATD abuse, by age and sex** | |
| Forbes and Thompson (1983)[65] | Canada's Labour Force Survey, 1975 |
| Collishaw and Myers (1984)[70] | Canada Health Survey |
| Choi and Nethercott (1988)[85] | Canada Health Survey (Statistics Canada, 1983)[149] City of Toronto Community Health Survey (MacPherson, 1984)[150] |
| Adrian et al. (1989a)[30] | Gallup Poll (1984)[151] |
| Kendall (1992)[108] | Canada's Labour Force Survey (Health and Welfare Canada, 1990)[152] |
| Saskatchewan Health (1994)[51] | Canada's Health Promotion Survey, 1990 |
| Choi and Pak (1996)[2] | Canada's Labour Force Survey (Health and Welfare Canada, 1990)[152] |
| Single et al. (1996)[3] | Canada's Health Promotion Survey, 1990 Canadian Alcohol and Drug Survey, 1994 Ontario Adult Alcohol and Drug Survey, 1994 Ontario Health Survey, 1990 General Social Survey, 1991 Health Canada Survey on Smoking, Cycle 3, 1994 |
| Kaiserman (1997)[4] | General Social Survey, 1991 |
| **3. Relative risks of mortality, disability, hospitalization, physician visits, etc., by age and sex** | |
| Forbes and Thompson (1983)[65] | US Department of Health, Education and Welfare (1979)[153] |
| Collishaw and Myers (1984)[70] | Hammond (1966)[154] Rogot (1974)[155] |
| Choi and Nethercott (1988)[85] | Collishaw and Myers (1984)[70] |
| Adrian et al. (1989a,b)[30,130] | Holmes (1976)[156] |

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<table>
<tr><td colspan="2" align="center"><strong>TABLE 4A</strong> <em>continued</em></td></tr>
<tr><td>Researchers</td><td>Source of data</td></tr>
<tr><td>Kendall (1992)[108]</td><td>US National Health Interview Survey (US Dept of Health and Human Services, 1987)[157]</td></tr>
<tr><td>Raynauld and Vidal (1992)[110]</td><td>Reports of the US Surgeon General, 1982, 1983, 1984</td></tr>
<tr><td>Kaiserman (1997)[4]</td><td>General Social Survey, 1991</td></tr>
<tr><td>Choi and Pak (1996)[2]</td><td>Collishaw and Myers (1984)[70]</td></tr>
<tr><td>Single et al. (1996)[3]</td><td>English et al. (1995)[168]</td></tr>
</table>

*4. Mortality rates by age and sex*

| Researchers | Source of data |
|---|---|
| Forbes and Thompson (1983)[65] | Statistics Canada (1980)[158] |
| Kendall (1992)[108] | City of Toronto Department of Public Health: Information Section |
| Single et al. (1996)[3] | Statistics Canada (1993)[115] |

*5. Directly determined attributable fractions*

| Researchers | Source of data |
|---|---|
| Single et al. (1996)[3] | Alter et al. (1989;1990)[166,167] Shultz et al. (1991b)[40] English et al. (1995)[168] Fox et al. (1995)[169] Rehm et al. (1996)[170] |

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<div align="center">

**TABLE 4B**

**Data sources used by Canadian researchers for estimating tangible costs of alcohol, tobacco and drug (ATD) abuse: (B) DIRECT COSTS**

</div>

| Researchers | Source of data |
|---|---|

*1. Hospitalization due to ATD abuse*

| Researchers | Source of data |
|---|---|
| Forbes and Thompson (1983)[65] | Boulet and Grenier (1978)[159] Statistics Canada (1978)[160] |
| Collishaw and Myers (1984)[70] | Canada Health Survey (Statistics Canada, 1983)[149] |
| Choi and Nethercott (1988)[85] | Ontario Ministry of Health (1984)[161] and Information Resources and Services Branch |
| Adrian et al. (1989a,b)[30,130] | Statistics Canada (1988)[162–164] |
| Kendall (1992)[108] | Ontario Ministry of Health: Financial Services Branch |
| Raynauld and Vidal (1992)[110] | Statistics Canada: Canadian Centre for Health Information |
| Kaiserman (1997)[4] | Statistics Canada |

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<table>
<tr><td colspan="2" align="center"><strong>TABLE 4B</strong> <em>continued</em></td></tr>
<tr><td>Researchers</td><td>Source of data</td></tr>
<tr><td>Choi and Pak (1996)[2]</td><td>Ontario Ministry of Health (1988)[165] and Community Information Section</td></tr>
<tr><td>Single et al. (1996)[3]</td><td>Alter et al. (1989; 1990)[166,167] Shultz et al. (1991b)[40] English et al. (1995)[168] Fox et al. (1995)[169] Rehm et al. (1996)[170] Statistics Canada (1994)[171,120]</td></tr>
</table>

*2. Physician visits*

| Researchers | Source of data |
|---|---|
| Forbes and Thompson (1983)[65] | Boulet and Grenier (1978)[159] |
| Collishaw and Myers (1984)[70] | Canada Health Survey (Statistics Canada, 1983)[149] Régie de l'assurance maladie du Québec (1980)[172] |
| Choi and Nethercott (1988)[85] | Canada Health Survey (Statistics Canada, 1983)[149] City of Toronto Community Health Survey (MacPherson, 1984)[150] Ontario Ministry of Health: Information Resources and Services Branch |
| Kendall (1992)[108] | Ontario Ministry of Health: Communications Branch |
| Choi and Pak (1996)[2] | Canada Health Survey (Statistics Canada, 1983)[149] Ontario Ministry of Health: User Support Branch |
| Single et al. (1996)[3] | Health Canada (1996)[173] Manitoba Health: Health Information System Branch |
| Kaiserman (1997)[4] | Canadian Medical Association |

*3. Crime-related costs*

| Researchers | Source of data |
|---|---|
| Adrian et al. (1989a,b)[30,130] | Statistics Canada (1988)[162–164] |
| Coordinated Law Enforcement Unit (1992)[133] | Municipal police agencies Royal Canadian Mounted Police (RCMP) Coordinated Law Enforcement Unit Health and Welfare Canada: Bureau of Dangerous Drugs British Columbia Transit Security British Columbia Ministry of Attorney General: Court Services Branch and Corrections Branch Department of Justice Canada Legal Services Society Correctional Service Canada National Parole Board British Columbia Board of Parole |
| Single et al. (1996)[3] | Statistics Canada (1994)[174,175] |

| TABLE 4B *continued* | |
|---|---|
| Researchers | Source of data |
| **4. Motor vehicle crashes** | |
| Adrian (1988)[27] | Ontario Ministry of Transportation and Communications (1985)[176] Insurance Bureau of Canada (1982; 1986)[177,178] |
| Coordinated Law Enforcement Unit (1992)[133] | Royal Canadian Mounted Police (RCMP) CounterAttack Stoduto et al. (1991)[179] Insurance Corporation of British Columbia |
| Single et al. (1996)[3] | Blincoe and Faigin (1993)[180] Traffic Injury Research Foundation (1992)[190] Groupement d' Assureurs automobiles Insurance Bureau of Canada Insurance Corporation of British Columbia Manitoba Public Insurance |
| **5. Nursing home stay** | |
| Kendall (1992)[108] | Ontario Ministry of Health: Fiscal Resources Branch |
| **6. Property and forest fires** | |
| Collishaw and Myers (1984)[70] | Dominion Fire Commissioner (1981)[181] Ontario Ministry of Natural Resources |
| Choi and Nethercott (1988)[85] | Office of the Fire Marshall (Ontario Ministry of the Solicitor General, 1983)[182] City of Toronto Fire Department, 1985 Ontario Ministry of Natural Resources: Aviation and Fire Management Centre, 1985 |
| Adrian (1988)[27] | Dominion Fire Commissioner (1981)[181] |
| Raynauld and Vidal (1992)[110] | Labour Canada (1987)[183] Forestry Canada: Petawawa National Forestry Institute, 1989 |
| Choi and Pak (1996)[2] | Ontario Ministry of the Solicitor General: Office of the Fire Marshall |
| Single et al. (1996)[3] | Association of Canadian Fire Marshals and Fire Commissioners (1992)[184] Statistics Canada (1994)[185] Alberta Forest Fire Centre Ontario Ministry of Natural Resources: Fire Statistics Section Nova Scotia Department of Natural Resources: Forest Protection Headquarters Québec Société de protection des forêts contre le feu |

| TABLE 4B *continued* | |
|---|---|
| Researchers | Source of data |
| Kaiserman (1997)[4] | Association of Canadian Fire Marshals and Fire Commissioners (1991)[186] Canadian Forest Service |
| **7. Specialty institutions** | |
| Kendall (1992)[108] | Ontario Ministry of Health: Fiscal Resources Branch |
| Single et al. (1996)[3] | Ellis and Rush (1993)[187] Addiction Foundation of Manitoba Statistics Canada (1993; 1994)[188,189] |
| Kaiserman (1997)[4] | National Population Health Survey, 1994 |
| **8. Professional services other than physicians** | |
| Coordinated Law Enforcement Unit (1992)[133] | British Columbia College of Pharmacists Fan-Out Program |
| **9. Prescription drugs for treatment** | |
| Kendall (1992)[108] | Ontario Ministry of Health: Drug Programs Branch |
| Coordinated Law Enforcement Unit (1992)[133] | Methadone Maintenance Program |
| Single et al. (1996)[3] | Health Canada: Drugs Directorate |
| Kaiserman (1997)[4] | Health Promotion Survey, 1990 Canadian Pharmaceutical Association |
| **10. Medical and health services research** | |
| Saskatchewan Health (1994)[51] | Saskatchewan Health Saskatchewan Alcohol and Drug Abuse Commission |
| Single et al. (1996)[3] | Traffic Injury Research Foundation (1992)[190] Medical Research Council (1993)[191] Alberta Alcoholism and Drug Abuse Commission Alberta Family Life and Substance Abuse Foundation Brewers Association of Canada British Columbia Alcohol and Drug Program National Native Alcohol and Drug Abuse Program Natural Science and Engineering Research Council Ontario Addiction Research Foundation Ontario Tobacco Research Unit |

| TABLE 4B *continued* | |
|---|---|
| Researchers | Source of data |
| **11. Program administration** | |
| Coordinated Law Enforcement Unit (1992)[133] | Canadian Association of Chiefs of Police: Substance Abuse Program<br>Health and Welfare Canada: Alcohol and Other Drugs Program<br>National Native Alcohol and Drug Abuse Program |
| Single et al. (1996)[3] | Rice et al. (1990)[5]<br>Workers' Compensation Board<br>Provincial social services departments |
| **12. Administrative costs of private insurance to treat ATD disorders** | |
| Not considered by Canadian studies reviewed | |
| **13. Direct costs related to AIDS due to drug abuse (treatment)** | |
| Coordinated Law Enforcement Unit (1992)[133] | British Columbia Ministry of Health: Sexually Transmitted Diseases Control Branch, 1989 |
| **14. Costs of abused substances** | |
| Not considered by Canadian studies reviewed | |
| **15. Prevention programs** | |
| Coordinated Law Enforcement Unit (1992)[133] | Police Drug Awareness Program<br>The Responsibility Is Yours Program<br>Community Action Program<br>Health Canada's Needle Exchange Program |
| Single et al. (1996)[3] | Canada's Drug Strategy<br>External Affairs<br>Health Canada's Needle Exchange Program<br>National Native Alcohol and Drug Abuse Program<br>Transport Canada<br>Alberta Alcoholism and Drug Abuse Commission<br>Alcoholism Foundation of Manitoba<br>British Columbia Alcohol and Drug Program<br>Ontario Addiction Research Foundation<br>Ontario Ministry of Health: Public Health Branch, Tobacco Strategy<br>Canadian Lung Association |

| TABLE 4B *continued* | |
|---|---|
| Researchers | Source of data |
| **16. Ambulance costs** | |
| Single et al. (1996)[3] | Canadian Institute for Health Information |
| **17. Training costs for physicians and nurses** | |
| Saskatchewan Health (1994)[51] | Saskatchewan Health: Saskatchewan Alcohol and Drug Abuse Commission |
| Single et al. (1996)[3] | Association of Canadian Medical Colleges (1993)[192]<br>Statistics Canada (1993)[193] |
| **18. Fetal alcohol syndrome** | |
| Not considered by Canadian studies reviewed | |
| **19. Customs and immigration** | |
| Coordinated Law Enforcement Unit (1992)[133] | Canada Customs: Intelligence and Interdiction Team<br>Ports Canada Police<br>Waterfront Drug Detection Team |
| Single et al. (1996)[3] | Kiedrowski and Associates (1996)[194] |
| **20. Extra neonatal care** | |
| Forbes and Thompson (1983)[65] | Dunn et al. (1976; 1977)[195,196]<br>Himmelbeger et al. (1978)[197]<br>Rantakallio (1978)[198] |
| **21. Neonatal disorders and complications related to drug abuse** | |
| Coordinated Law Enforcement Unit (1992)[133] | Special Care Nursery at British Columbia Children's Hospital<br>Foster care services |
| **22. Home care** | |
| Single et al. (1996)[3] | Canadian Institute for Health Information |
| **23. Household help** | |
| Not considered by Canadian studies reviewed | |

| TABLE 4B *continued* | |
|---|---|
| Researchers | Source of data |
| *24. Counselling, retraining and re-education* | |
| Coordinated Law Enforcement Unit (1992)[133] | Vocational Rehabilitation of Disabled Persons Program Alcohol and Drug Treatment and Rehabilitation Program |
| *25. Special equipment for rehabilitation* | |
| Not considered by Canadian studies reviewed | |
| *26. Employee assistance programs (EAPs)* | |
| Coordinated Law Enforcement Unit (1992)[133] | Survey of EAPs servicing public and private sector employees |
| Single et al. (1996)[3] | Addiction Management Systems Macdonald and Wells (1994)[199] |
| *27. Drug testing in workplace* | |
| Not considered by Canadian studies reviewed | |
| *28. Avoidance behaviour costs* | |
| Not considered by Canadian studies reviewed | |
| *29. Group life insurance* | |
| Alcohol and Drug Dependency Commission (1988)[26] | Insurance Bureau of Canada |
| *30. Widow's bonus from husband dying at age 60–79* | |
| Not considered by Canadian studies reviewed | |
| *31. Extra disability pension due to retirement for health reasons* | |
| Not considered by Canadian studies reviewed | |
| *32. Payroll taxes on earnings* | |
| Not considered by Canadian studies reviewed | |
| *33. Insured cost of care for fetal alcohol syndrome* | |
| Not considered by Canadian studies reviewed | |

**TABLE 4C**

**Data sources used by Canadian researchers for estimating tangible costs of alcohol, tobacco and drug (ATD) abuse: (C) INDIRECT COSTS**

| Researchers | Source of data |
|---|---|
| *1. Morbidity costs: income loss due to ATD abuse* | |
| Collishaw and Myers (1984)[70] | Statistics Canada (1981)[200] Rice (1966)[140] Shillington (1977)[201] Rice and Hodgson (1978)[202] Canada Health Survey (Statistics Canada, 1983)[149] |
| Choi and Nethercott (1988)[85] | Canada Health Survey (Statistics Canada, 1983)[149] City of Toronto Community Health Survey (MacPherson, 1984)[150] Statistics Canada (1985)[203] |
| Kendall (1992)[108] | Statistics Canada (1986)[204] |
| Choi and Pak (1996)[2] | Canada Health Survey (Statistics Canada, 1983)[149] Statistics Canada (1989)[205] |
| Single et al. (1996)[3] | Statistics Canada Canadian Socioeconomic Information Management |
| *2. Related productivity losses* | |
| Coordinated Law Enforcement Unit (1992)[133] | Addiction Research Foundation Workers' Compensation Board |
| Alcohol and Drug Dependency Commission (1988)[26] | Her Majesty's Penitentiary |
| Kaiserman (1997)[4] | General Social Survey, 1991 |
| *3. Mortality costs: present value of lifetime earnings* | |
| Choi and Nethercott (1988)[85] | Ontario Ministry of Health (1984)[206] Statistics Canada (1985)[203] |
| Adrian et al. (1989)[30] | Statistics Canada (1986)[207] |
| Kendall (1992)[108] | Statistics Canada (1986)[204] |
| Choi and Pak (1996)[2] | Ontario Ministry of Health: Office of the Registrar General Statistics Canada (1989)[205] |
| Single et al. (1996)[3] | Statistics Canada (1993)[208] |
| Kaiserman (1997)[4] | Statistics Canada |
| *4. Foregone consumption* | |
| Not considered by Canadian studies reviewed | |
| *5. Reduced property values in drug-ridden communities* | |
| Not considered by Canadian studies reviewed | |

## Discussion

This paper provides a classification scheme for cost categories used by existing methods to estimate the costs of the abuse of alcohol, tobacco and illicit drugs. This scheme was developed through a review of four major recent methodological studies[1,5–7] that themselves were based on review of many other cost studies. We hope that the documentation of a list of these cost studies by substance, year and author(s) will provide researchers with a useful resource for the literature on cost studies.

