THE ECONOMIC COSTS OF MENTAL DISORDERS AND ALCOHOL, TOBACCO, AND ILLICIT DRUG ABUSE IN ONTARIO, 2000:

A Cost-of-Illness Study

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Executive Summary

This Cost of Illness (COI) study estimates the economic costs, from a societal perspective, of mental disorders, alcohol abuse, tobacco abuse, and illicit drug abuse for Ontario for the calendar Year 2000. Mental disorders are defined according to the International Classification of Disease, 9th edition, clinical modification (ICD-9-CM) (U.S. Department of Health and Human Services, 1995), and include disorders defined by ICD-9-CM codes 291.xx – 319.xx, excluding dementia. We defined substance abuse as any substance use that results in a net social cost beyond the resource cost to provide the substance. This definition includes the continuum of risk associated with substance use.

Based upon the assumptions of the main approach, the total economic cost attributable to mental disorders and substance abuse in Ontario in the Year 2000 was $33,857, million ($33.9 billion) dollars. The costs associated with productivity losses comprised the majority of these costs at $ 28,704 million dollars. The **total economic costs** of mood disorders, of minor depression and anxiety disorders, and of severe mental illness were $12,539 million, $7,559 million, and $1,615 million dollars respectively. Among economic costs attributable to substance abuse, the costs associated with tobacco abuse were the largest at $4,954 million dollars, followed by $4,046 million attributable to alcohol abuse, and $2,670 million attributable to illicit drug abuse.

The **total direct** cost of mental disorders and substance abuse was $5,153 million dollars. The direct cost of substance abuse in Ontario 2000 was $3,035 million dollars, higher than the direct cost of mental disorders at $2,118 million dollars. The main cost components accounting for this substantial difference were the costs of law enforcement, which for substance abuse were estimated to be $2,049 million, compared to $308 million dollars attributable to mental disorders.

The direct cost attributable to alcohol abuse was the highest of any diagnostic group at $1,487 million, primarily because of the $1,141 million in law enforcement costs. The total direct cost attributable to illicit drug abuse was $1,003 million dollars, with almost $909 million dollars of this total related to law enforcement costs. The total direct costs attributable to tobacco abuse were $546 million dollars, with $407 million dollars (74.6%) of this sum due to the costs associated with hospitalization. Among mental disorder groupings, severe mental illness had the largest attributable direct cost at $641 million dollars, with health care costs comprising $505 million (79%) of this cost.

The total **direct health care** cost attributable to mental disorders and substance abuse was $2,395 million. The costs associated with acute care hospitalizations comprised the largest cost within health care at $855 million dollars, followed by the costs of prescriptions drugs ($413 million), community mental health services ($411 million dollars) and physician services ($334 million dollars). The total direct health care costs attributable to mood disorders, severe mental illness and minor depression and anxiety disorders were $536 million, $505 million, and $418 million dollars, respectively. Among substance abuse, tobacco abuse was associated with the highest total direct health care cost at $428 million dollars, followed by alcohol abuse ($262 million) and illicit drug abuse ($85 million).

Among the estimated **productivity losses**, the costs attributable to morbidity were 26 times greater than the costs attributable to premature mortality. The long-term productivity losses associated with mood disorders were $11,665 million dollars, and comprised more than one-third of the total economic costs attributed to all mental disorders and substance abuse in Ontario.

Based upon sensitivity analyses that changed the assumptions used to value productivity losses, the lower bound of the total economic costs of mental disorders and substance abuse in Ontario in 2000 was $6.2 billion dollars, and the upper bound was $ 55.3 billion dollars.

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The investigators also gratefully acknowledge the collaboration of the investigators involved in the Second Canadian Study on the Social Costs of Substance Abuse, completed in 2006, with Dr. Jurgen Rehm as the Principal Investigator, under the umbrella of the Canadian Centre on Substance Abuse (CCSA). Two investigators of this study were collaborators on the CCSA project, and the sharing of data and methodologies was invaluable and contributed jointly to these projects. In particular, participation in the CCSA project allowed the current study to benefit from updated information on the epidemiology and attributable fractions of numerous health conditions related to substance abuse.

The authors are also grateful for reviews of the original research protocol from Dr. Carolyn Dewa, from two anonymous reviewers, and from Dr. Eric Single. Dr. Carolyn Dewa facilitated access to data from the Community Mental Health Evaluation Initiative. However, remaining errors or omissions in this report are the responsibility of the investigators alone.

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CHAPTER 1: INTRODUCTION

Background

Mental health problems and substance abuse[1] contribute substantially to the overall disease burden of developed and developing countries, and this burden will increase over the next two decades (Murray & Lopez, 1996). A National Institute of Mental Health study in 1990 estimated the total annual cost of mental illness in the United States to be $148 billion (National Mental Health Advisory Council, 1993); in 1992 the total annual cost in the U.S. of alcohol dependence and abuse alone was approximately $148 billion, while drug abuse and dependence cost an estimated $98 billion (Holland & Mushinski, 1999). Of the 15 leading causes of disability in developed countries, five are mental health or substance-related problems: 1) unipolar major depressive disorder, 2) alcohol abuse, 3) schizophrenia, 4) self-inflicted injuries, and 5) bipolar disorder. Mental disorders and substance abuse are projected to comprise 15% of the global disease burden by the year 2020 (Murray & Lopez, 1997). Tobacco-attributable mortality accounts for approximately one in six deaths in Canada (Single, Robson, Rehm, Xie, & Xi, 1999). In light of demographic changes, changing family structures, rising rates of urbanization, migration and mobility, and alcohol and drug abuse, the risks for mental disorders will certainly increase.

The growing disease burden associated with mental disorders and substance abuse creates challenges for governments and policymakers responsible for the provision of mental health and substance abuse services, for allocating research funding, and for anticipating future needs and costs (Ustun, 1999). The economic cost implications of the rising burden of mental illness and

[1] Consistent with other recent cost-of-illness studies, we define substance abuse as any substance use that results in a net social cost beyond the resource cost to provide the substance. This definition includes the continuum of risk associated with substance use, and acknowledges that hazards, harm, and problems associated with substance are greater than the costs associated with the dependence or abuse disorders defined in the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV).

substance abuse for the Province of Ontario are not clear. Understanding the current costs of mental illness and substance abuse is vital if intermediate and long-term program and policy decisions are to be well-informed and proactive. Unfortunately, comprehensive cost data for mental disorders in Ontario have never existed, and cost data related to substance abuse in Ontario are outdated. Recognizing this knowledge gap, the Ontario Ministry of Health and Long-Term Care (MOHLTC) through the Ontario Mental Health Foundation sponsored a multi-disciplinary team of scientists to conduct a Cost-of-illness study of mental disorders and substance abuse in Ontario.

Previous Studies

Xie et al. (Xie, Rehm, Single, & Robson, 1996) estimated the respective costs of alcohol, tobacco, and illicit drug abuse in Ontario in 1992 to be $2.86, $3.68, and $0.49 billion dollars. The total indirect costs of substance abuse in Ontario were estimated to be $4.48 billion dollars. This research represented the first comprehensive estimates of costs of substance abuse using Cost-of-illness methodology (based on the human capital method) that conforms to guidelines recommended by the International Symposium on the Economic and Social Costs of Substance Abuse (Single et al., 2002). This research provides an important reference point for analyses related to substance abuse in the current study. No previous studies have estimated the comprehensive costs of mental disorders in Ontario from the societal perspective.

Objectives and Research Questions

The overarching objective of this study was to conduct a COI study of mental disorders, tobacco abuse, alcohol abuse, and illicit drug abuse in Ontario – from the societal perspective. In meeting this objective we sought to answer the following research questions:

A. What economic costs at the societal level are attributable to mental disorders and substance abuse? Specifically, what are the direct and indirect costs? What are the health care costs?