The classification scheme proposed should facilitate comparative analyses of studies based on different methods. For example, in Canada, most of the mortality and morbidity data required to generate cost estimates is available for each province, but provincial data may not be available in several other areas, such as workplace costs and certain law enforcement costs. Overall cost estimates from different studies are therefore not comparable. By stratifying cost estimates according to our classification scheme, results from different studies can be compared more readily.

The classification framework also allows investigators to customize their own cost studies, using an approach similar to that of French et al.[7] Cost categories of interest to researchers in a particular study can be identified and selected from the framework to develop a tailor-made model for estimating the costs of ATD abuse in a thorough manner.

This paper also describes a useful inventory of existing data sources in Canada that we hope can be used as a starting point for researchers who would like to conduct their own cost studies, whether in Canada or elsewhere.

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# Short Report

## Life Expectancy and Dementia in Canada: The Canadian Study of Health and Aging

*Gerry B Hill, William F Forbes, Joan Lindsay and Ian McDowell*

## Abstract

*Using the 1991 Canadian life table and estimates of the prevalence of dementia from the Canadian Study of Health and Aging, we have partitioned the expectation of life at age 65 into years spent in the community and in institutions, with and without different forms of dementia. The total expectation of life for women was 26% greater than that for men, but women's expectations of life with dementia and of life in institutions were more than twice the corresponding expectations for men. The difference between sexes was greater for Alzheimer's disease than for vascular and other types of dementia.*

***Key words:*** *Aging; Canada; dementia; expectation of life; institutionalization; sex ratio*

## Introduction

At older ages, dementia is an important cause of disability, institutional admission and death. The burden of dementia falls more heavily on women because they live longer. There are also differences between sexes in the incidence of the main types of dementia and in the likelihood of being institutionalized. In this paper, we quantify these differences in terms of the expected years lived after age 65 with and without dementia, in the community and in institutions.

## Methods

We used data on people aged 65 and over in the 1991/92 Canadian Study of Health and Aging (CSHA).[1] The study included 9008 people living in the community and 1255 people in institutions. Those living in the community were first screened for the likely presence of dementia using the Modified Mini-Mental State (3MS) Examination.[2] All residents in institutions plus those in the community scoring less than 78 on the 3MS Examination, were offered a clinical examination that classified them into one of four categories: normal, Alzheimer's disease, vascular dementia or other dementia.

The CSHA estimated the prevalence, in Canada, of the three categories of dementia by sex and age, both in the community and in institutions. We used these estimates to partition the years of life lived after age 65 derived from the 1991 Canadian life table, using the method described by Sullivan.[3]

## Results

Table 1 shows that the total expectation of life at age 65 is 19.98 years for women and 15.80 years for men. This difference of 4.18 years includes 1.22 more years with dementia for women and 1.35 more years in an institution. For every additional year women live in the community without dementia, they spend an extra 1.7 months in the community with dementia and 4.7 months in an institution with dementia.

***Author References***

*Gerry B Hill* (Adjunct Professor), *William F Forbes* (Visiting Professor) and *Ian McDowell* (Professor and Chairman), Department of Epidemiology and Community Medicine, University of Ottawa, Ottawa, Ontario
*Joan Lindsay*, Adjunct Professor, Department of Epidemiology and Community Medicine, University of Ottawa, Ottawa, Ontario; *and* Division of Aging and Seniors, Population Health Directorate, Health Promotion and Programs Branch, Health Canada, Ottawa, Ontario

Correspondence: Dr Gerry B Hill, Canadian Study of Health and Aging, Department of Epidemiology and Community Medicine, University of Ottawa, 451 Smyth Road, Ottawa, Ontario  K1H 8M5; Fax: (613) 562-5441; E-mail: csha@zeus.med.uottawa.ca

## TABLE 1

**Expectation of life with and without dementia at age 65 for Canadian women and men, subdivided by type of dementia and by residence in community or institution**

| | Expectation of life (years) | | |
| --- | --- | --- | --- |
| | Community | Institution | TOTAL |
| *Women* | | | |
| Without dementia | 16.63 | 0.92 | 17.55 |
| With dementia | | | |
|   Alzheimer's disease | 0.72 | 1.02 | 1.74 |
|   Vascular dementia | 0.12 | 0.22 | 0.34 |
|   Other dementia | 0.17 | 0.18 | 0.35 |
|   Subtotal | 1.01 | 1.42 | 2.43 |
| TOTAL | 17.64 | 2.34 | 19.98 |
| *Men* | | | |
| Without dementia | 14.15 | 0.44 | 14.59 |
| With dementia | | | |
|   Alzheimer's disease | 0.38 | 0.30 | 0.68 |
|   Vascular dementia | 0.18 | 0.15 | 0.33 |
|   Other dementia | 0.10 | 0.10 | 0.20 |
|   Subtotal | 0.66 | 0.55 | 1.21 |
| TOTAL | 14.81 | 0.99 | 15.80 |
| *Ratio (women:men)* | | | |
| Without dementia | 1.18 | 2.09 | 1.20 |
| With dementia | | | |
|   Alzheimer's disease | 1.89 | 3.40 | 2.56 |
|   Vascular dementia | 0.67 | 1.47 | 1.03 |
|   Other dementia | 1.70 | 1.80 | 1.75 |
|   Subtotal | 1.53 | 2.58 | 2.01 |
| TOTAL | 1.19 | 2.36 | 1.26 |

Table 1 also shows the sex ratios (female-to-male ratios) of the various components of the expectation of life. In relative terms, the increased burden for women is greatest for time spent in an institution with Alzheimer's disease. The ratio is lower for vascular dementia, though, in absolute terms, women spend slightly longer with vascular dementia than men, especially in institutions.

## Comment

Perenboom et al.[4] estimated life expectancy at age 65 in the Netherlands, with and without dementia, subdivided by type of residence but not by type of dementia. The results were similar to ours, except that the expected years lived with dementia in institutions were lower. Some of this discrepancy may be due to the definition of an institution or to the methods of estimating the prevalence of dementia in institutions.

The following calculations provide a measure of the public health impact of these sex differences. At present, about 225,000 Canadians reach the age of 65 each year. With the current sex differences, this cohort would experience 3,633,000 person-years without dementia and 417,000 person-years with dementia, including 227,000 person-years institutionalized with dementia. If men had the same expectations as women, the expected person-years without dementia for the cohort would increase by 9%, but the expected person-years with dementia would increase by 31%, and the expected person-years institutionalized with dementia would increase by 41%.

The difference between sexes in expectation of life at age 65 is primarily attributable to mortality from ischemic heart disease, lung cancer and chronic obstructive lung disease,[5] all diseases related to smoking. The apparent advantage of women's longer life expectancy is substantially reduced by the proportion of that time spent with dementia and in institutions. The difference will likely be further shortened by the equalization of the prevalence of smoking in men and women.

## Acknowledgments

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# Development of an Instrument to Measure Cancer Screening Knowledge, Attitudes and Behaviours

*Tricia Kindree, Fred D Ashbury, Vivek Goel, Isra Levy, Tammy Lipskie and Robin Futcher*

## Abstract

*The development of a comprehensive survey instrument to measure the knowledge, attitudes and behaviours of the general public with regard to cancer screening was the goal of this project. A thorough review of the literature was undertaken, and existing survey instruments were identified and organized according to type of cancer screening behaviour being measured; question foci (predisposing, enabling and reinforcing factors); and survey implementation protocol. A comprehensive survey instrument was developed with the intention that, if feasible, the survey of cancer screening behaviours could be implemented nationally by telephone. Separate survey instruments were developed according to sex. Focus groups were held across Canada to determine the comprehensiveness of the survey items; ease of understanding and ability to respond; feasibility with respect to possible sensitivity of some of the question items; and general implementation issues (e.g. length, sex of interviewer). This paper reports on the qualitative portion of the project. Our study supports the use of qualitative methodology for instrument development and implementation.*

***Key words:*** *Focus groups; neoplasms, epidemiology; neoplasms, prevention and control; qualitative research; screening; survey development*

## Introduction

Cancer control involves a range of activities: prevention, early detection and diagnosis, treatment, supportive care, palliative care, and research and evaluation. According to the Framework for Cancer Control of the National Cancer Institute of Canada (NCIC), the full range of these activities can be explained using five categories: fundamental research, intervention research, program delivery, surveillance and monitoring, all leading into knowledge synthesis and decision making.[1] An ideal cancer control strategy will conduct surveillance of each of these activities. Some activities can be monitored through routinely available data sources. For example, cancer registries provide data on incidence and mortality, and hospitalization data provide information on type and patterns of care.

Data about knowledge, attitudes and behaviours (KAB) with respect to cancer screening are currently incomplete. Systematically collected information is important for the development, implementation and evaluation of cancer control initiatives. In Canada, a variety of surveys have assessed some or a few cancer screening behaviours. National omnibus surveys, such as the National Population Health Survey, the Health Promotion Survey or the Canada Health Survey and some provincial surveys (e.g. Ontario Health Survey) collect some information on screening behaviours. Such surveys do provide a means to assess trends in screening test utilization and the social and demographic factors associated with this use. Additionally, special surveys have been used in Canada to specifically evaluate cancer screening KAB, but usually only for one specific cancer site. For example, studies have been conducted on mammography (particularly in the context of

***Author References***

*Tricia Kindree*, Health Management Co-ordinator, Magna International Inc. Health Centre, 455 Magna Drive, Aurora, Ontario L4G 7A9, Tel: (905) 713-9950, Fax: (905) 713-9948, E-mail: tricia_kindree@magna.on.ca
*Fred D Ashbury*, Assistant Professor, Department of Public Health Sciences, University of Toronto; *and* Affiliate, Centre for Health Studies, York University; *and* Principal, CAPPE Consultants, Toronto (Ontario)
*Vivek Goel*, Institute for Clinical Evaluative Sciences; *and* Associate Professor, Department of Public Health Sciences, University of Toronto, Toronto, Ontario
*Isra Levy*, Adjunct Professor, University of Ottawa, Ottawa, Ontario
*Tammy Lipskie*, Cancer Bureau, Laboratory Centre for Disease Control, Health Canada, Ottawa, Ontario
*Robin Futcher*, Centre for Behavioural Research and Program Evaluation, National Cancer Institute of Canada, Toronto, Ontario

breast screening programs) utilization,[2,3] cervical screening[4] and prostate screening.[5]

This study was part of a process to develop and evaluate the feasibility of a single survey instrument that could assess KAB on a range of cancer screening tests. Ideally, such an instrument would be administered in a national survey by telephone. The development of this cancer surveillance instrument was initiated by Health Canada in co-operation with the NCIC's Advisory Committee on Cancer Control. The project was undertaken because, although many surveys have been done at the national, provincial and community level, there is still no clear picture of what information is available, what information is missing and what information has been collected over time [see next article, "Workshop Report: Knowledge, Attitudes and Behaviours Concerning Cancer Screening in Canada"]. This paper describes the use of qualitative methods in survey design. Although not always standard practice in survey design, focus groups are increasingly used as an effective method in evaluating survey instruments. We will expand on this and also discuss this technique specifically with respect to developing surveys regarding sensitive health topics and surveillance of cancer screening KAB.

## Methods

### Instrument Development

The survey instrument was developed after a thorough review of the English-language literature. MEDLINE was searched using combinations of key words for neoplasms, screening, questionnaires and surveys. Reference lists of key studies were prepared and experts in the field were consulted for additional surveys. At the Laboratory Centre for Disease Control, an inventory of survey questions was created to map out the information that has been collected about cancer screening behaviours and the determinants of those behaviours. The inventory contains questions from national and provincial population surveys and commercial surveys maintained in a database of Canadian health surveys and from American surveys co-ordinated by the Centers for Disease Control and Prevention. Where possible, the original survey instruments were retrieved and incorporated into the discussion of which instruments or items would be considered for inclusion in the comprehensive survey instrument.

The survey items were organized using the PRECEDE/PROCEED framework for each cancer site[6] as stipulated in requirements for the search of relevant instruments directed by Health Canada. The rationale for using this model was that questions should be sought covering not only behaviours, but also the knowledge, attitudes and beliefs that predispose, enable or reinforce these behaviours. This framework emphasizes that health and health risks are caused by multiple factors, and that, because health and health risks are determined by multiple factors, efforts to effect behavioural, environmental and social change must be multidimensional or multisectoral.

For behaviour change, the PRECEDE/PROCEED framework outlines three sets of determining factors: reinforcing factors, predisposing factors and enabling factors.[6] Reinforcing factors are provided by the social context of family, society or health professionals and refer to rewards or feedback for the discontinuation or adoption of a behaviour. Predisposing factors comprise knowledge, attitudes, beliefs and values. Finally, enabling factors include skills (e.g. smoking cessation techniques) and resource needs and uses (e.g. office systems) that facilitate the adoption of new behaviours. The items included in the final survey instrument used in the focus groups were identified and organized according to these three factor sets.

A draft instrument was developed with the following components: demographic information, health status and health care utilization, cancer KAB and a series of site-specific inventories. For each cancer site, questions on the use of screening tests, reasons for having or not having the screening tests and the results of the most recent screening test were included. Cancer sites were selected based on burden of illness, availability of a screening test and expected level of screening test use in the community, based on data from other jurisdictions. Two slightly different sex-specific draft instruments were developed. The core sections of both surveys were identical. However, because some screening tests are sex-specific, a version for use among women included questions about screening for breast, cervical and ovarian cancer. The instrument to target men contained questions regarding testicular and prostate cancer screening. Additionally, both versions included questions about screening for colorectal, skin, lung and oral cancers.

### Focus Group Design

Surveys are an essential tool of researchers interested in measuring knowledge, attitudes and behaviours in large populations and are widely used in many sociobehavioural research studies.[7,8] There are several processes that can be used to develop survey instruments. Typically, investigators develop a draft questionnaire through a team brainstorming process and/or by compiling questions from other, previously developed survey instruments.[8] This step is generally followed by a review from other experts to identify ambiguities with respect to wording, item selection and response options. Next, the questionnaire is revised based on the responses of a pre-test subsample of the intended survey population.[9] Finally, the revised survey instrument is disseminated to the target audience.

It is now a more common practice to conduct focus group interviews also, either before developing or prior to implementing a structured questionnaire.[9–13] Prior to pre-testing the survey instrument, focus groups can be used to structure and facilitate questionnaire design. This process can identify issues to be included in the questionnaire, formulate question categories or simply fine-tune wording on particular questions.[14–17] While a pre-test was part of the original design for the KAB cancer screening survey, it was agreed that a qualitative research step involving focus

groups would be introduced to determine the feasibility of using the instrument and to confirm and elaborate or amend the item pool.

The research was administered in two phases: an exploratory phase and a consolidation phase. The first phase consisted of five exploratory focus group sessions designed to generate data on the understandability, comprehensiveness and feasibility of the survey instrument in addition to clarifying specific implementation issues. Three of these sessions were conducted in Ontario, one in British Columbia and one in Saskatchewan. During the second phase, two focus groups were assembled in Ontario in order to confirm and consolidate the findings generated during the first phase. These consolidation focus groups verified the results and interpretations generated from the first phase of focus groups.

Participants in all focus groups were selected from a convenience sample, rather than randomly, in order to reduce costs and save time. This convenience sample included some individuals known to the authors, but most were recruited through staff or volunteers associated with the NCIC or the moderators. Importantly, however, the groups consisted of adults over the age of 18 with a variety of income and education levels, occupations and ethnicities. Although qualitative research does not demand that representative samples be used, it was recognized that a general population sample would be used for the survey. Thus, demographic characteristics were identified from the focus group sample to ensure that it was representative of the general population. Additionally, the wide range of income and education levels and ethnicities seemed to represent the general Canadian population.

The number of participants in each group ranged from five to eight, and the interviews lasted approximately two hours. The group interviews were conducted in English because the survey instrument was not translated into French or other languages. The focus groups were sex-specific for several reasons: it simplified the focus group process since survey instruments were also sex-specific; the literature suggests that males and females may have sharp differences in opinion and behaviour associated with many health-related issues, including cancer screening;[18,19] and the focus group research regarding sensitive issues suggests that involving both sexes in the same group may inhibit frank discussion.[20] Table 1 outlines the number and sex of focus group participants by study phase.

Prior to the group discussion, each participant read and, if he/she agreed, signed a consent form explaining that all feedback would be strictly confidential. Participants were informed that, although the discussion would be tape-recorded (unless anyone objected), all responses would be analyzed as a group and combined with information provided by other participants. The consent form also explained that participation was voluntary and anyone could withdraw at any time during the session. Each focus group participant received a reimbursement of $15 for their involvement.

In keeping with focus group design,[14,17] only a few structured questions were necessary as the purpose of the interview was to evaluate the feasibility of a pre-designed survey instrument. All participants were informed of the instrument's potential use in a cross-Canada telephone survey. They were also told the purpose of the study and that the two facilitators had not assisted in the development of the questionnaire.

Two facilitators were present during the focus group session: one had primary responsibility as moderator to lead the interview, stimulate discussion and respond to questions, while the other took notes and helped to moderate the discussion as required. The first half hour of the interview was allotted to written survey completion by the participants, including their noting any questions, concerns or comments on the questionnaire. We chose to introduce the survey instrument at the time of the focus group session to generate a "top-of-mind" response from participants, as would be expected if the survey was implemented as a telephone interview. The remaining 1 1/2 hours was devoted to assessing the survey instrument page by page to obtain reactions to the questions, including wording, content, interpretation and comfort levels. Additionally, we solicited suggestions to add or delete questions from the item pool. Particular attention was paid to those survey questions covering sensitive topic areas (e.g. colorectal cancer screening procedures). The session concluded with a brief discussion regarding participants' perceptions of the overall feasibility of implementing the instrument as a nation-wide telephone survey.

Participants returned their completed questionnaires to the moderator, and the research team reviewed any written comments on the survey. Responses were coded, entered and analyzed to determine quantitatively how the survey worked, and completed surveys were retained for later analysis to obtain profiles of the participants and participation rates. Demographic data from the first 12 questions of the survey were entered in a database that recorded marital status, country and province of birth, year of immigration (if applicable), ethnicity, language spoken,

**TABLE 1**

**Number and sex of participants by each study phase**

| Phase I: Exploration (5 focus groups) | | Phase II: Consolidation (2 focus groups) | | Totals (7 focus groups) | |
|---|---|---|---|---|---|
| Females | Males | Females | Males | Females | Males |
| *n* = 20 | *n* = 14 | *n* = 5 | *n* = 6 | *n* = 25 | *n* = 20 |

employment status, job title, income (in $10,000 intervals), sex and age.

To ensure that the analysis of the qualitative data was systematic, the facilitators revisited their field notes from each focus group session in order to clarify and elaborate upon their findings.[8] Two researchers independently analyzed the qualitative data and prepared independent interpretations. These were discussed by the two team members in order to confirm their interpretations and identify areas of disagreement.[8,17] Because of the number of focus groups, it was possible to assess the reliability of the data by comparing statements within and across sessions.[15] Additionally, the use of a consolidation phase of two focus groups confirmed the interpretations and preparation of results. Finally, the accuracy of the interpretive analysis was further enhanced as the researchers involved in the analysis were intimately involved with actual data collection, having served as the focus group facilitators.[17]

## Results

### *Participant Feedback*

The focus group discussions and feedback from participants were very lively and extremely beneficial to the survey development process. Feedback was generated in three key areas.

- Item pool: reactions to specific questions and response options in terms of wording, understandability, comprehensiveness
- Feasibility and comfort levels: feasibility and comfort levels associated with responding to questions concerning particularly sensitive cancer screening methods
- Survey implementation issues: identification of issues relating to implementation of the survey instrument over the telephone

### Item pool

As stated earlier, question items were adopted or adapted slightly from existing survey instruments. From feedback on the understandability of question items, we discovered several wording problems that generated critical misunderstandings among the participants. When asked, "Describe your knowledge of the warning signs and symptoms of cancer," participants would state how much knowledge they had rather than listing the symptoms of which they were aware. For instance, several participants responded to this particular question by stating, "I really don't know much about these warning signs." Several other questions were also troublesome in terms of wording.

Additionally, the participants suggested modifications to the definitions of the cancer screening methods included in the questionnaire. For example, the survey described an ovarian ultrasound as follows: "Ultrasound uses sound waves to examine internal organs. Ultrasound to examine the ovaries can be done by examining the abdomen or with an internal (trans-vaginal) probe." We found that participants generally had great difficulty with these definitions and descriptions. Many suggested that this was because they lacked adequate familiarity with the different cancer screening techniques. Two specific comments from participants demonstrate the confusion this definition created.

*Is that like the thing they use when you are pregnant, to view the fetus? Because I have had that type of ultrasound, but I really don't know if they looked at my ovaries or not.*

*What on earth is an "internal, trans-vaginal probe?" That means absolutely nothing to me. After reading this definition, I really couldn't tell you whether or not I have ever had an ovarian ultrasound.*

The interviews revealed that, even with the increased publicity regarding particular methods of cancer screening and the potential health benefits derived from these tests, few persons had sufficient knowledge of the term "cancer screening." One question asked, "If recommendations about cancer screening were to be made by some official group or organization, which group would be most likely to influence your attitudes and choices?" This question and related questions were difficult for participants to answer because the majority did not understand generally what was meant by "cancer screening." Thus, the survey instrument should include a description or definition of cancer screening as a general term.

### Feasibility and comfort levels

The focus group interviews also provided feedback regarding the feasibility of specific questions in addition to the survey instrument as a whole. For instance, the personal screening questions asked respondents to recall the number of specified screening tests they had experienced in their lifetime. For some tests, such as Papanicolaou (Pap) tests and clinical breast exams, female respondents felt challenged to provide a meaningful response. In fact, the majority of female participants were unable to complete these questions. One participant commented:

*I have a big problem with this question PAP-4 that asks me how many Pap smears I've had in my lifetime. Are you kidding me? There is no way I can remember this. I suppose if I got a calculator out and added at least one for every year I've been having Paps, I might be able to figure it out—that is, if I can remember when I started having them! Anyway, this would take too much time—much more than I would be willing to spend on a survey.*

Furthermore, many of these questions were perceived as too personal and invasive to be asked over the telephone by a stranger. For instance, the participants were asked to explain why they had experienced particular screening tests by stating the main reason as well as the specific medical

condition or symptom(s) that led them to seek medical attention. The majority of participants felt uncomfortable with these questions and would be unwilling to disclose much of this personal information over the telephone, indicating that using the telephone to obtain this type of information was problematic. One woman explained it this way:

*What you are asking is very personal. I really don't know who you are when you call me or where this information could end up. What if a health insurance company or my employer got this information? It might not matter, but if I had a health problem I might not want anyone to find out about it. I would definitely feel uncomfortable divulging this information to some stranger over the phone.*

Participants suggested that they would prefer to complete this type of survey in written format. They all felt that this would ensure anonymity and confidentiality to a greater extent than a telephone survey would. One participant commented:

*I feel very uncomfortable discussing this information over the telephone. You (the interviewer) will have access to my name and address. How do I know where the information will end up? I certainly don't feel confident that my answers will remain confidential. I would be more likely to complete this survey if it was given to me in written form—like in the mail or something. At least then I would feel that my identity would remain anonymous.*

### Survey implementation issues

Important information regarding survey implementation was also generated from the focus group interviews. The sex of the interviewer was an issue for female participants, in particular, in that they would have preferred to be interviewed over the phone by a woman. The length of the questionnaire also produced much discussion. Every participant agreed that the survey was much too long (completion time ranged from 20 to 35 minutes). Instead, participants suggested they would only participate in a phone interview that lasted no more than 10–20 minutes. One participant commented:

*My biggest concern with this survey is the length. There is absolutely no way I would spend any more than 10 minutes of my valuable time completing a telephone survey. I want to help the cancer cause and everything, but I am just too busy to be spending that amount of time on the phone to do a survey.*

It is important to note, however, that completion time during the focus groups may have been longer than intended because the questionnaire was completed as a self-report rather than as a telephone interview. Although focus groups are not the appropriate tool for assessing length issues, participants in all groups consistently commented on the questionnaire's length and considered it to be an important issue for discussion.

The breadth of the survey instrument was also a problem. Participants did not feel that a cancer screening questionnaire to elicit KAB about a spectrum of cancer screening methods was feasible in a telephone survey format. One man expressed his opinion this way:

*I'm having difficulty figuring out exactly what this survey is trying to get at. In the beginning, you are asking me for a ton of information about all sorts of things—it jumps all over the place. Next thing I know, you start asking me very personal questions about rectal exams and prostate tests. From my perspective, this is just too much. I would rather be asked a smaller number of questions about one or two specific issues.*

## Discussion

The focus group technique is extremely important for survey instrument development. In our study, we were able to generate useful feedback about item language/wording, unanticipated areas of concern and implementation issues. Furthermore, we found that focus groups can and should be used even in the early stages of questionnaire development, when the concepts and item pool are still to be identified. However, because the instrument was at a draft stage, it was very important to continually focus the group discussions.

While it is always important to direct focus groups to the purpose of the discussion, it was a particular challenge with this study. The moderator had to reiterate that the purpose was to examine the wording, comprehension and feasibility of the survey, and to prevent discussions from turning to issues of appearance. Clearly, participants were often distracted by how the draft was formatted and several people tended to move the discussion in this direction. Perhaps providing a copy of the questionnaire with a letter explaining the task prior to the focus group interview would have avoided some of the discussion of formatting and related details. Alternatively, a more fully developed questionnaire with completed formatting, introductions to sections, etc. might have reduced this minor problem.

Focus group interviews aid the questionnaire development process as well as personally aiding the researcher.[13] This qualitative technique enabled us to gather important information in a relatively short time span. Routine population-based surveys strictly about cancer screening KAB are relatively rare. We believe that a comprehensive cancer screening instrument, such as the one drafted and focus group-tested for this study, has not been attempted elsewhere. As discussed earlier, questions were drawn from a variety of other questionnaires and combined to form this omnibus screening survey. Thus, feasibility and implementation information specific to this type of comprehensive questionnaire was not available in

the literature. Using focus groups provided a timely, inexpensive approach to obtain this important information.

Although the questions had been used in past surveys, we found that there were wording and comprehension problems in the new, integrated version. Additionally, there was an overall lack of understanding about cancer screening in general. This information likely would not have been gleaned from a pre-test study alone. In a quantitative pre-test scenario, we might have simply found incomplete answers or non-responses. Instead we were able to gain insight into the misunderstandings and comprehension problems. The qualitative methodology gave us in-depth, contextual information that clarified the potential non-responses and allowed for wording adjustments to improve comprehension.

In addition to revealing the difficulties with specific questions, the focus groups informed us about the overall lack of understanding the general population has regarding specific cancer screening methods as well as cancer screening in general. This was a rather surprising and extremely important discovery that makes us question just what is being assessed by the items on cancer screening surveys such as the National Population Health Survey. Past KAB cancer screening surveys have focused on specific screening methods rather than a range of various methods; therefore, very little information is available regarding the feasibility of conducting a comprehensive survey.

The contextual information gained through the use of this qualitative study fleshed out the general lack of understanding about cancer screening and indicated that an omnibus survey might not be feasible. We found that asking many in-depth, probing questions about a wide range of cancer screening methods was too challenging for the focus group participants. The focus group participants were more comfortable with fewer questions about one or two specific screening tests for the same number of sites. This information was critical to decisions about implementing the survey and most likely would not have been generated through a pilot study. A pilot study would probably have indicated low response rates, but not the reasons for such low rates. Our qualitative study uncovered this important detail and redirected our efforts to a more feasible approach.

In addition, this qualitative technique was highly useful in determining how people respond to questions regarding sensitive health information. The group discussions provided us with people's initial reactions to highly personal questions. In this respect, the process would be very useful to any researcher working in the health field and interviewing the lay population regarding personal and sensitive health information. For instance, a large portion of this survey required respondents to divulge personal information regarding frequency and reasons for many screening tests (e.g. Pap tests, digital rectal exams). Quite often, those of us working in the health field become very

comfortable discussing this information and almost desensitized to the very personal nature of such questions. It is easy to forget that many individuals do not feel as comfortable discussing personal health testing, particularly to a stranger and over the telephone. The detailed group discussions provided insight into these feelings in addition to generating a better understanding of how to approach sensitive topics with the general population.

Along the same lines, the group discussions provided insight into the language that the general population feels comfortable with when discussing personal health information. Certain phrases and wordings came up repeatedly among the participants, indicating the types of words and phrases that the general population is comfortable with. The depth of comfortable disclosure was also revealed by the focus groups. Most individuals were comfortable describing general reasons for having screening tests, but were reluctant to discuss specific symptoms or health problems. Once again, this type of in-depth detail would not be generated from a pilot study. Not only did we gain an idea of the levels of comfort the population has with screening questions, but we learned the reasons behind their discomfort, which will enable us to communicate better with the general public about this research topic.