B. How many deaths and hospitalizations are caused by mental disorders and substance abuse each year?

C. Which social groups (by age and gender) incur the greatest costs?

D. Which types of problems (mental disorders, or alcohol, tobacco, or substance abuse) involve the greatest costs?

CHAPTER 2: METHODS FOR ESTIMATING COSTS ATTRIBUTABLE TO MENTAL DISORDERS AND SUBSTANCE ABUSE

Overview and Definitions

This COI study estimates the economic costs of mental disorders, alcohol, tobacco, and illicit drug abuse for Ontario in the calendar year 2000. Mental disorders are defined according to the International Classification of Disease, 9th edition, clinical modification (ICD-9-CM) (U.S. Department of Health and Human Services, 1995), and include disorders defined by ICD-9-CM codes 291.xx – 319.xx, excluding dementia. However, most data sources for this study do not contain fully validated diagnostic information. Accordingly, for most cost analyses we apportioned costs by diagnostic groupings. The baseline approach, similar to that used in a 1994 Manitoba study (Tartaryn, Mustard, & Derksen, 1994) apportioned these costs by 3-digit ICD-9-CM codes into seven groups:

1. Severe mental illness, including schizophrenia and pervasive developmental disorders (codes 295, 297-299);
2. Mood disorders (unipolar major depression or bipolar disorders) (codes 296, 311);
3. Minor depression and anxiety disorders (codes 300, 301, 306-309);
4. A heterogeneous group of other mental disorders (codes 293, 294, 302, 310, 312-319) including paediatric behavioural disorders, organic mental disorders, and mental retardation.
5. Alcohol-induced disorders and alcohol abuse and dependence (codes 291, 303);
6. Tobacco abuse (305);
7. Other substance-induced disorders and substance abuse and dependence (codes 292, 304);

These groupings are meaningful for policy purposes, but also reflect the limitations of clinical diagnostic accuracy inherent in most data sources. The main limitation of these diagnostic groupings is that some costs related to mood disorders may have been attributed to the minor depression and anxiety disorder groupings. This reflects the wide variability in administrative coding of this disorder in the data sources used for the costing analyses.

For the purposes of costing, substance-related costs were expanded beyond those related to a substance use disorder as defined by the DSM-IV in order to include any use of substances that created a social cost (excluding the purchase price or resource cost for the provision of that substance)[2]. A social cost occurs if the community incurs a cost (net of the acquisition cost) as the result of drug use. This definition is consistent with international guidelines (Single et al., 2002), conforms to past and recent COI studies (Single et al., 1998; Xie et al., 1996; Rehm et al, 2006), and acknowledges that the significant consequences of "abuse" are not limited to those associated with dependence or heavy use. In this report we use the term "substance abuse" to reflect this wide range of consequences. Data sources used to estimate the costs in this study are summarized in Table 1 at the end of this report.

General Economic Assumptions

Underlying COI studies are fundamental decisions that determine what to consider as costs. This study adopted the societal perspective. From that perspective, all relevant costs related to mental disorders are counted, irrespective of who bears them. However, the definition of substance abuse above implies that the resource costs for the production and provision of the substance of abuse are not included. Another perspective common in COI studies is the governmental perspective, confined to costs (expenditures) borne directly by government for

[2] The definition of social costs used here is closely related to the concept of externality (or an external cost) as used in Economics.

health services, income support, and administrative and capital costs attributable to mental disorders and substance abuse. The costs of lost productivity are thus excluded. The governmental and societal perspectives diverge on how disability payments (such as Canada Pension Plan disability or the Ontario Disability Support Program) are counted. From the government's perspective, disability payments are a direct cost, since if the illness did not occur, the transfer payments could be used for other purposes (Manning, Keeler, Newhouse, Sloss, & Wasserman, 1991; Rupp et al., 1993). From the societal perspective, the cost of illness is not the disability payment itself, but the underlying loss of productivity (earnings) it seeks to compensate. Including transfer payments in societal cost of illness estimates would result in double counting – counting both the individual's lost productivity, and the redistribution of society's resources to compensate the individual for the loss. While this study conducted costing from the societal perspective, we also estimated the cost of some government transfers, and employed separate methods to estimate these costs.

Costs can be divided into direct and indirect costs. Direct costs reflect the value of goods and services for which payment was made and resources used that could have been used for other purposes. Indirect costs represent the value that society places upon "life" and "health". To calculate indirect costs, we adopted a modified form of the human capital (HC) approach (Hodgson, 1983), described below. The pros and cons of the HC approach, compared to willingness-to-pay methods (the major alternative), are not discussed at length in this report, but have been described in numerous other settings. This study focuses on net rather than gross costs of substance abuse. The abuse of substances involves benefits as well as costs -- for example, moderate levels of alcohol consumption are associated with decreased rates of coronary artery disease (English et al., 1995). In recognition of this, the costs associated with substances were computed to be net of the benefits they incur.

This COI study is prevalence-based, (Rice, Hodgson, & Kopstein, 1985), and examines the costs related to mental disorders and substance abuse that occurred in Ontario in the calendar Year 2000. The Year 2000 was chosen because it is the most recent year for which relevant data were fully available. Inevitably, some cost data based upon earlier and subsequent years have been used; these costs were inflated or deflated to the base year using either the general or the salary component of the Canadian Price Index.

Where more than one plausible cost estimate was available, we generally adopted a conservative approach and selected the lower estimate. In cases where there is considerable uncertainty or controversy regarding attributable costs (for example, the impact of depression on mortality following myocardial infarction), we assumed that the economic costs were zero.

Discounting

To reflect the fact that individuals and society have a positive rate of time preference (i.e., they prefer desirable benefits to occur earlier, and adverse events (costs) to occur later in time) (Lipscomb, Weinstein, & Torrance, 1996), future productivity losses related to mortality have been discounted. The proper discount rate is controversial, and the controversy has not been resolved empirically, or by economic theory (Frederick, Loewenstein, & O'Donoghue, 2002; Krahn & Gafni, 1993; Lipscomb et al., 1996). To maximize the comparability of the proposed research with other Canadian economic evaluations, we followed the guidelines established by the Canadian Coordinating Office for Health Technology Assessment (Canadian Coordinating Office for Health Technology Assessment, 1997), and used 5% as the (real) discount rate for the baseline analysis. We conducted sensitivity analyses at 3% and 7%. The lower and upper bounds of the sensitivity analysis incorporate uncertainty in the “correct” discount rate, and using 3% facilitates comparisons with economic evaluations that follow the Washington (U.S.) panel guidelines (Lipscomb et al., 1996). The proposed range of discount values also overlaps

with international guidelines for the conduct of economic evaluations of substance abuse (Single et al., 2002).

DIRECT COSTS:

Psychologists, Social Workers, and Other Non-physician Mental Health Services

The number of non-physician mental health services used by Ontarians in 2000 was estimated by analyzing data from the Canadian Community Health Survey Cycle 1.2 (CCHS c1.2), a population-based, provincial-level survey of mental health disorders and substance-related problems including dependence, sociodemographic characteristics, labour market activity, and related mental health service utilization of household respondents residing in all provinces. The survey identified mental disorders and substance abuse by the Composite International Diagnostic Inventory (CIDI), a survey instrument administered by lay interviewers that generates valid diagnoses of mental disorders and substance abuse[3] according to the Diagnostic and Statistical Manual of Mental Disorders, a classification system that can be related to the ICD-9-CM. The CCHS c1.2 also asked respondents to recall the number of visits that they made to a variety of health providers, including physicians, psychologists, social workers, psychotherapists, nurses, and spiritual or religious advisors. We used multiple regression techniques to estimate the number of visits attributable to mental disorders or substance abuse. To eliminate double counting of visits due to co-morbid conditions, we took the difference between predicted mean number of visits with and without the particular mental disorder or substance abuse, controlling for other co-occurring conditions and patient characteristics. The per-visit unit costs of non-physician services by provider type were estimated from Statistics Canada figures on the average hourly wage by occupation (Statistics Canada, 2000). The total

[3] Due to an omission in the CCHS c1.2 survey instrument, the diagnostic information from resulting data do not correspond precisely to the DSM-IV criteria for substance use disorders (abuse or dependence).

cost of these services was obtained as a product of the number of visits and unit cost of services by a particular provider.

Primary Care and Specialty (Non-Psychiatrist) Physician Services

Previous claims analyses in Ontario have demonstrated that the majority of mental health services in the Province are delivered by fee-for-service (FFS) primary care physicians (Lin & Goering, 2000a; Lin & Goering, 2000b). To estimate the costs associated with these claims in Ontario, we analyzed the comprehensive Ontario Health Insurance Plan (OHIP) FFS claims database maintained at the Institute for Clinical Evaluative Sciences (ICES). For this study, claims were classified as mental health or substance-related claims if the service code unambiguously identified that the service was related to mental health or substance abuse, or if the claim included a 3-digit International Classification of Disease, 9th edition, clinical modification (ICD-9-CM) (U.S.Department of Health and Human Services, 1995) diagnostic code for mental disorders (i.e., ICD-9-CM codes 291-293, 294-319), excluding dementia, and the visit or service type *could plausibly* be related to mental health or substance use. The latter scenario would occur, for example, if a claim submitted by a primary care physician for an intermediate assessment also contained a ICD-9 diagnostic code of 296 (major affective disorder). This approach to identifying mental health services is conservative because anecdotal evidence suggests that physicians may sometimes submit claims for mental health services with ambiguous or non-mental health diagnoses out of concern for patient stigma and confidentiality.

Studies of claims data in the United States and Saskatchewan suggest that claims-based mental health diagnoses are valid, (Melfi & Croghan, 1999; Rawson, Malcolm, & D'Arcy, 1997; Steinwachs et al., 1998; Walkup, Boyer, & Kellermann, 2000). However, no previous Ontario-based research establishes the validity of mental health or substance abuse diagnostic

information on claims, and accordingly we were not able to fully apportion these claim costs by precise clinical diagnoses. Instead, as described earlier, we distributed costs by seven meaningful diagnostic groupings, similar to those used by Tartaryn et al.(1994). The seven groups are defined by 3-digit ICD-9-CM codes on page 12 above. Unit costs for each visit type or procedural code were taken from the charges included in the OHIP data, and are based upon the MOHLTC Schedule of Benefits for FFS physicians in Ontario (Ministry of Health and Long-Term Care, 2001b).

Psychiatrists' Services

In Ontario, psychiatrists are either employed directly by hospitals or outpatient programs, or they bill the government for their services. The costs of professional services for psychiatrists employed in hospitals and programs are included in the operating budgets of hospitals, and were not estimated separately. To ascertain the costs of psychiatrists' services billed through the Ontario Health Insurance Plan, we used algorithms developed at ICES to identify psychiatrists. This identification file was then used to identify and aggregate psychiatrists' claims for the year 2000. We derived costs and apportioned costs by diagnostic groupings using the methods specified in the preceding section.

Community Mental Health Care

Community mental health care in Ontario includes a wide range of programs including assertive community treatment teams, case management, and self-help support programs, supportive housing, crisis intervention, and clubhouses. Costs for community mental health care were obtained from budgetary data provided by the MOHLTC. Data limitations prevented us from allocating costs according to program type. To attribute community mental health care costs by diagnostic grouping, we used client-specific longitudinal data on diagnosis, community health care service use, and costs collected by the Community Mental Health Evaluation Initiative

(CMHEI). The CMHEI was a set of multi-site longitudinal observational studies that evaluated the effectiveness of three different types of community mental health services and supports (case management, self-help initiatives, and crisis intervention) in Ontario. Although community mental health services participating in the CMHEI were not chosen at random (and therefore may not be representative of all such services in Ontario), in the absence of other data sources we assumed that the client data obtained through CMHEI were representative of all Ontario community health care services for 2000.

Specialized Substance Abuse Programs

In Ontario, most substance abuse treatment is provided by approximately 200 specialized services administered by 150 separate agencies. These services include assessment, withdrawal management, community treatment, day treatment, residential treatment, and residential support. The operating costs of these agencies were made available through Ministry budgetary documents and provided separately for non-residential, residential, and withdrawal management services. Due to data limitations we were unable to apportion these costs by type of service, or for alcohol or other drugs separately.

Acute Care (General) Hospitals

To determine the costs of mental disorders and substance abuse associated with general hospitals, we analyzed comprehensive data on the number of separations and inpatient days in Ontario acute care hospitals from the Canadian Institute for Health Information (CIHI) Discharge Abstract Database (DAD) during the calendar year 2000. Hospital separations, wholly or mostly attributable to mental disorders or substance abuse, were identified using the CIHI variable *Most Responsible Diagnosis (MRD)*, which contains a 4-digit ICD-9-CM code. For these separations, we assumed that all the hospital costs were attributable to the MRD. Inpatient

stays related to general medical conditions arising from tobacco, alcohol, or illicit drug abuse were also identified using the MRD.

Hospital cost estimation for substance abuse would be incomplete using only hospital stays that are "directly" related to substance abuse (i.e., hospital separations that are coded with substance-related diagnoses). A large number of general health conditions are known to be caused indirectly by substance abuse (English et al., 1995), where there are multiple causes of the health condition, or the delay between substance abuse and hospitalization for the health condition is prolonged. To estimate these "indirect" hospitalization costs, we adopted and updated the method of Single and colleagues (Single, Rehm, Robson, & Truong, 2000), who estimated the aetiological fraction of causes of separate diseases and injuries (categorized by ICD-9 chapter) attributed to substance abuse (for different levels of abuse) combined with prevalence data on the number of persons consuming at different levels. Estimates of aetiological fraction for separate diseases were calculated according to the following general formula:

$$Aetiological\ fraction = \left[\frac{P_0 + P_1(RR_1) - 1}{P_0 + P_1(RR_1)} \right],$$

where P_0 and P_1 are the prevalence rates of non-abusers and abusers, respectively, and RR_1 is the relative risk of a disease or injury for abusers relative to non-abusers. This formula can be modified to account for different levels of use (English et al., 1995). Measures of relative risk for each gender and 5-year age category were developed by syntheses of exhaustive pooled analyses of these risks from several published international sources (English et al., 1995; Fox, Merrill, Chang, & Califano, Jr., 1995; Makomaski Illing & Kaiserman, 1999).

The analyses developed in Single et al. were updated by Rehm (Rehm et al., 2006), based upon a review of new studies that may materially change the calculation of aetiological fraction for specific diseases and injuries attributable to alcohol and illicit drugs. For tobacco, we relied on updated estimates that have recently been created by Rehm and collaborators (Rehm et al., 2006), who updated several measures of relative risk, taking into account, among other studies, emerging evidence on the effects of environmental tobacco smoke.

The cost per hospital day by diagnosis was derived from the Ontario Case Costing Initiative (OCCI), a comprehensive fully distributed costing dataset based upon a sample of 10 acute care hospitals in Ontario in fiscal 2000/2001, with costs assigned according to the ICD9-CM. To obtain total hospitalization costs by diagnosis, we multiplied the aggregate total bed-days per diagnosis from the DAD by the matching per-diem cost by diagnosis from the OCCI.

Provincial Psychiatric Hospitals

Hospitalization data pertaining to Provincial Psychiatric Hospitals were obtained from Canadian Institute for Health Information's (CIHI) Hospital Mental Health Data Base (HMHDB) for the calendar Year 2000 according to the International Classification of Diseases version 9 (ICD9). The Hospital Mental Health Database is a national database containing information on separations involving mental illness and substance abuse from Canadian psychiatric and general hospitals. It combines two data sources – psychiatric hospitals from the Hospital Mental Health Survey as well as general hospitals extracted from the CIHI Hospital Morbidity Database. Based on this data, the numbers of inpatient days and the distribution of inpatient days by gender, ICD-9 diagnosis and age group were estimated for the six diagnostic groupings described earlier. Data obtained from the HMHDB included only psychiatric facilities in Ontario that did not report to the Discharge Abstract Database during calendar 2000, eliminating potential overlap between the two databases.

In the absence of cost data related to Provincial Psychiatric hospitals, we used unit costs per hospital day derived from the OCCI (Ontario Case Costing Initiative) in fiscal 2000/2001. Although the OCCI is sourced from a sample of acute care hospitals and not psychiatric hospitals, we assumed that the per diem costs for specific mental disorder and substance diagnoses are comparable between acute general hospitals and provincial psychiatric hospitals, and calculated total hospitalization costs by diagnostic grouping as a product of aggregate bed days and the per diem cost, matched by diagnostic code.