It is important to note, however, that the use of focus groups in the process of questionnaire development should not be viewed as a substitute for the conventional pre-test. The pre-test is necessary to complement the focus groups because it provides a final check of the questionnaire in the actual interview setting.[13] This is particularly useful for telephone-administered surveys, since having respondents complete a survey in written format does not provide the same experience as completing it over the telephone. The survey needs to be pre-tested over the telephone so that such things as normal phone line noise and the respondent's ability to complete questions while completely dependent on a verbal message are a part of the test situation.[5]

The limitations of focus group evaluations must be noted as well. Focus groups are not the only methodological alternative for questionnaire design. Compared with individual interviews, the focus group researcher has less control of the interview and the data generated.[12,21] Thus, a great deal of the information may be unusable. Group influences must also be considered. You cannot be sure that the response a person gives in a group setting is the same as one that would be given in an individual interview.[13] Individual interviews might also be preferred for complex topics because the interviewer can use probe and follow-up questions to explore issues that may not be brought up in a group setting.[21] Additionally, because ethnographic interviews are less structured than focus groups, unanticipated issues are more likely to be discovered.[14] Clearly, there are many qualitative techniques that are beneficial in the survey development process.

## Conclusion

This study provides further evidence to support the use of focus group interviews as a valuable tool in the questionnaire development process. The technique is often used before constructing the specific questions in a survey, but our study shows that it is also useful after questions have been generated. In fact, we gained valuable information about questions adopted or adapted from previous questionnaires. As a result, the research team was in a better position to make some important decisions regarding the format, content and implementation of the KAB cancer screening survey. The groups also provided useful feedback with respect to problems associated with language, wording and comfort levels, which improved the quality of this survey instrument. Moreover, the focus groups produced information about discussing highly sensitive and personal health topics that might have been otherwise overlooked by the researchers. We were able to learn the reasons behind non-responses and respondent discomfort, information critical to ensuring good communication about this research topic, and all in a short time span.

Furthermore, because comprehensive, population-based surveys measuring KAB in cancer screening are relatively rare, little is known about the feasibility of their implementation. Our study revealed valuable findings in this respect: an omnibus screening questionnaire would likely *not* be feasible. The qualitative methodology uncovered much in-depth, contextual information critical to understanding the views of the general population regarding cancer screening and questionnaires, something a pre-test may not have done.

Overall, our experience of using qualitative methodology in the form of focus group interviews to inform the survey development process was very positive. It helped us to conceptualize the important contribution that qualitative research can bring to quantitative methodologies. This technique can assist the quantitative investigator to ask useful questions in a useful way. Additionally, the technique could prove useful in generating introduction letters and informed consent information—both of which are integral parts of survey research. Thus, focus groups should not be left out of the instrument development process since both quantitative and qualitative methodologies can be used jointly to produce a highly effective research technique.

## Acknowledgements

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# *Workshop Report*

## Knowledge, Attitudes and Behaviours Concerning Cancer Screening in Canada

*Tammy Lipskie, Laurie Gibbons, Barbara Whylie, Heather Bryant and Fred D Ashbury*

### Abstract

*The Advisory Committee on Cancer Control funded a one-day workshop to discuss the surveillance of knowledge, attitudes/beliefs and behaviours concerning early cancer detection in Canada. Participants considered the need for such national surveillance and related methodological issues. Some exploratory work has been conducted in this regard. Results were presented from an inventory of existing survey questions and a summary of established cancer screening guidelines. There was overall agreement on the utility of collecting details of early cancer detection behaviours and their determinants. Explicitly, participants identified a need for site-specific information, highlighting cancers of the prostate and colon/rectum, as well as recognizing a need for qualitative information regarding the determinants that enable early cancer detection behaviours.*

***Key words:*** *Canada; mass screening; neoplasms, epidemiology; neoplasms, prevention and control; primary prevention*

## Background

Over the past year, the Advisory Committee on Cancer Control (ACOCC) and the Laboratory Centre for Disease Control (LCDC) of Health Canada have discussed and initiated exploratory work to investigate the early cancer detection behaviours of Canadians as well as the knowledge, attitudes and beliefs that determine those behaviours.

Two working documents have been developed: an inventory of existing population-based survey questions used in North America and a summary of established cancer screening guidelines. Very few population-based surveys have been conducted that focus on cancer-related information. Furthermore, neither a consistent nor a complete series of questions was found concerning cancer and early cancer detection. Prevalence data on early detection behaviours for several cancer sites have been collected periodically. Consequently, there is a small array of early cancer detection questions that are not necessarily comparable over time or across instruments. Current cancer screening guidelines fall into one of two categories: those that are evidence-based (e.g. The Canadian Task Force on the Periodic Health Examination and the US Preventive Services Task Force) or those of professional organizations. Wide variation exists in the statements for many cancer sites.

A workshop, funded by the ACOCC, was held in Toronto on March 18, 1997, to discuss the above issues in the context of surveillance of knowledge, attitudes/beliefs and behaviours (KAB) concerning early cancer detection in Canada. The objectives were to question the need for KAB surveillance of cancer screening; to consider the short-term and long-term priorities of KAB surveillance activities; to discuss the methodological issues and options of national surveillance versus special studies; and, given that the

**Author References**

*Tammy Lipskie and Laurie Gibbons,* Cancer Bureau, Laboratory Centre for Disease Control, Health Canada
*Barbara Whylie,* Medical Affairs and Cancer Control, Canadian Cancer Society/National Cancer Institute of Canada, Toronto, Ontario
*Heather Bryant,* Division of Epidemiology, Prevention and Screening, Alberta Cancer Board, Calgary, Alberta
*Fred D Ashbury,* Centre for Behavioural Research and Program Evaluation, National Cancer Institute of Canada, Toronto, Ontario

Correspondence: Laurie Gibbons, Cancer Bureau, Laboratory Centre for Disease Control, Health Canada, Tunney's Pasture, AL: 0601C1, Ottawa, Ontario  K1A 0L2

previous objectives were met, to agree on a core set of questions. Participants represented varied expertise from national health agencies in Canada and the United States, provincial governmental and non-governmental organizations, and academic institutions. A complete listing of participants is appended.

## Summary

This one-day workshop commenced with brief presentations: Drs Heather Bryant and Isra Levy introduced key discussion areas and summarized the exploratory work mentioned above; Dr Fred Ashbury offered perspectives on key issues surrounding a surveillance decision framework; Ms Cynthia Jorgensen from the Centers for Disease Control and Prevention shared the details of KAB surveillance implemented in the United States. Her presentation was complemented by Mr Gary Catlin, who provided insight into the Canadian National Population Health Survey. Drs Vivek Goel and Fred Ashbury and Ms Tricia Kindree presented the results of a KAB instrument development exercise. These presentations were followed by discussion in plenary and a priority-ranking exercise.

It was agreed that certain criteria ought to be considered in the establishment of the surveillance of cancer detection behaviours. KAB surveillance information could place health issues on the agendas of various sectors. It could address public concern, support evidence-based decisions and aid in the description of the burden of disease. Knowledge about early cancer detection behaviours and their determinants could facilitate the planning, implementation and evaluation of programs and research.

Cancer detection information has been collected for some cancer sites. In the United States, the Centers for Disease Control and Prevention co-ordinate the Behavioral Risk Factor Surveillance System (BRFSS) and the National Health Interview Survey (NHIS). Both of these systems have collected information about people's screening behaviours for cervical, breast and colorectal cancers. The BRFSS is an annual telephone interview consisting of core questions used throughout the United States and standard modules that individual states may implement. The NHIS collects information on an ongoing basis through personal interviews. A cancer supplement was included as part of the NHIS in 1992.

In Canada, there are similar population-based data collection procedures in place. The National Population Health Survey (NPHS) is a biennial survey consisting of both telephone and personal interviews. Supplemental NPHS questions for specified sample size can be purchased. Some Canadian cancer detection data exist regarding breast, cervical and prostate cancers. Breast cancer detection information was collected in two provincial health surveys (Ontario, Quebec), one focused provincial survey (Alberta) and the NPHS. Data regarding cervical cancer detection came from two provincial health surveys (Ontario, Quebec) and the NPHS. What is known

about prostate cancer detection behaviours was obtained from a national, site-specific telephone survey.

Workshop participants discussed the potential benefit of data triangulation, that is, the use of multiple existing data sources including administrative databases and special surveys to address different issues. There already is some activity in this area. Participants in the NPHS have enabled linkage studies to be implemented by granting permission to use their provincial health numbers. Such studies have been initiated in Ontario, Manitoba and Saskatchewan. The key issue in data triangulation is that most existing data sources tend to be administrative and therefore contain scant information pertaining to early cancer detection behaviours and their determinants. Although existing sources of information were acknowledged, these sources were felt to provide inconsistent information for some cancer sites and no information about others.

The results of a two-phase instrument development exercise were presented [see previous article, "Development of an Instrument to Measure Cancer Screening Knowledge, Attitudes and Behaviours"]. In the first phase, a comprehensive instrument had been developed from existing surveys. It was designed to take 20–30 minutes to complete and addressed personal and family history of cancer, sources of health information and early detection procedures for nine cancer sites. The second part of the instrument development exercise was based on focus groups. Respondents had provided suggestions to improve the comprehensibility and feasibility of the instrument.

Workshop participants suggested that such an omnibus instrument may not be appropriate due to the potential of providing diluted information, although it was felt to be a worthwhile exercise in providing the basis of cancer site-specific module development.

## Recommendations

- There was overall agreement about the utility of collecting information on knowledge, attitudes/beliefs and behaviours concerning early cancer detection in Canada.
- The workshop recognized the need for focused, site-specific information on early cancer detection behaviours among Canadians. Cancers of the breast, cervix, prostate and colon/rectum were identified as priority areas, with emphasis on cancers of the prostate and colon/rectum.
- In addition to monitoring cancer screening behaviours themselves, there is a need to explore the factors that enable those behaviours, including access to services and perceptions of social norms.
- The workshop recognized the need for qualitative information on perceptions of social norms and other determinants of early cancer detection behaviours. Special studies will be required.

## Acknowledgements

## Participants

# *Working Paper*

## Safety and Safety Promotion: Conceptual and Operational Aspects

*Pierre Maurice, Michel Lavoie, Antoine Chapdelaine and Hélène Bélanger Bonneau*

This paper will provide a basis for discussions that will occur during an international seminar on safety and safety promotion to be held in Quebec City, February 5–6, 1998. Readers are invited to participate in the preparations for this seminar by providing rapid feedback on the contents of this paper to the corresponding author.

## Abstract

*After illustrating the main difficulties usually encountered in efforts to prevent injuries and improve the safety of populations, this paper will propose a frame of reference on the subject of safety promotion. It applies to the prevention of non-intentional injuries as well as to the problem of violent crimes and suicide. This framework should facilitate dialogue among those involved in these issues by encouraging better integration of the various prevention models used. It should also improve both the implementation and the effectiveness of interdisciplinary and intersectorial interventions.*

***Key words:*** *Injury prevention; safety; safety promotion; wounds and injuries*

## Introduction

In co-operation with the World Health Organization (WHO), the Quebec WHO Collaborating Centre for Safety Promotion and Injury Prevention was given the mandate to propose (1) a definition of safety, (2) a global approach for evaluating and promoting the safety of a population, and 3) a definition of the factors required to successfully mobilize a community to improve its safety. The purpose of publishing this paper is to report on the progress of work related to this mandate. For the moment, this proposal does not involve any responsibility of the WHO. This publishing is also intended to improve the initial proposal by obtaining as many reactions as possible before it is finalized by consensus at an international seminar on safety and safety promotion to be held in Quebec City, February 5–6, 1998. Finally, this publication serves to highlight Canada's involvement in this important new safety promotion initiative.

The proposal concerns all those whose mandate is to improve the safety of the population or to prevent intentional or non-intentional injuries. These players may come from the health sector or any other sector involved in these issues, such as justice, public safety, transport and municipalities, as well as sports and leisure.

## Difficulties Encountered when Improving the Safety of Communities and Preventing Injuries

So far, efforts to improve safety in communities and to prevent injuries generally have encountered difficulties that can be described as cultural, conceptual, strategic and operational.

### Cultural Difficulties

Around the world, two types of attitudes prevail among various peoples concerning the occurrence of injuries: fatalism and "victimization." Both attitudes are detrimental to the implementation of effective programs for injury prevention and safety promotion.

*Fatalism* is the attitude that all events are preordained by destiny. It leads to resigned acceptance of injuries and the belief that they are simply due to bad luck or to the unchangeable will of a Supreme Being. Fatalism results in social acceptance of this important health problem, which in turn hinders many efforts to prevent it.

*Victimization* is the attitude that an individual who has been injured is somehow personally responsible because that person did not adequately protect himself or herself, or because he or she was not careful. This attitude results from the fact that most individuals can, to a certain extent, control the risks to which they expose themselves during any given activity (e.g. driving an automobile, mountain climbing, using a blunt instrument). This observation leads to the belief that education constitutes the principal means by which accidents can be prevented, to the detriment of other preventive interventions (e.g. environmental initiatives).

In addition to these two attitudes, one must consider the idea of *social acceptability of risk*. For an individual, a risk is always more acceptable if he or she has the impression of controlling the risk rather than simply enduring it, regardless of the potential consequences to the person's health. Therefore the perception of risk control mentioned in the previous paragraph leads many to be far more tolerant about dangers that can result in injuries than about uncontrollable risks for an individual, such as air pollution from toxic substances.

### Conceptual Difficulties

Much confusion remains concerning the terms *accident*, *injury* and *safety*. The tendency in the Anglophone world up to now has been to emphasize *injury reduction* rather than *accident reduction*.[1] The argument generally put forward to justify this position is that the fortuitous character associated with the word *accident* can hinder an epidemiologic understanding of the phenomenon and the recognition that injuries occur according to a certain logic by which it is possible to intervene to prevent them. *Injury* is therefore understood as any bodily lesion resulting from a sudden transfer of energy (mechanical, thermal, electrical, chemical or radiant) or from sudden deprivation of any of the vital elements (e.g. drowning, strangulation, freezing).[1] According to this definition, *injury prevention* includes the entire range of possible interventions from preventing the occurrence of any event that could lead to injury to preventing the injury should such an event occur in spite of everything.[2]

In the Francophone world, this distinction between *accident* and *injury* is less important, and there is a tendency to interchange both terms.[3] In general, the expression *accident prevention* is preferred because it is closer to the popular idea of the phenomenon, and it allows concentration on the event, whether or not the event caused an injury.

At first glance, the distinction between the two approaches (accident prevention versus injury prevention) may seem theoretical. However, it leads to a slightly different understanding of the problem as well as to different choices in working goals and intervention strategies. For example, should we try to prevent accidents that do not cause injuries? Or, what emphasis should we put on preventing incidents compared to preventing the consequences of these events, including injuries and handicaps?

As for the definition of *safety*, opinions are even more diverse. For some, this concept refers only to the prevention of crime and violence, while for others it refers more to a feeling than to a state, or to the satisfaction of basic needs (food, shelter, sleep, etc.). This interpretation does not always include injury prevention. Many agencies have launched programs to enhance the safety of a population, but little effort has been put into defining this field of intervention. Thus, the concept of safety is quite difficult to understand in all its dimensions (physical, social, psychological, etc.) and is therefore difficult to promote.