Residential Care Facilities (RCFs)

Hospitalizations data by diagnostic assessment category, age and gender for Ontario's residential care patients were obtained from CIHI's CCRS (Chronic Care Report System) data base. The CCRS contains data from three different bed/hospitalization settings: freestanding complex continuing care facilities; acute care hospitals with a wing or ward dedicated to chronic care; or small hospitals with a few chronic care beds as part of a larger unit. Diagnostic information in the CCRS data base is based on the Resident Assessment Instrument Minimum Data Set Version 2.0 (MDS 2.0) The MDS 2.0 documents only a limited number of clinical mental disorders, and excludes substance abuse. To attribute costs by diagnostic group we took the number of hospital days for a given diagnosis, age group and gender, and multiplied by the MIS-derived unit cost.

Per diem costs were derived as the daily per bed cost using the "total expense" category by hospital type from the MIS data base. The total cost for all CCRS hospitalizations was obtained as a product of daily unit cost by hospital type based on MIS and the CCRS utilization.

Drug Costs

Appendix Table A10_1 presents a classification of drugs used in the treatment of mental disorders and substance abuse in Ontario. To estimate total Ontario drug costs, we obtained validated market data from IMS Canada's Canadian Drug Store and Hospital Purchases Audit (IMS Canada, 2001). This database estimates total wholesale outpatient pharmacy sales of prescription drugs, by therapeutic class or by specific molecular structure of the drug. Dispensing fees for prescriptions are included in the cost data of outpatient pharmacy sales. Hospital drug sales were not included in total COI figures, since pharmacy costs are included in OCCI per diem cost estimates (Ontario Case Costing Initiative, 2001). To calculate the proportion of drug sales attributable to specific mental disorders or major substance abuse category, we used data from the Canadian Disease and Therapeutic Index (CDTI) (IMS Canada, 2000). The CDTI is a two-day practice audit of a representative sample of 680 physicians in Canada, including the number of visits for patients by diagnosis, and information on medications prescribed. The CDTI was also used to estimate the proportion of mental health drug sales that were prescribed for non-mental health indications (such as the use of tricyclic antidepressants in migraine headache). For some drugs used to treat substance abuse, the particular substance for which the drug is prescribed is self-evident (e.g., the use of antabuse in alcohol dependence, or the use of Methadone for opiate dependence). We used the entire Canadian sample for these estimates, because restricting the sample to Ontario physicians would have reduced the sample size by 70%, resulting in unstable estimates.

Police, Enforcement, and Incarceration Costs

Empirical evidence suggests that the rate of crime among persons with severe mental illness or substance abuse is slightly higher than the general population rate (Monahan & Arnold, 1996). Law enforcement costs attributable to substance abuse and mental illness consist of the costs of policing, courts and prosecution, as well as costs of custodial (incarceration) services. For

alcohol and illicit drugs, attributable crimes consist of alcohol or illicit drug violations (such as public drunkenness, simple possession, or impaired driving), plus a portion of violent crimes attributable to alcohol or illicit drugs. The proportions of crimes attributable to substance (alcohol or drugs) abuse were adopted from Rehm et al. (Rehm et al, 2006). Rehm's study estimated Ontario attributable fractions based upon the work of Pernanen and colleagues (Pernanen et al., 2002), Brochu and colleagues (Brochu et al., 2005), and their own research. These proportions were derived based on interviews with inmates of Ontario federal (Pernanen et al., 2002) and Ontario Provincial prisons (Brochu et al., 2005). – Offenders were asked if they believe that the offence would have happened if they had not been intoxicated. To identify severe drug or alcohol-related problems among inmates, the Drug Addiction Severity Test (DAST) and the Alcohol Dependence Scale (ADS) were used. For the category of criminal offences that were attributable to both alcohol and illegal drugs, the figures were allocated proportionally to the AFs for single substances. All numbers were weighted by the sample size of the number of interviews. To estimate the proportion of crimes attributable to mental illness (i.e., the aetiological fraction) we used prevalence rates of respective mental disorders in the population of male federal inmates in Canada, as documented by Motiuk and Porporino (1991). The prevalence rates used in the costing were adjusted for comorbid conditions by eliminating those cases with more than one diagnosis.

Once derived, the aetiological fractions were then multiplied by separate estimates of the total policing costs, prosecution and court costs, as well as custodial costs as tabulated by Statistics Canada. As no data exist pertaining to the costs of border enforcement for contraband tobacco, we were unable to estimate these costs. We derived the costs of policing related to mental disorders and substance abuse based on police-reported criminal incidents, police expenditure data, as well as attributable fractions for mental disorders and substance abuse as described above. The court and prosecution costs associated with the processing of substance- and

mental illness-related charges were obtained based on the respective aetiological fractions, the number of related criminal charges, as well as expenditures on court and prosecution. The Ontario incarceration costs attributable to mental disorders, as well as alcohol and drugs, were estimated as the product of the baseline proportion, the aggregate number of incarceration-days, and the average per diem cost per incarceration day.

Capital Costs

Providing mental health and substance abuse treatment and services requires capital investments, primarily in land, buildings, and equipment. The costs of these capital investments are an important (but often neglected) issue in assessing the social cost of mental illness and substance abuse (McGuire, 1991). Neglecting capital costs results in significant underestimation of the costs of services for mental disorders and substance abuse that are delivered through mental health and substance abuse treatment facilities. Capital costs are made up of two elements: changes in the market value of the capital, and the opportunity cost of tying up capital in its present use. For public hospitals and substance abuse treatment facilities, the change in the market value of the building and property is driven much more by fluctuations in real estate prices than by depreciation. Because changes in the market value over one year are likely to be negligible, we assumed that the market value of the capital remained unchanged in 2000. The market value of current hospitals and other facilities was determined from estimates of the facilities' land value. The opportunity cost of capital was based upon the real return from long-term Government of Canada bonds (4.53% in fiscal 2000). Capital costs related to mental disorders, alcohol, tobacco, and illicit drug abuse at General Hospitals were determined based upon the proportion of total bed days at these facilities used primarily for one of these conditions. The estimates of the capital costs of hospital buildings were based on replacement cost in 2000. The computations were based on CIHI's MIS data on Ontario hospital expenses, an estimate of total square footage of Ontario hospitals, as well as

replacement cost per square foot estimates obtained from the Ontario Hospital Association and Council of Academic Hospitals of Ontario. The total replacement costs of all Ontario hospitals were derived as a product of total square footage and a replacement cost per square foot. The total cost was then apportioned by hospital type according to proportions for building and ground expense obtained from the MIS database.

Disability and Income Support Payments

Disability and income support payments such as Ontario Disability Support (ODSP), Employment Insurance (EI), or General Welfare may be a financial consequence of mental disorders or substance abuse. From a societal perspective, these payments represent transfers and not opportunity costs, and are not included as a cost of illness. From a governmental perspective, however, these payments are part of the direct costs of mental disorders or substance abuse. In the absence of data regarding the prevalence of EI or General Welfare related to mental disorders or substance abuse, we were unable to estimate these payments. The portion of ODSP payments attributable to mental disorders or substance abuse was determined based upon aggregate cost data provided by the MOHLTC. Data on total ODSP allowances and benefits expenditures, direct operating expenditures as well as average monthly caseload by 3-digit ICD9-CM diagnostic groups were obtained from the Ministry of Community and Social Services of Ontario.[4]

Supportive Housing Costs

We estimated the total cost of supportive housing for people with severe mental illness using MOHLTC budget documents. Our estimates include the ongoing annualized rental costs and supplements as well as the capital costs of purchase and renovation of rental units.

[4] The ODSP program did not support persons disabled by substance abuse without another mental disorder, and therefore is an incomplete indicator of disability due to substance abuse.

Research, Education, and Prevention Costs

We estimated the total cost of mental disorder and substance abuse - related research in Ontario by examining the grants and awards for health science research granting agencies in the year 2000. The costs of industry-supported research are captured in the "drug costs" category, and to avoid double counting were not included here. Most mental health and substance abuse education is provided by nurses, physician, and social workers, and therefore is counted in other categories. However, we surveyed the Canadian Mental Health Association to estimate the costs of paid public lectures, brochures, and other public education activities not accounted for elsewhere. We included education, training, research, and community development expenditures related to substance abuse based upon expenditure data from the Centre for Addiction and Mental Health, the Drug and Alcohol Registry of Treatment, and the Drug and Alcohol Treatment Information System. We also tabulated the costs of primary prevention programs for alcohol, smoking, and illicit drugs from Federal and Provincial government budget information.

Miscellaneous Other Costs

Employee Assistance Programs operate in companies and other organizations and may provide treatment to employees with mental health and substance abuse problems. Unfortunately, we were unable to identify recent data on the prevalence, costs, and diagnoses of recipients of EAP services in Ontario. We were unable to quantify out-of-country treatment expenditures for mental disorders and substance abuse.

The costs of fire damage was estimated by multiplying the total cost of estimated fire damage to property in Ontario by the fractions of these fires that are attributable to persons igniting fires with smoking materials, and/or igniting fires while intoxicated. Estimates of aetiological fractions for these events by property class were determined based on the Annual Report 2000 of

Council of Canadian Fire Marshals and Fire Commissioners as well as work conducted by Rehm et al (Rehm et al., 2006).

INDIRECT COSTS:

Methods for Estimating Indirect Costs: Lost or Reduced Productivity

In assessing the cost of illness, an important but controversial component of the costs is the value of production that is lost due to premature mortality, long or short-term disability, and reduced productivity while at work. Most COI studies over the last 35 years have valued lost production using the human capital (HC) approach (Hodgson, 1983). In the HC framework, the cost of premature mortality (or long-term disability) due to a disease is the discounted present value of the projected stream of production for that person – that is, the stream of production that would have occurred if they had not died prematurely.

The rationale for the HC approach involves several assumptions that are unrealistic in contemporary Canadian and Ontario labour markets. The approach assumes that there is full employment in labour markets, such that production lost by premature death is a permanent societal loss, because persons leaving the labour market are not replaced. However, involuntary unemployment has been a persistent feature of the Canadian and Ontario labour market over several years (Fortin, Keil, & Symons, 2001; Amano & Macklem, 1998). Whether caused by sticky wages or imperfect macroeconomic policy, the result may be that the prevailing wage is higher than the level that would equate the quantity of labour demanded to the quantity supplied.

As an alternative to the full employment assumptions of the HC model, it has been proposed that the value of lost productivity due to premature death should be limited to the cost of

replacing an absent worker – the so-called 'friction cost' approach (Koopmanschap, Rutten, van Ineveld, & van Roijen, 1995). For practical calculations, Koopmanschap and colleagues suggested that the replacement period for a worker averaged three months in duration (Koopmanschap & Rutten, 1996). The friction cost approach may be more realistic when the labour market is not at full employment, but it does assume that the societal opportunity cost of labour is zero – that is, the sacrifice of replacement workers' leisure for work has no monetary value. However, lost leisure is a cost that should be considered, if one adopts the societal perspective that encompasses all costs and benefits that matter to citizens. In this case, the value of lost work beyond the friction period is obviously not zero – it is equal to, or greater than, the (marginal) reservation wage that unemployed workers would require to sacrifice leisure for work. Determining the value of the marginal reservation wage for unemployed persons empirically is difficult (Shaw, 1992), although its lower bound would be the marginal value of leisure. Empirical estimation of the marginal value of leisure is complicated (Alvarez-Farizo, Hanley, & Barberan, 2001), and would require primary data collection that is beyond the scope of the current research. For this reason we estimated the marginal reservation wage using a replacement wage approach, assigning values to household jobs that replacement workers perform based upon Statistics Canada estimates of the value of housekeeping services (Statistics Canada, 1995), and weighted over all household activities using time weights. The time weights were based upon Statistics Canada General Social Survey 1998 Cycle 2 data. We then aggregated the marginal reservation wages for all of the replacement workers across their expected productive lives, adjusted for labour force participation rates, discounted to present value using a 5% discount rate, and inflated by 3% per annum to reflect the projected productivity growth over time.

Productivity Costs due to Premature Mortality

Once the numbers of lost years of life were determined (by gender and age group), we calculated the productivity costs using the modified human capital approach described above. The cost of premature mortality due to mental disorders and substance abuse was calculated as the sum of the friction costs of replacing the deceased worker, plus the discounted present value of the projected future stream of the marginal reservation wage (for the worker who fills the vacant position), adjusted for sex and age-group labour force participation rates. The algebraic form of this cost equation is given in Appendix B. To facilitate comparisons of the current study with past COI studies and international guidelines, in sensitivity analyses we also calculated productivity costs using the traditional HC and friction cost methods.

Productivity Costs due to Long-term Disability

Reduced productivity due to mental disorders or substance abuse could result from long-term disability, from increased rates of absenteeism (including short-term disability spells), or from the reduced productivity of workers while on the job. To estimate the productivity costs for those Ontarians on long-term disability due to mental disorders or substance abuse, we first estimated the number of Ontarians permanently disabled from working due to mental disorders or substance abuse using data from Canadian Community Health Survey, cycle 1.2 (CCHS c1.2). We then used these estimates in conjunction with the age distribution of those permanently disabled to estimate the number of years of lost productive life. From these figures we then calculated productivity losses using the modified Human Capital method described above for premature mortality. Because the CCHS c1.2 did not include smoking questions, we estimated the long-term disability costs associated with tobacco abuse by scaling the corresponding long-term disability figure related to alcohol abuse by the ratio of hospitalization days attributable to tobacco abuse to hospitalization days attributable to alcohol abuse.

Productivity Costs due to Short-term Disability, Absenteeism, and Reduced Productivity

To estimate the productivity losses due to short-term disability, absenteeism, and reduced productivity at work, we ultimately adopted methods similar to those used in some past research. Past COI studies have assumed that these reductions in productivity are reflected by a decline in the wage rates paid to ill workers in the labour market. Based upon this assumption, both Rice and colleagues (Rice et al., 1991) and Goeree and colleagues (Goeree et al., 1999) used multiple regression analysis (using personal income as the dependent variable) to assess the effect of various mental illnesses and substance use disorders on wages. Single (Single et al., 1998) used differences in the annual mean earned income between substance abusers and the general population reported in survey data to calculate the value of productivity losses. These approaches assume that worker productivity is readily observable to the employer; that wages adjust rapidly to reflect changes in productivity; and that the ill employee bears most of the costs of reduced productivity due to illness. Even if these assumptions are reasonable, there are potential weaknesses in the empirical implementation adopted by COI studies. The economics research literature that has examined the relationship between income and substance abuse or mental disorders has uniformly acknowledged the potential for biased estimates with multivariate regression methods, because of simultaneity and omitted variable biases. Potential simultaneity bias arises because empirical evidence (Blake & Nied, 1997) and theoretical considerations (Becker & Murphy, 1988) suggest reverse causation – i.e., earnings levels affect alcohol consumption, illegal drug abuse, and mental disorders. Omitted variable bias arises from the fact that predictors of substance abuse and mental disorders (such as personality characteristics (Finn et al., 2000)) that may have direct importance to labour market outcomes are generally unavailable in survey datasets. Most of the studies cited above have used selection models to control for unobserved differences between ill and comparison cohorts. However, these studies lacked plausible exclusion restrictions, and they achieved identification primarily through distributional assumptions, a

procedure known to yield non-robust estimates. (Puhani, 2000). While we intended to employ Instrumental Variables (IV) estimation (Angrist, Imbens, & Rubin, 1996; Greenland, 2000) to address some of these potential limitations, our econometric specification tests revealed that multiple linear regression models for income were an adequate specification, and that IV estimation was unnecessary. Accordingly, to estimate the value of productivity losses for employed persons who remained at work attributable to substance abuse, we conducted a multiple linear regression analysis of the personal income data recorded in the CCHS c1.2 for respondents aged 15 to 74 years who participated in labour force in 2002. Other sociodemographic and human capital variables included in the income equations were age, marital status, geographical residence, categorical variables for education, family size, home ownership, and dummy variables for several chronic medical conditions. Once the regression models were fit, we took the difference between the predicted mean income of the survey respondents with and without the particular mental disorder or substance abuse, controlling for other co-occurring conditions, as the final estimate of the productivity losses. All analyses were performed on the CCHS cycle 1.2 microdata at the Toronto Regional Data Centre (RDC) of Statistics Canada.