Moreover, we seldom take into account the fact that the different dimensions of the concept of safety are related and evolve according to a peculiar dynamic that must be considered if efficient initiatives are to be implemented. For example, the presence of an armed guard at the front door of a hotel can represent an effective measure of protection against crime, but it can also generate feelings of insecurity because of the apparent need for such measures in the area. Conversely, a person driving a car that is so well soundproofed that no outside noise can be heard may feel very secure and easily exceed the speed limit. In other words, we are not always aware that a measure implemented to improve physical safety can harm psychological safety and vice versa.

### Strategic Difficulties

The *priority level* given to safety issues does not always reflect the seriousness of the problem. Unfortunately, any spending for injury prevention or safety improvement is usually viewed as an expense rather than as an investment. This attitude is a major impediment to many interventions and forces the use of even more time and resources to convince people of the importance to act. This observation applies equally at the individual level (e.g. convincing an individual to use an effective method of protection), the organizational level (convincing a municipality to allocate resources to improve the safety of its citizens) and the community level (convincing the population of the wisdom of allocating collective resources to improving safety).

The low priority assigned to safety often means that effective interventions never see the light of day. Even if actions are taken to fulfil a safety need, they are often only ineffective half-solutions that are a waste of the minimal resources available. The low priority given to safety means that limited resources are invested in research activities.

Therefore, it is very difficult to obtain the necessary funding for implementing or evaluating innovative projects.

Basically, the safety issue today is in a strategic position similar to the one held by environmental/ecological issues 10 or 15 years ago. If more energy is devoted to improving the quality of the environment today, thanks are partly due to the many ecological movements that encouraged global strategies promoting the environment as an irreplaceable resource worth preserving. These strategies did not focus solely on the prevention of specific problems related to pollution, rather they aimed to promote sustainable development. Thus, gradually, environmental interventions have come to be seen as profitable economic and social investments by many decision makers.

### Operational Difficulties

Among the injury prevention strategies, a *problem-oriented approach* has been emphasized up to this point. The majority of initiatives under way follow the traditional *disease prevention* paradigm, which is based on the medical model. This pattern is based on a very mechanical reality. For each isolated problem, the goal is to identify the principal risk factors and the solutions that will modify them.

The emphasis on this type of practice has serious consequences: it compartmentalizes interventions; it ignores the fact that problems are often as interrelated as their solutions; it isolates intervening agencies from one another; it decreases the efficiency of interventions; and it jeopardizes the development of global solutions and of a positive mentality that considers safety as an important value to be preserved, rather than an unwanted problem.

Finally, many different approaches are used in the field of safety promotion and injury prevention. This diversity of approaches as well as the compartmentalization of interventions makes communication and collaboration among agencies difficult. These approaches attract different followers, often based on their occupation and country of origin. Each group uses a specific vocabulary and may have very different ways of understanding reality, as well as of designing interventions and putting them in place.

For example, in order to prevent suicide, some advocate the use of a clinical model that prevents mental disorders, others pursue a mental health promotion model, while others propose an intentional injury prevention model.[4] Yet, all are working toward the same goal. However, the absence of a connecting thread among these models results in misunderstanding among various groups and makes it difficult to understand each group's actions in light of the realm of possible interventions. This situation reinforces the compartmentalization of safety interventions and of the players.
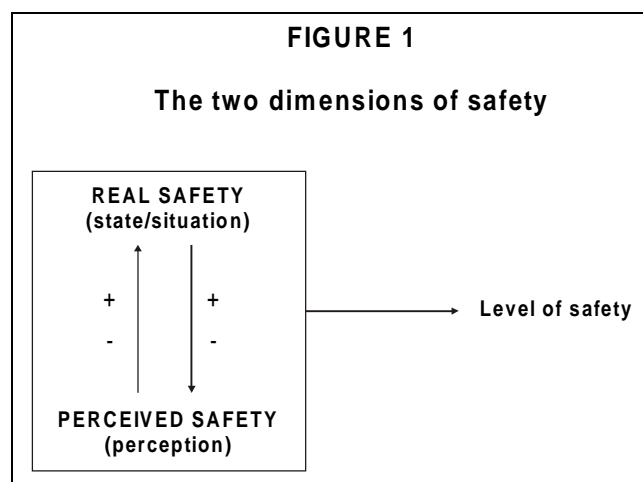
## The Concept of Safety

Many of the difficulties described above could be partially solved by the proposal of a global, positive vision of safety that integrates the various approaches and models used in the field. In proposing such a vision, the present monograph should encourage the mobilization of local, national and international communities concerning issues of safety. It should also contribute to making safety a value to promote because it pays off economically and socially. Finally, it should enable different groups to formulate their safety objectives and do what has to be done to attain them.

### Definition of Safety

*Safety can be defined as a state or situation devoid of physical, material or moral threats, which must lead to a perception of being sheltered from danger.[a]*

Thus, safety consists of two dimensions (Figure 1), one being a state of reality that can be assessed according to objective behavioural and environmental parameters, herein labelled *real safety* (RS), and the other being a perceived state measured in terms of the feeling of safety (subjective parameter) within a population, herein labelled *perceived safety* (PS).

**FIGURE 1**

**The two dimensions of safety**

REAL SAFETY (state/situation)

\+ \+ → Level of safety
\- \-

PERCEIVED SAFETY (perception)

These two aspects can influence each other either positively or negatively. In fact, improvement of real safety often leads to improvement of the feeling of safety within a population. However, improving real safety can sometimes diminish perceived safety (e.g. the presence of numerous police in a given area to fight crime could generate a feeling of panic among some citizens). Similarly, improving perceived safety can lead to a deterioration of real safety as in "the Titanic syndrome" (e.g. speeding among drivers of

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ABS-equipped cars, acquiring a firearm to protect oneself from attacks). This dynamic between real and perceived safety is sometimes manipulated in certain interventions to induce a feeling of insecurity in order to encourage safer behaviours that will benefit all (e.g. reducing the width of roads to slow traffic speeds in school zones).

### Links between Safety and Health

In their 1994 report on human development, the United Nations considered safety to be a fundamental right and an essential condition for any sustainable development by societies.[5] According to Maslow's Needs Theory,[6] safety is one of the fundamental needs of human beings, just like physiological needs. Consequently, safety can be viewed as a prerequisite for maintaining and improving the health and welfare of a population (Figure 2).

**FIGURE 2**

**Links between safety and health**
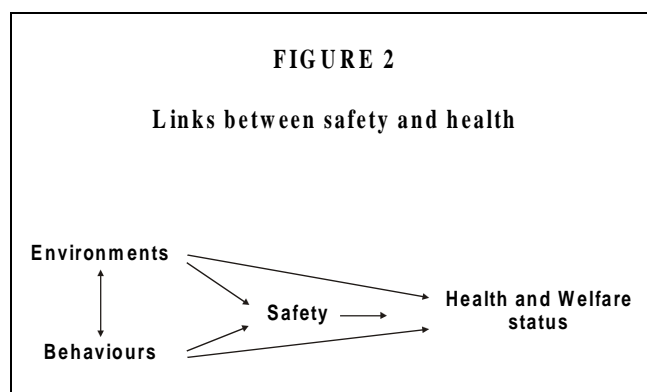
It must be understood that the health and welfare of a population is determined by environmental conditions or exhibited behaviours. Here, the environment is considered in a global sense (physical, social, technological, organizational, political, economic, etc.). The effect of behavioural and environmental determinants on health and welfare is often a function of the level of safety attained. On the other hand, there is also an association between the environment and behaviours (e.g. the use of seat belts by a large number of motorists facilitates the adoption of a law that makes them mandatory and vice versa).

### Three Basic Conditions for Safety

Attaining an optimum safety level for an individual or a community hinges on the presence of three conditions and the assurance that everything is being done to attain or maintain them. These conditions are the following.

- Climate of social peace
- Control of dangers related to injuries
- Respect for the physical, material or moral integrity of people

A climate of social peace refers to the harmonious and non-violent co-existence of different communities or interest groups; this state leads to a society free of violent confrontations among groups of different countries, races, religions, sexes, social and economic status, etc.

The control of dangers related to injuries means the presence of environments and behaviours that prevent the occurrence of bodily lesions resulting from a sudden transfer of energy (mechanical, thermal, electrical, chemical or radiant) or from sudden deprivation of any vital element (e.g. drowning, strangulation, freezing).

Respect for the physical, material or moral integrity of individuals refers to the harmonious and non-violent co-existence of individuals within a community. This state allows each individual to live without the fear of being personally attacked, either morally (harassment, hate literature, etc.) or physically (robbery, rape, etc.), and to be able to enjoy his or her belongings without fear of having them stolen or vandalized. Unlike a climate of social peace (the first condition), which refers to interactions between groups, the present condition refers to interactions between individuals. Suicides are considered here as self-inflicted aggressions.

## Promoting Safety

### Proposed Definition

The World Health Organization[7] defines health promotion as a process that aims to give populations the means to ensure better control of their health and the capacity to improve it. *Thus, we could define safety promotion as a process that aims to provide populations with the conditions and abilities that are necessary to reach and sustain an optimal level of safety.* These conditions can be guaranteed through behavioural and environmental (physical, social, technological, organizational, political, economic, etc.) initiatives. This definition assumes that safety promotion is above all an enabling process for a community, requiring the active participation of the population in defining program objectives as well as in choosing solutions.

### Operational Aspects

To improve the safety of a community, two types of approaches can be used: problem-oriented and setting-oriented (Figure 3). These two approaches, though quite distinct, are both complementary and essential. Both presuppose the active participation of citizens and decision makers. The role of a safety promotion agent is first and foremost to drive and support the process specific to either approach.

#### Problem-oriented approach

The problem-oriented approach consists of the study of specific solutions to a certain number of problems, taken one at a time (Figure 3). The mobilizing goal is the prevention of one type of intentional or non-intentional injury, such as suicide, transportation-related injuries, falls, urban violence, etc. These problems can be selected after establishing an order of priority, usually based on their importance in a given community in terms of frequency and severity.

With this approach, the population of interest is composed of individuals who are exposed to the risk factors associated with the injury categories judged as high priority. The process followed is to identify the environmental or behavioural causes of a given problem and to develop a specific prevention program. Thus, the improvement of real and perceived safety levels is more an outcome than an explicit objective.

The problem-oriented process is essential to the safety promotion approach. It permits a good definition of the health objectives to be obtained as well as the risk factors that must be acted upon. However, when used alone, this process can present certain limitations. First of all, the fact that the underlying conceptual framework is based on a simplification of a reality that is often very complex makes it much harder to take into account the interaction among existing problems. For example, an increased risk of being attacked in some downtown areas can lead many to move to the suburbs, which can then expose the population working

downtown to a higher risk of traffic injuries. Moreover, this model does not facilitate consideration of interactions among proposed solutions, to the point that it's not always clear that the accepted solution truly improves the real and perceived safety of the population concerned.

Sometimes it is even possible that the end result of a solution applied separately to solve a given problem compromises the level of real or perceived safety of the population. For example, the construction of a pedestrian tunnel to reduce the risks of collision could represent a new opportunity for assaults in an area. Or, the installation of safe recreational equipment in a park can result in an increased flow of people in the neighbourhood, which can in turn increase the risk of collisions with automobiles in the area. Or even, the systematic exclusion of a group or a category of individuals to ensure a climate of social peace in a public place may jeopardize their physical, material or moral integrity by reducing their rights and freedom.

Secondly, by generating solutions for only one problem at a time, this type of process does not help to create global solutions that could reduce not only many types of injuries at the same time, but also other types of health problems. For example, a program to reduce falls among the aged could propose better maintenance of sidewalks as one of several interventions. However, this program could fail to consider the climate of insecurity in the town that reduces daily outings by seniors, thus reducing their physical and mental health, and their autonomy.

Thirdly, the problems in a population are often so complex that they require a broad range of expertise in order to solve them. The problem-oriented approach does not always favour the integration of this diverse expertise; rather, it leads to a certain isolation among people involved in safety issues.

**Setting-oriented approach**
The mobilizing goal in the setting-oriented approach is not the solution of a specific problem, but rather the improvement of the safety level in a community (Figure 3). The objective is not to prevent this or that problem, but to act on a set of determinants in order to improve the real and perceived safety of citizens. The prevention of specific problems is more a probable outcome than an explicit objective.

**FIGURE 3**

**Promoting safety: problem-oriented and setting-oriented approaches**
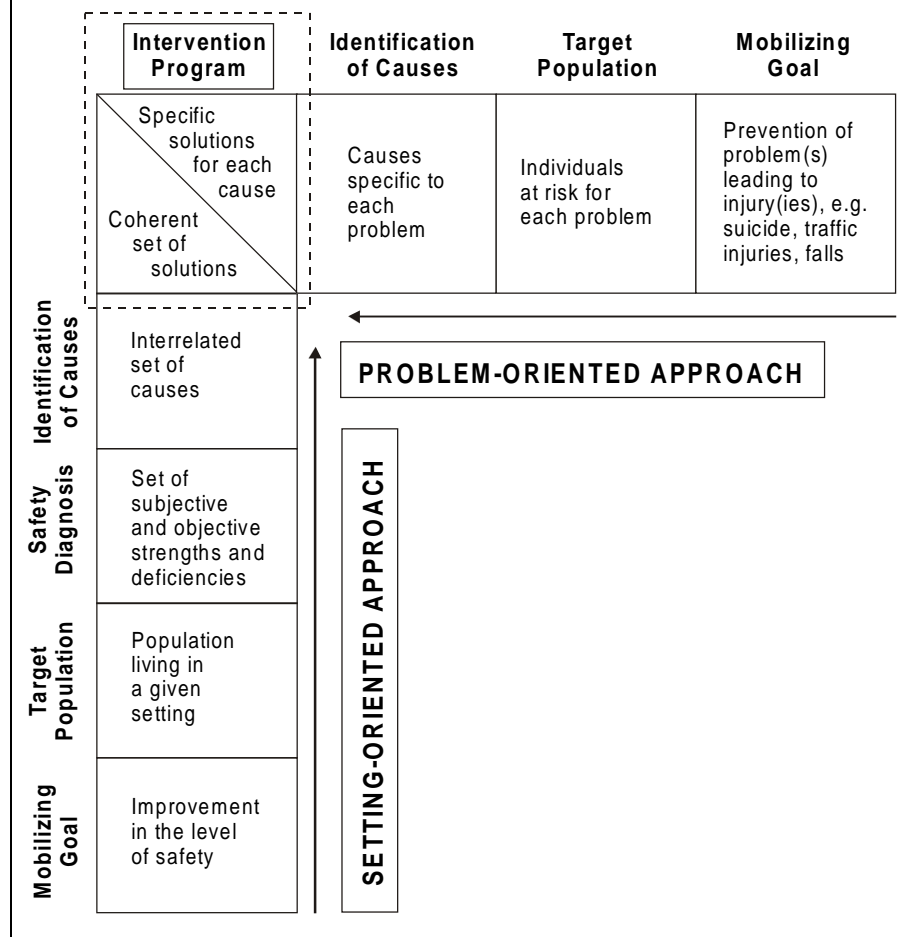
In this approach, the population of interest is composed of individuals gathered in a given setting (street, park, school, factory, neighbourhood, town, etc.), each of which is considered as a system having one or more finalities. Each setting is made up of many components (population; economic and technical infrastructures; physical environment; etc.), each of which fulfils a specific function. These components influence each other according to rules that are not always well known. Safety is considered to be a state resulting from a dynamic equilibrium that is established between the different components of the system.

The setting-oriented process includes three stages.