Productivity Costs due to Hospitalizations in Acute Care Hospitals, PPHs and Long-term Care Facilities

The productivity costs related to hospitalizations were obtained by multiplying the aggregate totals of hospital days attributable to mental disorders and substance abuse by age group and gender-specific daily average wages, adjusted for age and gender-specific labour force participation rates.

CHAPTER 3: DIRECT COST RESULTS

Non-Physician Mental Health Service Providers

Ontarians made an estimated total of 5.2 million visits with non-physician providers of mental health services in Ontario in 2000 related to mental disorders and substance abuse. Females made 66% of these visits, and 34% were made by males. Social workers were the most common non-physician professional group visited, with 39% of visits. Visits with psychologists accounted for 26% of all visits, and visits with a variety of other professionals including nurses and religious leaders accounted for 36%. The total estimated cost of visits with these non-physician providers amounted to $98 million dollars. The largest proportion of the costs was attributable to mood disorders, followed by anxiety disorders, and then by severe mental illness. The costs of visits for substance abuse (alcohol abuse and illicit drug abuse) comprised only 4.7% of these costs. However, the substance abuse related costs may be underestimated as no chronic conditions attributable to substance abuse were included in our analysis. Details of the cost and visit figures can be found in Table 2 and Appendix Table A2_1.

Physician Visits: All Fee-for-Service Physicians

Table 3 describes the aggregate numbers of visits and costs for all visits to physicians paid by fee-for-service (FFS) in Ontario in 2000 related to mental disorders and substance abuse. For substance abuse, the visits tabulated here are for physician visits where substance abuse (and not a medical condition arising from substance abuse) was identified as the primary reason for the visit. The total number of visits paid to FFS physicians in Ontario in 2000 for mental disorders and substance abuse was just above 8 million, at a cost of $347 million dollars. The majority of these costs (68%) were for visits related to minor depression and anxiety disorders, followed by the costs related to mood disorders (14%), and severe mental illness (5.2%). Visits related to substance abuse comprised 6.2% of total costs.

The majority (60%) of all FFS physician visits for mental disorders or substance abuse are made to primary care (general or family practitioners) physicians, and account for $170 million dollars (49%) of costs. The largest proportion of these costs was related to visits for minor depression and anxiety disorders (73%), followed by costs related to mood disorders (9%), illicit drug abuse (5%), severe mental illness (2%), and alcohol abuse 2%.

The total number of visits made by Ontarians to psychiatrists reimbursed through FFS in 2000 was 2.8 million, at an aggregate cost of $152.7 million dollars. Compared to primary care physicians, a lower proportion of the total costs (63%) for psychiatrists were related to visits for minor depression and anxiety disorders, and for illicit drug abuse (0.7%), but higher proportions were related to visits for mood disorders (24%) and for severe mental illness (8.5%).

Within all FFS physician services for substance abuse, the cost of visits to primary care physicians was 80%, the cost of visits to psychiatrists was 13.2%, and cost of visits to other physicians was 6.8% of the total.

Community Mental Health Care

The overall cost of Community Mental Health Care Costs was $410.6 million dollars. Clients with severe mental illness (schizophrenia) accounted for 63% of the total cost. Further details on these figures are displayed in Table 4.

Specialized Substance Abuse Programs

In Ontario most substance abuse treatment is provided by approximately 200 specialized programs administered through 150 separate agencies. Based upon Ministry budgetary documents, in 2000 the Ontario government spent $90.1 million dollars on substance-abuse related treatment programs, of which non-residential treatment accounted for 39%, residential

treatment accounting for 38%, and withdrawal management accounted for 23% of the total. Due to data limitations no attribution of costs by substance type was possible. Table 5 summarizes these results.

Acute Care Hospitalization Days and Costs

Tables 6 and 7 depict, respectively, the total person-days and costs of hospital stays in acute care hospitals attributable to mental disorders and substance abuse in Ontario for the year 2000. Ontarians spent 5,239,103 days in acute care hospitals for all health conditions (physical, mental, and substance-related) in the calendar year 2000. The average length of stay for all health conditions was 7 days, with a median of 3 days. Hospital days for mental disorders accounted for 9.3% (a total of 484,943 days), tobacco abuse accounted for 8.8% (462,734 days), alcohol abuse accounted for 2.6% (135,231 days), and illicit-drug abuse accounted for 0.2% (11,583 days) of all hospital days in acute care hospitals in Ontario in 2000.

Of acute hospital days related to mental disorders and substance abuse, males had 52% of the hospital days, accounting for 56% ($479.4 million dollars) of total costs, and females had 48% of hospital days, accounting for 44% ($376 million dollars) of total costs. Ontarians aged 45-69 accounted for 20.3% (the biggest share) of the total costs of mental disorder and substance abuse related hospitalizations, followed by Ontarians aged 70-79 with 17.8% of total costs.

Total acute hospital costs attributable to hospital days for all mental disorders were $245.2 million dollars. Hospital costs related to mood disorders accounted for 50.5% ($124 million dollars) of all acute hospital costs related to mental disorders, and severe mental illness accounted for 28.4% of acute care hospital costs for mental disorders. Patients aged 30-44 accounted for the largest percentage (28.4%) of all hospitalizations related to mental disorders. The total acute hospital costs attributable to stays for substance abuse was $610.2 million

dollars, with 66.2% of these costs attributable to tobacco abuse, 32.1% attributable to alcohol abuse, and 1.7% attributable to illicit drug abuse. Further breakdowns of these figures are provided in Tables 6 and 7. Appendix Tables A6_1 to A6_3 and A7_1 to A7_3 present detailed figures on hospitalization days and costs by substance of abuse and by related physical illness.

Provincial Psychiatric Hospital (PPH) Costs

Ontarians spent 292,587 days in Ontario PPHs in 2000 related to mental disorders and substance abuse, at a total cost of $140.3 million dollars. Persons with severe mental illness (including schizophrenia and psychotic disorders) accounted for 46% of the total PPH hospital costs, and persons with mood disorders accounted for 23.2% of all costs. Alcohol abuse PPH costs accounted for 6.7% and illicit drug abuse PPH costs comprised 3.1% of total PPH costs. Details of PPH hospital costs and hospital days by gender, age group, and diagnostic groupings are displayed respectively in Table 8 and in Appendix Table A8_1.

Residential Care Facilities (RCFs)

Tabulations of costs for residential (long-term) care facilities related to mental disorders and substance abuse are presented in Table 9. The total hospital days in RCFs related to mental disorders and substance abuse in 2000 was 371,634, at a total cost of $53.4 million dollars. RCF days related to depression comprised the largest percentage of the cost (72%). Figures on RCF hospital days by diagnosis, gender, and age category can be found in Appendix Tables 9_1 through 9_4.

Drug Costs

The total cost of purchases for drugs used to treat mental disorders and substance problems in Ontario 2000 was $413.0 million dollars, with the largest percentage of the cost attributed to drugs used to treat mood disorders (45.4%, or $187.6 million). Drugs prescribed for severe

mental illness (schizophrenia, other psychoses, and pervasive development disorders) cost $73.9 million, and accounted for 18% of the total drug expenditures. Drug costs related to substance abuse accounted for 7% of all these drug costs, with largest cost for drugs to treat tobacco abuse. Further details are provided in Table 10. A breakdown of costs by drug category can be found in Appendix Table A10_1.

Police, Enforcement, and Incarceration Costs

Costs attributable to the excess crime arising from mental disorders and substance abuse include the costs of police enforcement, legal defence and prosecution, incarceration, and the cost of crime to victims. The total cost of law enforcement in Ontario in 2000 amounted to $2,357.7 million dollars and included the costs of policing, courts, prosecution, legal aid, custody for adults and youth. Policing was by far the most expensive category ($1,423.4 million) accounting for 60% of all law enforcement costs. Custodial services for adult inmates accounted for further 15% ($344.4 million) of the total. Court expenditures constituted 10% ($225.4 million) of all law enforcement costs. Most of the total law enforcement costs were attributable to either alcohol abuse (48.4%) or illicit drug abuse (38.5%), with smaller proportions of the costs (12.8% and 0.3%) attributable to psychosexual disorder and psychosis, respectively. Table 11 and Appendix Tables A11_1 through A11_10 provide further details on these costs.

Capital Costs

The total opportunity cost of capital invested in all Ontario hospitals attributable to hospital days for mental disorders, alcohol, tobacco and illicit drugs was $183 million dollars. After aggregating the capital costs for all hospital types by diagnostic groups, we estimated that the costs related to services for tobacco abuse were the highest at $64.7 million dollars (35% of total capital costs). The second most costly grouping was mood disorders at $37.9 million

(20.7%). Severe mental illness was associated with a capital cost of $33.8 million dollars (18.5%) Further details of these costs are depicted in Table 12.

Research, Education, and Prevention Costs

The total costs of research, education, and preventative services for mental disorders and substance abuse from April 2000 to March 2001 amounted to $55.4 million dollars. Appendix Table A19_1 provides further details.

Other Costs

The costs of supportive housing in Ontario for persons with severe mental illness was $94.0 million dollars, a figure that includes rental and supplement costs and the capital costs of purchase and renovation of rental units. This figure is included in summary Tables 19 and 20. The value of fire losses caused by smokers' materials and fire losses was estimated to be $67.9 million dollars, representing 21% of all losses due to fire in Ontario in 2000. Details of these figures are found in Appendix Table A19_2.

Ontario Disability Support Payments

Although transfer and support payments are not considered to be a cost of illness from the societal perspective, from a governmental perspective they represent an economic cost. The total amount of benefits and allowances and operating expenditures for ODSP amounted to $2,323.2 million in Ontario during the fiscal 2000/2001. The total amount of benefits and allowances from the Ontario Disability and Support Payments budget dedicated to eligible beneficiaries suffering from mental disorder, alcohol disorders, or illicit drugs was $895.3 million dollars in fiscal 2000/2001 and accounted for 45% of the total. The largest proportion of this expenditure (34%) was allocated to Ontarians suffering from a heterogeneous group of mental disorders, amounting to $306.8 million dollars. Annual ODSP expenditure associated with minor

depression/anxiety disorders accounted for 26% of this total ($234.9 million), the share of severe mental illness in this expenditure accounted for 23% ($208.9 million), and depression accounted for 12% ($107.6 million). The remaining 4% was paid to beneficiaries suffering from alcohol or illicit drug abuse.

CHAPTER 4: INDIRECT COST RESULTS

Deaths

Table 13 provides an overview of the number of deaths related to substance use and mental disorders, as well as their distribution by age group and gender in Ontario 1999 – the year with data available closest to the year 2000. This table is based upon the population aged 15-69. Appendix Tables A13_1 to A13_3 provide further breakdowns of mortality by specific cause for deaths attributable to alcohol, illicit drug, and tobacco abuse.

In Ontario in 1999 there were 7,313 premature deaths attributable to mental disorders and substance abuse, with 68.3% of the total attributable to tobacco abuse, 20.4% attributed to alcohol abuse, 6.3% attributed to mood disorders (primarily through suicides), and 4.2% attributable to illicit drug abuse.

Smoking-related malignant neoplasm of trachea, bronchus and lung accounted for the largest number of tobacco-related deaths (43% of all deaths attributed to tobacco use), causing 2,160 deaths – 65% in males and 35% in females. Most deaths occurred between 60 and 69 years.

Among mortality attributable to alcohol abuse, 36% of deaths were attributable to the direct effects of alcohol (e.g., abuse and dependence, acute alcoholic hepatitis, alcoholic cirrhosis of the liver), and 17.1% were attributable to motor vehicle accidents. Almost one-quarter (24%) of all illicit-drug related deaths were due to suicide and self-inflicted injury. Accidental poisoning by opiates and related narcotics accounted for 19% of illicit-drug related deaths. The majority of deaths attributed to mood disorders were suicides.

Years of Life Lost

Table 14 and Appendix Tables A14_1 through A14_3 report the potential years of life lost attributable to mental disorders and substance abuse. Years of life lost represent the difference between age of death and life expectancy after taking age and gender into account. The life expectancy tables were adjusted for productive age. We estimated that 207,245 potential years of life were lost due to premature mortality related to mental disorders and substance abuse, with 120,608 years (58.2% of the total) attributed to tobacco abuse, 54,252 years (26.2%) attributed to alcohol abuse, 18,669 years (9%) attributed to mood disorders, and 12,330 years (5.9%) attributed to illicit drug abuse. Of the total potential years life lost, 142,613 (68.8%) were lost by men and 64,632 (31.2%) were lost by women.

Costs of Productivity Losses due to Premature Death – Main Estimation Approach

Based upon the aggregate lost years of life figures, and employing our main estimation method assuming a 5% discount rate, we estimated the productivity losses due to premature death related to mental disorders and substance abuse to be $1,063 million dollars in Ontario 2000, with 89.2% of this total attributable to substance abuse. Losses attributable to tobacco abuse were $569.1 million, losses attributable to alcohol abuse were $304.4 million, losses attributable to illicit drug abuse were $74.6 million, and losses attributable to all mental disorders were $114.9 million dollars. Table 15 provides further details on these figures.

Costs of Productivity Losses due to Premature Death – Alternate Estimation Approaches

Appendix Tables A15_1 presents sensitivity analyses of the costs of productivity losses comparing our main estimation method with two alternate methods used in cost-of-illness studies – the friction cost method, and the traditional human capital method. As expected, the estimates vary substantially according to the method. Using the friction cost method, the total cost of productivity losses due to premature death from mental disorders or substance abuse

was estimated to be $43.1 million, and the comparable estimate based upon the traditional human capital approach was $2,185 million dollars. Appendix Tables A15_2 and A15_3 present further sensitivity analyses based upon different discount rate assumptions.

The Cost of Productivity Losses due to Morbidity

Table 16 presents the productivity losses for Ontarians due to morbidity attributable to mental disorders or substance abuse that include short-term disability (i.e., day spent in bed), days with reduced productivity, long-term disability, and losses due to hospitalizations. Productivity losses due to morbidity from all categories were estimated to total $ 27,641 million dollars, greatly exceeding the productivity losses attributable to premature mortality. Long-term disability (LTD) dominates the productivity losses due to morbidity, and LTD costs were estimated to be $27,305 million dollars, or 98.8% of the total. The costs of short-term productivity losses due to partial disability days exceeded the costs due to complete disability days (i.e., days spent in bed) across most diagnostic groups. Productivity losses attributable to mood disorders in the categories of long-term disability, short-term disability (days spent in bed), and short-term partial disability days were much larger than the corresponding losses due to other mental disorders, and much larger than the corresponding losses due to substance abuse. However, the true productivity losses associated with substance abuse may be higher than our estimates because we could not estimate most of the productivity losses associated with the known medical complications of substance abuse. Productivity losses due to morbidity in all categories attributable to mood disorders comprised 42.9% of all productivity losses due to morbidity. Minor depression and anxiety disorder comprised 25.8%, tobacco abuse comprised 13.9%, alcohol abuse comprised 8.2%, illicit drug abuse comprised 5.8%, and severe mental illness comprised 3.5% of the total. Further details of these figures are provided in Table 16. Sensitivity analyses related to assumptions about methods and discount rates can be found in Appendix Tables A16_1 to A16_3.

CHAPTER 5: THE ECONOMIC COSTS OF MAJOR DEPRESSIVE DISORDER

International projections of aggregate disease burden have predicted that unipolar major depression will soon be associated with the second highest disease burden in developed countries, surpassed only by heart disease. Reducing the health and economic burden of major depression is an important priority for research and policy. The direct and indirect costs for this disorder are broken out and presented in Tables 17 and 18.

The Direct Costs of Major Depression

The total direct health care costs attributable to major depressive disorder in Ontario in 2000 were $434 million dollars. The aggregate cost of drugs used to treat major depression in Ontario was estimated to be $187.6 million dollars, or 43% of the total cost. Hospitalization costs were $80 million dollars, or 18% of the total. Physician services and non-physician service costs amounted to 12.2% and 11.6%, respectively, of the total costs. Because of data limitations it was not possible to estimate the total costs of research, education, and preventative services attributable to major depression. Table 17 provides further details on these figures.