*First stage*: The first stage consists of identifying the strengths and weaknesses of a given setting in order to make a safety diagnosis. Figure 4 presents a two-axis matrix of the elements to consider when making such a diagnosis. The horizontal axis contains the elements necessary to reach an optimum level of safety, namely a climate of social peace, control of the dangers related to injuries and respect for the physical, material or moral integrity of individuals. The vertical axis contains three categories of indicators that can be used to evaluate the safety conditions across the horizontal axis.

The first category of indicators can help to evaluate the *measures* taken by a community to ensure the attainment or maintenance of each of the safety conditions (e.g. setting up a school patrol system to help school children cross dangerous intersections). The second category can be used to assess the *community's level of exposure to factors liable to harm or to help* in attaining or maintaining these same safety conditions (e.g. many drivers driving with impaired faculties). The last category of indicators allows for documentation of the occurrence of *undesirable events* relative to those same conditions

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**FIGURE 4**

**Safety diagnosis of a particular setting: dimensions to consider**

| CONDITIONS / INDICATORS | Climate of social peace | Control of dangers related to injuries | Respect for the physical, material or moral integrity of individuals |
|---|---|---|---|
| Measures taken | 1 | 4 | 7 |
| Exposure to risks | 2 | 5 | 8 |
| Number of events | 3 | 6 | 9 |

Examples of strengths (S) and weaknesses (W) concerning real safety (RS) and perceived safety (PS) for each cell of the matrix:

1. *Co-existence of street youth and other citizens in a given neighbourhood*
   RS: A consulting committee was formed of youth, police and social workers to find peaceful solutions to the existing tensions. (S)
   PS: The population believes that the police force let the street youth disturb passers-by. (W)

2. *Co-existence of different ethnic groups in a school*
   RS: Youth in a school are hostile to immigrants. (W)
   PS: Youth in a school believe that immigrants have aggressive behaviours. (W)

3. *Violent outbursts between different groups of supporters during sporting events*
   RS: Two riots occurred at the stadium during the past year. (W)
   PS: Sporting event organizers deny the possibility of riots among supporters. (W)

4. *Control of dangers related to disasters in a community*
   RS: The community has an effective emergency plan in case of disaster. (S)
   PS: The population believes that the emergency disaster plan is ineffective. (W)

5. *Fire control in a residence for senior citizens*
   RS: Many residents smoke while in bed. (W)
   PS: Most of the residents are aware of the dangers of smoking in bed. (S)

6. *Poison control for children in a community*
   RS: The number of poisonings among children under 5 years old has increased. (W)
   PS: The population believes that poisoning among children rarely occurs. (W)

7. *Respect for the physical integrity of individuals in a country*
   RS: There is no effective firearm control legislation. (W)
   PS: The population believes that firearm control measures are useless. (W)

8. *Risks of violent crime among individuals in a given community*
   RS: There are significant socio-economic inequities in the community. (W)
   PS: The population is not aware of the importance of the socio-economic inequities in the community. (W)

9. *Number of assaults in a city's parks*
   RS: No assaults were reported in the parks for the last two years. (S)
   PS: The population believes there are frequent assaults in the parks. (W)

(e.g. the number of school children involved in traffic collisions at those intersections).

Every time safety conditions (horizontal axis) are evaluated, it must be done using objective and subjective information related to the three categories of indicators (vertical axis). Objective data are used to evaluate the level of real safety in the setting under study: factual data that can be obtained from different sources (safety rounds, analysis of existing published data, etc.). Subjective data are used to evaluate the level of safety in the setting as it is perceived by its inhabitants: these are personal observations that can be obtained through various consultation mechanisms (discussion groups, complaints, surveys, forums, etc.).

The safety diagnosis of a given setting therefore comprises two dimensions (objective and subjective) that can either agree or disagree. For example, when evaluating the measures taken to ensure a climate of social peace, it is possible that people may feel that the number of police on duty is insufficient while the facts may indicate there are enough or even more than necessary. In the same way, by comparison with the number of incidents that actually occur in a community, prolonged media coverage of a particular rape can lead many to believe that the problem is more widespread that it is in reality. That being said, it must be remembered that the subjective and objective dimensions are equally important. However, they must always be distinguished from each other, as they do not lead to the same solutions.

Moreover, this diagnostic process must not consider only the weaknesses of a community, but also its safety assets. There must also be an analysis of the interactions between the different strengths and weaknesses identified, which will yield a dynamic and more complete understanding of the safety situation of the population. Thus, the use of an evaluation grid that systematically takes all safety aspects into account will probably mean that some phenomena will be identified that would not have been found using only the problem-oriented approach. At the end of this stage of the diagnostic process for a given setting, a composite picture will emerge of the strengths to be reinforced as well as the weaknesses to be corrected, with priorities established.

*Second and third stages:* The second and third stages of the setting-oriented approach involve the identification of specific causes and solutions to endorse for each of the weaknesses observed in the preceding stage. This identification is done following the problem-oriented process. However, having a complete and dynamic understanding of the situation should facilitate the identification of causes or solutions common to various problems as well as of strengths in the community that will enable the solving of these problems. It also allows better identification of potential undesirable side effects of the proposed solutions.

The global nature of the setting-oriented process requires integration of different kinds of expertise, which is not possible without concerted teamwork. This should encourage greater efficiency in any interventions developed. In addition, the mobilization of intervening agents and the population that is needed to accomplish this process should also encourage the emergence of a positive mentality within the community that favours safety as a valuable resource to preserve. This heightened awareness is more likely to place safety on the agenda of decision makers and in their decision-making criteria.

Going back to the example used earlier, a safety promotion program for seniors in a given neighbourhood will be interested in the overall improvement of their safety. In addition to better sidewalk maintenance, the program could recommend implementation of a walking club, crime control and pedestrian signs adapted for the elderly. Such a program would not only reduce falls among seniors, but would also diminish their social isolation and improve their autonomy, their physical condition and their mental health. This same program would also benefit the entire population.

The problem-oriented and setting-oriented approaches have been described separately to better understand their specific attributes. The proportionate contribution of either approach to the activities in an intervention program will vary according to the context. Thus, in a city, because of its very specific mandate to have a service for fighting fires, the fire department could adopt an approach that is predominantly problem-oriented. On the other hand, for a city council, mandated to ensure all the safety conditions for the population, an approach that is predominantly setting-oriented would be more appropriate.

## Conclusion

The injury prevention approach has contributed to the understanding that injuries are an important health problem with specific risk factors and target groups. These concepts emphasize that, like other health problems, injuries are due to preventable causes rather than to random events beyond our control. This understanding of the phenomenon has elicited the development of numerous initiatives to better document the epidemiology of the problem and to develop preventive measures. Resources were initially mobilized for non-intentional injuries and then, more recently, in the field of intentional injuries (violence, homicides and suicides).

The description of this phenomenon as a health problem has placed injuries primarily on the agenda of the health sector. Since other sectors do not have an explicit mandate in terms of injury prevention, they do not identify as well with this definition of the problem, making certain collaborative links with the health sector more difficult. Notwithstanding, whoever works in injury prevention knows the indispensable contribution of sectors other than that of health (e.g. public safety, transport, justice, sports and recreation, housing, etc.) when the time comes for creating interventions.

These other sectors generally have a mandate to ensure the safety of the population. That is why we believe that an approach defining the concepts of safety promotion can be a junction point for the health sector and the other sectors involved in the safety of the population. Moreover, by proposing a common basis of understanding, such an approach should help to improve collaboration among the different disciplines and sectors concerned, thereby encouraging the decompartmentalization of interventions. It should stimulate the development of global initiatives that not only reduce the occurrence of a given problem, but that also improve the real and perceived safety of the population. This can only help to create a positive vision of safety as a value to promote in our communities.

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# *Book Review*

## Design Concepts in Nutritional Epidemiology, Second Edition

*Design Concepts in Nutritional Epidemiology* is a valuable addition to the burgeoning field of nutritional epidemiology. The newly released second edition has added chapters on qualitative and sociological measures, anthropometric measures, gene-nutrient interactions and cross-sectional studies. Chapters from the first edition have been revised to take recent developments into account. There is a brief, five-page introduction that touches on the importance of nutritional epidemiology, general progress that has been made in the field and the role of nutritional epidemiology in public health nutrition. This section has been substantially revised from the first edition in order to "bring a more practical focus to the theoretical concepts around study design."

This second edition of the book has been used as a course text for the European postgraduate summer course in public health nutritional epidemiology, and it is divided into three parts. Part A (chapters 1–4) deals with concepts in study design; Part B (chapters 5–11) discusses problems inherent in the measurement and interpretation of a wide variety of variables relevant to nutritional epidemiology; and Part C (chapters 12–16) describes the application of various research designs to studies of nutritional epidemiology. *Design Concepts in Nutritional Epidemiology*, differs greatly from the current standard text, Willett's *Nutritional Epidemiology*,[1] in that it does not assume any prior knowledge of epidemiologic methods.

Chapter 1 provides an overview of the principles of nutritional epidemiology. It covers, in part, the objectives of nutritional epidemiologic research, types of epidemiologic studies and measures, and the interpretation of epidemiologic research. Readers familiar with the general concepts of epidemiology may wish to read quickly through this chapter, focusing most of their attention on the examples of nutritional epidemiology. The second chapter covers the design, planning and evaluation of nutritional epidemiologic studies. Chapter 3 considers issues of sampling, study size and power as they relate to different types of epidemiologic studies. It succeeds as a straightforward introduction; however, researchers seeking more depth will need to consult additional texts. "Covariate measurement errors in nutritional epidemiology: effects and

remedies" is the title of Chapter 4. While the potential problems are well covered, the remedies, unfortunately, seem too theoretical or out of the reach of most researchers. Those looking for simple, easy-to-implement solutions will be disappointed. A useful feature of Part A is that readers are guided toward additional information on whatever they are reading, should such information exist in subsequent parts of the book.

Part B begins with a comprehensive and easy-to-read chapter focusing on the estimation of nutrient intakes from food consumption surveys using food composition tables. Included in this chapter are references to World Wide Web home pages where the reader can go for additional information. Ways of assessing food consumption and nutrient intake are discussed in Chapter 6. The first section of this chapter looks at the strengths and weaknesses of various methods for assessing household diets, while the second section outlines measures of diet in individuals. The latter section includes a short, interesting look at the problem of underreporting of energy intake and why energy adjustment is sometimes necessary. Chapter 7 presents the reasoning behind the use of various kinds of biomarkers (blood, urine, fecal, etc.) as well as a detailed section on biomarkers for different minerals, vitamins and lipids. Researchers and other health professionals involved in the use of biomarkers will find this chapter invaluable, and at 71 pages, it is the longest chapter in the book. The validation of dietary assessment (Chapter 8) and sociodemographic and psychosocial variables (Chapter 9) are subsequently examined. Chapter 10 reviews appropriate anthropometric measurements and general problems associated with such measurements. Part B concludes by providing approaches to gene-nutrient interaction research and insight into its possible role in nutritional epidemiology.

Chapter 12 opens the last section of the text by presenting a thorough examination of the strengths and weaknesses of ecological studies, including ways of collecting and analyzing ecological data. Chapter 13 is similarly well done and very practical in nature. It provides some useful guidance for readers looking for help in designing a cross-sectional study or for those trying to choose the most appropriate dietary assessment method to use for their study. A short chapter follows on cohort studies, highlighted by examples from different phases of the life cycle and a checklist for planning and analyzing such studies. While the next chapter (15) provides a good summary of the ins and outs of case-control studies, it would be considerably better served if it had greater

application to nutritional epidemiology. The final chapter of the text focuses on the design and analysis of experimental studies.

Individual chapters were written by subject area experts, with 24 authors contributing in total. Although a rather uniform style of writing was achieved throughout the text, more effort could have gone into developing standard purpose and conclusion sections for each chapter. In addition, because most of the text was written by people in the United Kingdom, the book sometimes takes on a British slant, particularly in the section dealing with existing sources of nutritional data. However, these limitations don't significantly detract from the overall usefulness of the book.

*Design Concepts in Nutritional Epidemiology* is a valuable resource for epidemiologists who lack a strong background in nutrition and would be a welcome addition to the bookshelf of anyone involved in nutritional epidemiology.

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*Larry Ellison*
*Behavioural Risk Assessment, Cancer Bureau*
*Laboratory Centre for Disease Control*
*Health Canada, Tunney's Pasture*
*Address Locator: 0601C1*
*Ottawa, Ontario  K1A 0L2*

# New Publication

## Tobacco or Health:
## A Global Status Report

*World Health Organization*, *1997; ix + 495 pp (available in English; French in preparation); ISBN 92 4 156184 X; $195.30 (CAN) / $139.50 (US) / 155.00 (Sw fr); Order no 1150449*

This report documents, with comprehensive up-to-date statistics, the current situation of the tobacco epidemic in virtually every country in the world. Trends over the past two decades are also presented and discussed. Intended to serve as a resource and reference work for those concerned with epidemiologic surveillance, the report draws on a vast body of data that have been systematically collected and carefully validated by the WHO. The result is an authoritative account of both the current global situation and the many factors from industry practice to national control policies that are likely to influence future trends. By comparing and ranking countries according to key indicators of the tobacco situation, the report also allows policy makers to see where their own countries stand in terms of global patterns of tobacco production and use, related mortality, national policies for control and the specific measures used.

The report has two parts. The six chapters in the first part provide a global overview of the current "tobacco or health" situation. Chapter 1 describes some of the major forms of tobacco products currently in use, noting that manufactured cigarettes are the predominant form of tobacco consumption around the world. Chapter 2, on smoking prevalence, ranks 87 countries according to estimated smoking prevalence in men and in women. Data on global smoking prevalence, by geographical region, are also presented and discussed. Tobacco consumption is profiled in the next chapter, which ranks 111 countries according to estimated annual per capita consumption of cigarettes and assesses global trends, by region, over the past two decades.

Chapter 4 profiles the tobacco industry with abundant data on the world's leading producers, importers and exporters of unmanufactured tobacco and manufactured cigarettes, followed by country rankings according to the import costs of tobacco and export earnings from tobacco. The remaining chapters in Part 1 document the magnitude of morbidity and mortality attributed to tobacco use and review the numerous positive experiences of countries that have introduced comprehensive tobacco-control policies. This review of countries' experiences yields several practical lessons about the effectiveness of specific measures. Assessment of the effectiveness of financial measures is facilitated by tables showing the average price of 20 cigarettes in selected countries, the minutes of labour at the average industrial wage required to earn this price and the percentage of tax included in the price.

Part 2 presents over 400 pages of up-to-date facts and figures profiling the tobacco situation in 190 countries. Each country profile is presented according to a standard format, which features data on the socio-economic situation; health status, including life expectancy at birth and infant mortality rate; tobacco production, trade and industry; tobacco consumption; prevalence of tobacco use by age group and sex and among population subgroups; mortality from tobacco use; and the specific control measures currently in effect.

# Abstract Reprints

## 1. Dog bite incidence in the city of Pittsburgh: a capture-recapture approach

*Yue-Fang Chang, Joan E McMahon, Deidre L Hennon, Ronald E LaPorte, Jeffrey H Coben*

*Objectives.* The purpose of this study was to estimate the number of dog bite injuries occurring in the city of Pittsburgh in 1993.

*Methods.* The capture-recapture method was used, along with log-linear modeling. Three sources were used to identify victims: hospital reports, animal control reports, and police/victim reports.

*Results.* In 1993, 790 dog bites were reported. The capture-recapture method estimated that there were 1388 unreported dog bites, with an estimated incidence rate of 58.9 per 10 000.

*Conclusions.* Dog bite is a common but preventable injury. To improve surveillance, the focus should be on educating the general public about the serious consequences of dog bite injuries.

## 2. Alcohol, tobacco and cannabis use among Nova Scotia adolescents: implications for prevention and harm reduction

*Christiane Poulin, David Elliott*

*Objective:* To characterize adolescent drug use in terms of a risk continuum and to explore the rationale for harm reduction as a potential approach for school-based drug prevention.

*Design:* Self-reported surveys, in 1991 and 1996, of adolescent students concerning their use of drugs, especially alcohol, tobacco and cannabis, and the harmful consequences of such use.

*Setting:* Nova Scotia.

*Participants:* A total of 3452 (in 1991) and 3790 (in 1996) junior and high school students in randomly selected classes in the public school system.

*Outcome measures:* Prevalence of drug use and patterns of multiple drug use and of alcohol- and drug-related problems; independent risk factors for multiple drug use. The risk continuum for the response to alcohol problems was used as a policy framework.

*Results:* The prevalence of cigarette smoking and the use of hallucinogens and stimulants was markedly higher in 1996 than in 1991. Over one-fifth (21.9%) of the students reported multiple drug use of alcohol and tobacco and cannabis in the 12 months before the 1996 survey. The 3 main subgroups—nonusers, users of alcohol only and users of multiple drugs—had distinct patterns of use, numbers of problems and risk factors. In all, 27.1% of the students had experienced at least 1 alcohol-related problem and 6% had experienced at least 1 drug-related problem in the 12 months before the 1996 survey.

*Conclusion:* There is a need for integrated school- and community-based drug prevention programs, with goals, strategies and outcome measures capturing the full spectrum of patterns of use and levels of risk among subgroups of the adolescent student population.

## 3. Alcohol consumption and breast cancer risk among women under age 45 years

*Christine A Swanson, Ralph J Coates, Kathleen E Malone, Marilie D Gammon, Janet B Schoenberg, Donna J Brogan, Mary McAdams, Nancy Potischman, Robert N Hoover, Louise A Brinton*

In a population-based case-control study of women younger than 45 years of age, we obtained a detailed lifetime history of alcohol use to evaluate the effects of drinking during different periods of life in relation to breast cancer risk. This analysis focused on interviews obtained from 1,645 cases and 1,497 controls. Breast cancer risk was not influenced by drinking during the teenage years or early adulthood. Contemporary drinking (that is, average intake during the recent 5-year interval) was directly associated with risk, but the adverse effect of recent drinking was restricted to women who consumed ≥14 drinks per week [relative risk (RR) = 1.7; 95% confidence interval (CI) = 1.2–2.5]. The effect of alcohol was most pronounced among women with advanced disease. Compared with nondrinkers, the risk estimate associated with recent consumption of ≥14 drinks per week was 2.4 (95% CI = 1.6–3.8) for women with regional/distant disease. Our data add support to the accumulating evidence that alcohol consumption is associated with increased risk of breast cancer and further indicate that alcohol acts at a late stage in breast carcinogenesis.

## 4. Alcohol consumption and coronary heart disease morbidity and mortality

*Jürgen T Rehm, Susan J Bondy, Christopher T Sempos, Cuong V Vuong*

Alcohol consumption is associated with a reduced risk of coronary heart disease (CHD) but an increased risk of other causes of morbidity and mortality. It remains unclear whether there is an upper limit to a protective effect of alcohol intake on CHD risk. Whether there is a U- or an L-shaped relation between alcohol consumption and CHD incidence (hospitalization and mortality due to ischemic heart disease: *International Classification of Diseases* codes 410–414) is examined using the National Health and Nutrition Examination Survey I. Baseline data were collected in 1971–1975. Follow-up data through 1987 (14.6 years mean follow-up) were analyzed for 6,788 European-American males ($n = 2,960$) and females ($n = 3,828$) aged 40–75 years at baseline. Cox regression was used to assess the association between alcohol consumption and incidence of

CHD. For females, an increased risk was found above 28 drinks per week relative to abstainers (relative risk = 2.6, 95% confidence interval 1.2–5.5), which was significant, but was based on small numbers. For males, no upturn in risk was found at higher intake. Mortality data supported these results. Sex differences should be explored further, since they are relevant to understanding causal mechanisms and public policy and prevention.

## 5. Marijuana use and mortality

*Stephen Sidney, Jerome E Beck, Irene S Tekawa, Charles P Quesenberry, Gary D Friedman*
***Am J Public Health*** *1997;87(4):585–90*

*Objectives.* The purpose of this study was to examine the relationship of marijuana use to mortality.

*Methods.* The study population comprised 65 171 Kaiser Permanente Medical Care Program enrollees, aged 15 through 49 years, who completed questionnaires about smoking habits, including marijuana use, between 1979 and 1985. Mortality follow-up was conducted through 1991.

*Results.* Compared with nonuse or experimentation (lifetime use six or fewer times), current marijuana use was not associated with a significant increased risk of non-acquired immunodeficiency syndrome (AIDS) mortality in men (relative risk [RR] = 1.12, 95% confidence interval [CI] = 0.89, 1.39) or of total mortality in women (RR = 1.09, 95% CI = 0.80, 1.48). Current marijuana use was associated with increased risk of AIDS mortality in men (RR = 1.90, 95% CI = 1.33, 2.73), an association that probably was not causal but most likely represented uncontrolled confounding by male homosexual behavior. This interpretation was supported by the lack of association of marijuana use with AIDS mortality in men from a Kaiser Permanente AIDS database. Relative risks for ever use of marijuana were similar.

*Conclusions.* Marijuana use in a prepaid health care-based study cohort had little effect on non-AIDS mortality in men and on total mortality in women.

## 6. Marijuana use and cancer incidence (California, United States)

*Stephen Sidney, Charles P Quesenberry Jr, Gary D Friedman, Irene S Tekawa*
***Cancer Causes Control*** *1997;(8):722–8*

The purpose of this retrospective cohort study was to examine the relationship of marijuana use to cancer incidence. The study population consisted of 64,855 examinees in the Kaiser Permanente multiphasic health checkup in San Francisco and Oakland (California, United States), between 1979–85, aged 15 to 49 years, who completed self-administered questionnaires about smoking habits, including marijuana use. Follow-up for cancer incidence was conducted through 1993 (mean length 8.6 years). Compared with nonusers/experimenters (lifetime use of less than seven times), ever- and current use of marijuana were not associated with increased risk of cancer of all sites (relative risk [RR] = 0.9, 95 percent confidence interval [CI] = 0.7–1.2 for ever-use in men; RR = 1.0, CI = 0.8–1.1 in women) in analyses adjusted for sociodemographic factors, cigarette smoking, and alcohol use. Marijuana use also was not associated with tobacco-related cancers or with cancer of the following sites: colorectal, lung, melanoma, prostate, breast, cervix. Among nonsmokers of tobacco cigarettes, ever having used marijuana was

associated with increased risk of prostate cancer (RR = 3.1, CI = 1.0–95) and nearly significantly increased risk of cervical cancer (RR = 1.4, CI = 1.0–2.1). We conclude that, in this relatively young study cohort, marijuana use and cancer were not associated in overall analyses, but that associations in nonsmokers of tobacco cigarettes suggested that marijuana use might affect certain site-specific cancer risks.

## 7. Smoking in Ontario, 1991 to 1996

*Susan Jane Bondy, Anca Ruxandra Ialomiteanu*
***Can J Public Health*** *1997;88(4):225–9*

Surveys by the Addiction Research Foundation of Ontario have produced annual estimates on smoking prevalence since 1991. This report describes the three series of telephone surveys from which these data are drawn as well as future plans to monitor tobacco use in Ontario. In addition to provision of updated descriptive results, the methodology and limitations of the data are discussed. Prevalence data for 1996 are presented from the Ontario Drug Monitor, a telephone survey of Ontario adults (n=2721). The overall prevalence of smoking in Ontario was 27% (95% confidence interval: 25% to 29%); 23% smoked daily (95% confidence interval: 21% to 25%). There is no evidence of any decline in the prevalence of smoking since 1991, and no sex differences were found in smoking prevalence. Future reports will update trend data and provide robust regional estimates.

## 8. The health of Canada's elderly population: current status and future implications

*Mark W Rosenberg, Eric G Moore*
***Can Med Assoc J*** *1997;157(8):1025–32*

The growing size of Canada's elderly population and its use of health care services has generated much discussion in policy circles and the popular press. With data from the National Population Health Survey, undertaken in 1994–95, the authors examine the health status of Canada's elderly population using 3 sets of measures: level of activity limitations, prevalence of chronic illnesses and self-assessment of overall health. They also analyse the utilization of physician and institutional services. The profile of this population the authors develop is in many respects not much different from that of the remaining adult population, until the age of 75. People aged 75 and over are much more likely than other adults to have health problems and use health care services. Also, elderly women living alone and with low income are identified as an especially vulnerable group who need access to medical and nonmedical services if they are to remain in the community. Using Statistics Canada projection data the authors discuss some aspects of the elderly population's health status in the future. Their look into the future raises issues about the preparedness of health care providers and our health care system to meet the challenges of tomorrow's elderly population.

## 9. Characteristics of non-responders and the impact of non-response on prevalence estimates of dementia

*Froukje Boersma, Jan A Eefsting, Wim Van Den Brink, Willem Van Tilburg*
***Int J Epidemiol*** *1997;26(5):1055–62*

*Background.* Differential distributions of sociodemographic characteristics and cognitive impairment in responders and non-responders may result in a biased prevalence estimate of dementia based on responders only.

*Methods.* Responders (n = 2191) to a cross-sectional, two-stage community study were compared with regard to sociodemographic characteristics and cognition with three subgroups of non-responders: (A) subjects who refused to participate (n = 369), (B) subjects who were too ill or who had died prior to the screening (n = 72) and (C) subjects who had moved out of the study region or were not traceable (n = 23). Prevalence estimates specific for age and housing situation in responders and physicians' ratings of cognitive impairment were used to estimate the prevalence of dementia among non-responders.

*Results.* Group A differed from responders in age and housing situation, group B in age, housing and cognition, and group C only in age. Separate prevalence estimates of dementia based on age, housing and cognition yielded figures for group A between 4.9% and 7.2%, for group B between 13.1% and 19.1%, and for group C between 2.6% and 4.2%. Joined with the prevalence rate among responders (6.5%) the best possible point estimate of the prevalence of dementia in the target population lies between 6.4% and 6.9%, i.e. within the 95% confidence interval (CI) of the prevalence among responders (5.4–7.5%).

*Conclusions.* Although in this study non-response had no important influence on the overall prevalence, the findings among the distinct non-response subgroups point to the importance of describing non-response sociodemographically as well as in terms of the study objective. The authors recommend that non-responders are categorized into distinct groups based on the reason for non-response.

## 10. Vector diagnostics in dementia derived from Bayes' theorem

*Arnold B Mitnitski, Janice E Graham, Alexander J Mogilner, Kenneth Rockwood*
**Am J Epidemiol** 1997;146(8):665–71

This paper introduces the concept of vector diagnostics. In contrast to the conventional approach where one diagnosis takes precedence, the authors propose an alternative strategy that addresses the clinical reality of comorbidity and multiple diagnoses for an individual. Based on a Bayesian approach, the probability distribution for the etiologically heterogeneous dementia diagnoses is estimated from the Canadian Study of Health and Aging database. These data were collected between February 1991 and May 1992. This method facilitates the establishment of a probability for more than one diagnosis within a given individual. By analyzing the correspondence between diagnostic groups, it is demonstrated that some clinical diagnoses are not reliably distinguished on the basis of the considered subset of symptoms and signs. As a consequence, the conventional diagnostic categories might require revision. The resulting probabilistic algorithm allows for the mining of existing epidemiologic databases for patterns of signs and symptoms that characterize emerging diagnostic categories which might better account for the heterogeneity of the dementia subtypes and individual variability.

## 11. Prostate cancer screening in the midst of controversy: Canadian men's knowledge, beliefs, utilization, and future intentions

*Shawna L Mercer, Vivek Goel, Isra G Levy, Fredrick D Ashbury, Donald C Iverson, Neill A Iscoe*
**Can J Public Health** 1997;88(5):327–32

Despite controversy about prostate cancer screening, administrative data show that the use of prostate specific antigen (PSA) testing in Canada has increased. This study sought to determine awareness and knowledge of prostate cancer and screening, use to date, and future intentions to have a digital rectal examination (DRE) and PSA test among Canadian men aged 40 and over. Data were collected through a Canada-wide cross-sectional random digit dial telephone survey of 629 men. Awareness of DRE and PSA, use to date, and future intended use varied with age and education. Although only 9% of respondents had had PSA testing for screening, future intentions to undergo this test were higher than use to date. Knowledge of prostate cancer and screening controversies was low, and men received more information about PSA from the media than from doctors. Men would, therefore, benefit from age- and education-specific information regarding the factors to consider in making an informed choice about prostate cancer screening.

## 12. Factors important in promoting mammography screening among Canadian women

*Colleen J Maxwell, Jean F Kozak, Sheril D Desjardins-Denault, Jean Parboosingh*
**Can J Public Health** 1997;88(5):346–50

Among women aged 50 to 69 years, regular screening by mammography in combination with clinical examination, can substantially decrease the morbidity and mortality associated with breast cancer by facilitating early detection. Unfortunately, many Canadian women are not screened in accordance with current guidelines. Research to date is based primarily on large surveys conducted in the United States and less is known about the relevance of specific barriers to mammography screening among Canadian women.

Multivariate results from the 1994–95 National Population Health Survey (NPHS) indicate that younger (40–49) and older (70+) women, those who are socioeconomically disadvantaged, and minority women are least likely to report having had a mammogram. Conversely, women with positive health behaviours, high social support, and positive mental health attributes are more likely to participate in mammography screening. These findings are discussed in terms of the implications for developing successful intervention programs for Canadian women and for setting priorities for further research.

## 13. Effect of breast self-examination techniques on the risk of death from breast cancer

*Bart J Harvey, Anthony B Miller, Cornelia J Baines, Paul N Corey*
**Can Med Assoc J** 1997;157(9):1205–12

*Objective:* To measure the effect of breast self-examination (BSE) technique and frequency on the risk of death from breast cancer.

*Design:* Case-control study nested within the Canadian National Breast Screening Study (NBSS).

*Setting:* The Canadian NBSS, a multicentre randomized controlled trial of screening for breast cancer in Canadian women.

*Subjects:* The case subjects were 163 women who had died from breast cancer and 57 women with distant metastases. Ten control subjects matched by 5-year age group, screening centre, year of enrolment and random allocation group were randomly selected for each case subject.

*Exposure measures:* Self-reported BSE frequency before enrolment in the NBSS, annual self-reports of BSE frequency during the program and annual objective assessments of BSE technique.

*Outcome measures:* Odds ratios (ORs) associated with BSE practice were estimated by conditional multiple logistic regression modelling, which permitted control of covariates.

*Results:* Relative to women who, when assessed 2 years before diagnosis, examined their breasts visually, used their finger pads for palpation and examined with their 3 middle fingers, the OR for death from breast cancer or distant metastatic disease for women who omitted 1, 2 or 3 of these components was 2.20 (95% confidence interval [CI] 1.30 to 3.71, $p = 0.003$). The OR for women who omitted 1 of the 3 components was 1.82 (95% CI 1.00 to 3.29, $p = 0.05$), for those who omitted 2 of the 3 components, 2.84 (95% CI 1.44 to 5.59, $p = 0.003$), and for those who omitted all 3 components, 2.95 (95% CI 1.19 to 7.30, $p = 0.02$). The results remained unchanged after adjustment for potential confounders.

*Conclusion:* The results, obtained with the use of prospectively collected data, suggest that the performance of specific BSE components may reduce the risk of death from breast cancer.

## 14. Current and projected rates of hip fracture in Canada

*Emmanuel A Papadimitropoulos, Peter C Coyte, Robert G Josse, Carol E Greenwood*
**Can Med Assoc J** 1997;157(10):1357–63

*Objective:* To determine the current values and estimate the projected values (to the year 2041) for annual number of proximal femoral fractures (PFFs), age-adjusted rates of fracture, rates of death in the acute care setting, associated length of stay (LOS) in hospital, and seasonal variation by sex and age in elderly Canadians.

*Design:* Hospital discharge data for fiscal year 1993–94 from the Canadian Institute for Health Information were used to determine PFF incidence, and Statistics Canada population projections were used to estimate the rate and number of PFFs to 2041.

*Setting:* Canada.

*Participants:* Canadian patients 65 years of age or older who underwent hip arthroplasty.

*Outcome measures:* PFF rates, death rates and LOS by age, sex and province.

*Results:* In 1993–94 the incidence of PFF increased exponentially with increasing age. The age-adjusted rates were 479 per 100 000 for women and 187 per 100 000 for men. The number of PFFs was estimated at 23 375 (17 823 in women and

5552 in men), with a projected increase to 88 124 in 2041. The rate of death during the acute care stay increased exponentially with increasing age. The death rates for men were twice those for women. In 1993–94 an estimated 1570 deaths occurred in the acute care setting, and 7000 deaths were projected for 2041. LOS in the acute care setting increased with advancing age, as did variability in LOS, which suggests a more heterogeneous case mix with advancing age. The LOS for 1993–94 and 2041 was estimated at 465 000 and 1.8 million patient-days respectively. Seasonal variability in the incidence of PFFs by sex was not significant. Significant season-province interactions were seen ($p < 0.05$); however, the differences in incidence were small (on the order of 2% to 3%) and were not considered to have a large effect on resource use in the acute care setting.

*Conclusions:* On the assumption that current conditions contributing to hip fractures will remain constant, the number of PFFs will rise exponentially over the next 40 years. The results of this study highlight the serious implications for Canadians if incidence rates are not reduced by some form of intervention.

## 15. Injuries in a problematic socioeconomic context: a population-based study in Réunion, Indian Ocean, 1993–1994

*Françoise Masson, Marianne Savès, L Rachid Salmi, Arnaud Bourdé, Guy Henrion, Philippe Erny*
**Int J Epidemiol** 1997;26(5):1033–40

*Background.* This study was designed to estimate the incidence and describe the characteristics of injuries during a one-year period in the French island of Réunion, Indian Ocean, a defined geographic population with socioeconomic problems.

*Methods.* Cases were injuries from accidents (unintentional injuries), self-inflicted injuries (suicides and attempted suicides), or injuries purposely inflicted by other people, that resulted in hospital admission or death. Patients and injury characteristics were recorded prospectively, alternately every other week, in all emergency rooms on the island; all death certificates were studied.

*Results.* The overall annual incidence of injuries was 1578 per 100 000 residents. The three main causes of injury were (i) falls on the same level (23.6%), (ii) poisoning (23.0%) and (iii) traffic accidents (21.5%). Of the traffic accident cases, 44% were motorcyclists (mostly mopeds) and more than half of the cases were 15–25 years old. Suicides and attempted suicides accounted for 80.9% of poisonings, 35.5% of immediately fatal injuries, and 19.6% of non-fatal injuries. Homicides and assaults accounted for 8.3% of all injuries. The employment rate was lower for injured patients than in the total Réunion population (standardized ratio for males: 74; $P < 0.001$). Half of the injured hospitalized patients had an Injury Severity Score $< 5$ and 8 days after hospitalization, 83.5% of patients had returned home.

*Conclusion.* Injury epidemiology may be affected by different demographic, socioeconomic, cultural and geographical factors. Targeted studies are therefore necessary to guide injury prevention measures.

### 16. Incidence and mortality of neuroblastoma in Canada compared with other childhood cancers

*Ru-Nie Gao, Isra G Levy, William G Woods, B Ann Coombs, Leslie A Gaudette, Gerry B Hill*
**Cancer Causes Control** *1997;8:745–54*

The incidence and mortality of neuroblastoma was reviewed in the general context of childhood cancer in Canada for the periods 1982–86 and 1987–91. This was done to complement the preliminary work of the Quebec Neuroblastoma Screening Project that is studying the impact of screening North American infants for the preclinical detection of neuroblastoma on population-based mortality. Annual age-standardized incidence rates for all childhood cancer in Canada appear to have declined slightly (nonsignificantly) from 155.1 to 150.8 per million, between 1982–86 and 1987–91; the rates for neuroblastoma were stable between the two five-year periods (11.8 per million in 1982–86 and 11.4 per million in 1987–91). With respect to mortality, the age-standardized rates for childhood cancer in Canada have shown a declining trend between the first and second halves of the decade, from 43.4 to 34.7 per million, while the rates for neuroblastoma have not changed (4.4 and 4.2 per million). The age-specific distributions of incident cancers indicate that neuroblastoma accounts for the greatest proportion of all cancers in children less than one year of age. Similarly, neuroblastoma is the leading cause of cancer deaths in children aged one to four years. Theoretically, infants less than one year of age could benefit most from effective preventive interventions, treatment, and research.

### 17. Quantifying the future impact of disease on society: life table-based measures of potential life lost

*Wen-Chung Lee*
**Am J Public Health** *1997;87(9):1456–60*

*Objectives.* Quantifying health status in human populations by means of an index such as "years of potential life lost" has recently received attention. However, such an index, being cross-sectional in nature, only measures the current burden to society resulting from a specific cause of death.

*Methods.* The author proposes new indices of potential life lost to quantify future impacts on society of particular causes of death. These indices also properly reflect the effects of competing risks. The computation is simple, requiring no more than a standard life-table calculation. Real-world as well as hypothetical data are used to illustrate the method.

*Results.* The new indices convey valuable health status information about a population that is not revealed by traditional indices.

*Conclusions.* The new indices are promising alternatives as measures of future potential life lost.

### 18. Age and depression in a nationally representative sample of Canadians: a preliminary look at the National Population Health Survey

*Terrance J Wade, John Cairney*
**Can J Public Health** *1997;88(5):297–302*

There are considerable inconsistencies in the literature concerning the relationship between age and depression. Recently, however, two independent studies in the U.S. have shown that the distribution is U-shaped with the lowest reported levels of depression at ages 45–49. Three reasons for past inconsistencies are identified and addressed using the 1994 National Population Health Survey by Statistics Canada. Using both a distress scale and a diagnostic measure, a substantially different relationship was found. The prevalence of distress decreased steadily with age until about 65, with only a slight increase afterwards for both males and females. After the introduction of several sociodemographic covariates, however, this relationship was clearly negative. These findings are discussed in terms of future research questions.

### 19. Predictors of dietary intake in Ontario seniors

*Heather H Keller, Truls Østbye, Elizabeth Bright-See*
**Can J Public Health** *1997;88(5):305–9*

This study determined the independent association of 24 risk factors with dietary intake in community-living seniors. The study sample was 5,073 seniors for whom complete data were available from the 1990 Ontario Health Survey. Risk factors were items completed on an interviewer-administered health questionnaire. Diet Score, Mean Adequacy Ratio and energy were the diet outcomes derived from a self-administered food frequency questionnaire. The independent association of risk factors with these diet outcomes was assessed with multiple linear regression analyses. Factors that were consistently and positively associated with diet outcomes included: education, income, social support, perceived health status, belief in the nutrition/health link, dependence in walking and vision. Factors that were consistently and negatively associated with diet outcomes included: chewing status, dentition, hearing, level of happiness and body mass index. These results provide a basis for the development of a screening tool for the identification of "at risk" subgroups of seniors.

### 20. Self-reported cardiovascular disease and risk factors: prevalence in Ontario among women 50 and older

*Corinne Hodgson, Ellen Jamieson*
**Can Fam Physician** *1997;43:1747–52*

*Objective.* To determine the prevalence of self-reported cardiovascular disease and risk factors among Ontario women aged 50 and older.

*Design.* Analysis of the 1990 Ontario Health Survey, a population-based, cross-sectional survey.

*Setting.* Ontario communities.

*Participants.* Residents of Ontario communities during 1990 who responded to the 1990 Ontario Health Survey (61 239 respondents in 35 479 households), weighted to represent the population of Ontario.

*Main outcome measures.* Reported heart disease, hypertension, diabetes, height and weight, physical activity, and smoking habits.

*Results.* Nearly 11% of women aged 50 and older report "heart disease"; 24.9% hypertension, and 5.4% diabetes. Women were less likely than men to smoke daily, to smoke 25 or more cigarettes a day, and to be overweight, but were more likely to have lower levels of physical activity.

*Conclusions.* The prevalence of self-reported heart disease and medical and lifestyle risk factors for heart disease is relatively high among Ontario women aged 50 and older. Physicians and public health officials must keep women in mind when designing or implementing programs or services for heart disease.

# *Calendar of Events*

**February 6–7, 1998**
**Toronto, Ontario**

"Better Breathing '98"
Annual Scientific Conference on Respiratory
  Health of The Ontario Thoracic Society

*Information*
The Ontario Thoracic Society
201 – 573 King Street East
Toronto, Ontario  M5A 4L3
Tel:    (416) 864-9911
Fax:    (416) 864-9916
E-mail: ots@titan.tcn.net
Web site: http://www.on.lung.ca

**February 19–21, 1998**
**Vancouver,**
 **British Columbia**

4th International Multidisciplinary Qualitative
  Health Research Conference

*Information*
Dr Joan L Bottorff
School of Nursing
T201 - 2211 Wesbrook Mall
University of British Columbia
Vancouver, BC  V6T 2B5
Fax:    (604) 822-7466
E-mail: qhrconf98@nursing.ubc.ca

**February 26–28, 1998**
**Orlando, Florida**
**USA**

15th Annual International Breast Cancer
  Conference

*Information*
Lois Osman
Program Co-ordinator
Miami Cancer Conference, Inc.
Tel/Fax:     (305) 447-3804

**April 2–5, 1998**
**San Francisco, California**
**USA**

"Prevention 98: Translating Science into Action"

*Information*
American College of Preventive
 Medicine
1660 L Street NW, Suite 306
Washington, DC
USA  20036-5603
Tel:    (202) 466-2044
Fax:    (202) 466-2662
E-mail: prevention@acpm.org
Web site: www.acpm.org

**April 21–23, 1998**
**Vancouver,**
 **British Columbia**

"The Role of Cancer Registries in Cancer
  Surveillance and Control"
Annual Meeting of the North American
  Association of Central Cancer Registries
Hosted by the British Columbia Cancer Registry

*Information*
Venue West Conference Services Ltd
645 – 375 Water Street
Vancouver, BC  V6B 5C6
Tel:    (604) 681-5226
Fax:    (604) 681-2503

**April 22–24, 1998**
**Graz, Austria**

6th International Symposium: Epidemiology and
  Occupational Risks
Organized by the International Research
  Section of the International Social Security
  Association (ISSA)

*Information*
Symposium Secretariat
Allgemeine Unfallversicherungsanstalt
Kongressbüro
Adalbert-Stifter-Strasse 65
A-1200 Vienna, Austria
Tel:    +43-1-33 111 537
Fax:    +43-1-33 111 469
E-mail: presse@auva.or.at

| April 26–29, 1998<br>Lucerne, Switzerland | UICC Breast Cancer Meeting<br>International Meeting on the Psycho-social<br>Impacts of Breast Cancer | *Information*<br>Jeanne Froidevaux<br>Swiss Cancer League<br>Effingerstrasse 40, CH-3001<br>Berne, Switzerland<br>Tel:    +41 31 389 91 14<br>Fax:    +41 31 389 91 60<br>E-mail: froidevaux@swisscancer.ch<br>Web site: http://www.swisscancer.ch |
|---|---|---|
| April 27–28, 1998<br>Ottawa, Ontario | 1998 Canadian Pharmacoepidemiology Forum<br>Canadian Association for Population<br>  Therapeutics<br>*Call for abstracts—deadline: **February 1, 1998***<br>(April 26: session on "Risk Communication") | *Information*<br>Ineke Neutel<br>Bureau of Drug Surveillance<br>Therapeutics Program, Health Canada<br>Ottawa, Ontario<br>Tel:    (613) 954-6788<br>Fax:    (613) 957-0335<br><br>*Abstracts to*<br>Kathryn Gaebel<br>143 James Street South<br>6th Floor, Undermount Bldg<br>Hamilton, Ontario  L8P 3A1<br>Tel:    (905) 522-1155, ext 4901<br>Fax:    (905) 521-6129<br>E-mail: gaebelk@fhs.scu.mcmaster.ca |
| April 27–30, 1998<br>Tampa, Florida<br>USA | 1998 CDC – Diabetes Translation Conference<br>Centers for Disease Control and Prevention | *Information*<br>Margaret R Hurd<br>Centers for Disease Control,<br>NCCDPHP, DDT<br>4770 Buford Hwy NE, Mailstop K-10<br>Atlanta, Georgia<br>USA  30341-3724<br>Tel:    (770) 488-5505<br>Fax:    (770) 488-5966<br>E-mail: mrh0@cdc.gov |
| May 17–20, 1998<br>Amsterdam,<br>  The Netherlands | 4th World Conference on Injury Prevention<br>  and Control | *Information*<br>Conference Secretariat<br>Van Namen & Westerlaken Congress<br>  Organization Services<br>PO Box 1558, 6501 BN NIJMEGEN,<br>The Netherlands<br>Tel:    (31-24) 3234471<br>Fax:    (31-24) 3601159<br>E-mail: reg.fowoco.nw@prompt.nl |
| June 7–10, 1998<br>Montreal, Quebec | "Best Practices in Public Health: An Essential<br>Contribution, A Promising and Exciting Future"<br>  Canadian Public Health Association<br>  89th Annual Conference<br>Co-sponsored by the *Association pour la santé<br>  publique du Québec* | *Information*<br>CPHA Conference Department<br>400—1565 Carling Avenue<br>Ottawa, Ontario  K1Z 8R1<br>Tel:    (613) 725-3769<br>Fax:    (613) 725-9826<br>E-mail: conferences@cpha.ca |

**Boston, Massachusetts**
**USA**
**August 15–19, 1998**

10th Conference of the International Society for
Environmental Epidemiology and
8th Conference of the International Society
of Exposure Analysis
*Call for abstracts—deadline: **January 31, 1998***

*Information*
Carol Rougvie, Conference Secretariat
JSI Research and Training Institute
44 Farnsworth Street
Boston, Massachusetts
USA  02210-1211
Tel:    (617) 482-9485
Fax:    (617) 482-0617
E-mail: isee&isea98@jsi.com
Web sites:
http://www.med.ualberta.ca/PHS/ISEE
http://www.iit.edu/~butler/isea

## Editorial Committee