The Indirect Costs of Major Depression

Table 18 presents the indirect costs (productivity losses) associated with major depressive disorder, due to partial or complete short-term disability days, long-term disability, hospitalizations (in acute care, psychiatric, and long-term care facilities), and premature mortality. The cost of productivity losses attributable to major depression in Ontario in 2000 was $ 9,019 million dollars, with $8,756 million (97.1%) arising from long-term disability alone.

Short-term productivity losses associated with partial disability days exceeded the losses associated with complete disability days (“days in bed”) by 47% The productivity losses associated with premature mortality (primarily through suicides) were $108.9 million dollars.

CHAPTER 6: DISCUSSION AND CONCLUSIONS

Overview of Direct Costs

Table 19 presents a summary of all direct costs. The **total direct** cost attributable to mental disorders and substance abuse in Ontario for the year 2000 was $5,153 million dollars. The cost attributable to alcohol abuse was the highest of any diagnostic group at $1,487 million, primarily because of the $1,141 million dollars in law enforcement costs. The total direct cost attributable to illicit drug abuse was $1,003 million dollars, with almost $909 million dollars of this total related to law enforcement costs. The total direct cost attributable to tobacco abuse was $546 million dollars, with $407 million dollars (74.6%) of this sum due to the costs associated with hospitalization. Among mental disorder groupings, severe mental illness has the largest attributable direct cost at $641 million dollars, with health care comprising $505 million (79%) of this cost. Mood disorders had the largest attributable **direct health care** cost at $536 million dollars (accounting for 93% of the total direct cost for these disorders).

The total **direct health care** costs attributable to mental disorders and substance abuse were $2,395 million. The costs associated with acute care hospitalizations comprised the largest cost within health care at $855 million dollars, followed by the costs of prescriptions drugs ($413 million), community mental health ($410 million dollars) and physician services ($334 million dollars). The total direct health care costs attributable to mood disorders, severe mental illness and minor depression and anxiety disorders were $536 million, $505 million, and $418 million dollars, respectively. Among substance abuse, tobacco abuse was associated with the highest total direct health care costs at $428 million dollars, followed by alcohol abuse ($262 million) and illicit drug abuse ($85 million).

Overview of Total Economic Costs

All societal costs attributable to mental disorders and substance abuse in Ontario 2000 are summarized in Table 20. Based upon the assumptions of the main approach, the total economic costs attributable to mental disorders and substance abuse in Ontario in the Year 2000 was $33,857 million dollars. Several aspects of the summary cost figures are noteworthy. While the total direct costs of mental disorders and substance abuse are significant at $5,153 million dollars, the costs associated with productivity losses are far greater at $ 28,704 million dollars. This relationship between direct and indirect costs has been found in most previous cost-of-illness studies. Among the estimated productivity losses, the costs attributable to morbidity were 26 times greater than the costs attributable to premature mortality. The long-term productivity losses attributable to mood disorders of $11,665 million dollars are particularly noteworthy, as they comprise more than one-third of the aggregate societal costs attributed to mental disorders and substance abuse in Ontario.

These figures also illustrate the miniscule societal costs of research, education, and prevention compared to the total direct health care costs attributed to mental disorders and substance abuse. The estimated costs of research, education, and prevention were $55.4 million dollars, representing 1.1% of the total direct societal costs of 5,153 million dollars.

Among total economic costs attributable to substance abuse, the costs associated with tobacco abuse were the largest at $4,954 million dollars, followed by $4,046 million attributable to alcohol abuse, and $2,670 million attributable to illicit drugs. However, these comparative figures must be interpreted with caution. The larger figure attributable to tobacco abuse is primarily related to the much higher estimated cost of long-term disability. Due to data limitations, the long-term disability costs related to tobacco abuse were estimated by a different

and more indirect method than the long-term disability costs of alcohol abuse and tobacco abuse.

Appendix Table A20 compares the aggregate social costs of mental disorders with the aggregate social costs of substance abuse. The total **direct cost** of substance abuse in Ontario 2000 was $3,035 million dollars, higher than the total direct cost of mental disorders at $2,118 million dollars. The main cost components accounting for this substantial difference were the costs of law enforcement, which for substance abuse were estimated to be $2,049 million, compared to $308 million dollars attributable to mental disorders. In the indirect cost category, this ranking was reversed. The total indirect costs (due to the productivity losses associated with premature mortality and morbidity) attributable to mental disorders were $ 20,069 million dollars, compared to $ 8,635 dollars attributable to substance abuse. The morbidity-related productivity losses attributable to mental disorders were much larger than the comparable productivity losses attributable to substance abuse. The productivity losses associated with premature mortality were higher for substance abuse than for mental disorders, primarily reflecting the important impact of tobacco abuse on mortality.

Sensitivity Analyses

The most important category of the total economic costs of mental disorders and substance abuse are the costs of productivity losses. Estimates of these losses are known to vary substantially depending upon assumptions made about the labour market consequences of disability and premature death. These issues are fully discussed in the Chapter 2, and the sensitivity analyses that vary the method and the discount rate are presented in Appendix Tables A15_1 to A15_3. To facilitate comparisons with previous studies, we illustrate the differences in the total costs using different assumptions. Using our (preferred) main method, the total economic cost attributable to mental disorders and substance abuse in Ontario in the

Year 2000 was $33,857 million dollars. If the traditional human capital method is employed, the total economic costs increase to $ 55,328 million dollars. This represents the upper bound of estimate of total costs. If, on the other hand, the friction cost method is applied – the method that values lost productivity due to disability and premature mortality only by the cost of replacing the worker – the lower bound estimate of the total economic costs becomes $6,195 million dollars. This range illustrates the sensitivity of these estimates to the assumptions underlying the valuation of productivity losses.

Limitations

This study has several limitations, related to data gaps but also to knowledge deficits. Family burden is widely acknowledged as an important social cost related to mental disorders and substance disorders, but we identified no data source that would allow us to meaningfully provide an estimate of these costs. Similarly, the absence of data prevented us from estimating the direct costs related to mental disorders and substance abuse of Employee Assistance Programs. We were unable to estimate the costs of prescription drug abuse, or of self-harm behaviour. Related to law enforcement and the criminal justice system, there were numerous limitations, including the paucity of information relating crime to mental disorders that precluded us from estimating attributable fractions. Despite the prominence of long-term disability costs in the overall estimates, the best available data upon which our estimates are based has limitations, particularly in the determination of long-term disability related to the medical consequences of tobacco abuse. Finally, we note that while the method of attributable fractions represents a well-established method in epidemiology, judgements about the relative merits of the existing epidemiological data remain controversial. (For example, see Fillmore et al., 2006).

Implications and Conclusions

The economic costs of mental disorders and substance abuse in Ontario in the year 2000 were significant at $33,857 million in 2000, suggesting that reducing these costs in the future should be a priority for Ontarians and their government. These issues are particularly salient because the literature on alcohol, tobacco, and certain mental disorders (such as major depression) indicates that there are several evidence-based interventions available to reduce these costs. The estimates of the social costs of substance abuse and mental disorders contained in this report are useful for policy and future planning as a preliminary step, but there are natural extensions of this work that will be necessary for more practical programming and policy. The information needs for practical programming and policy include an analysis of those costs that are avoidable, as well as tools and methods for forecasting future costs. In addition, the linkage of population surveys with administrative data creates new opportunities for more direct estimation of attributable health care costs that does not rely on the method of attributable fractions. Fortunately, there are several initiatives underway in Ontario that, as a companion to the current study, will provide new relevant information and tools to improve future planning and policy.

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MAIN TABLES

Table 1: Data sources for the cost of mental disorders and substance abuse estimation

Cost Type	Source of Data
Visits with non-physician mental health professionals	Canadian Community Health Survey (CCHS) 1.2
Cost of service of non-physician mental health professionals	CCHS 1.2 Earnings of Canadians 2000, Statistics Canada Ontario Wage Survey 1999 Salary inflation index for Health Care and Social Assistance occupations
Visits with general physicians, psychiatrists and other physicians	OHIP FFS claims data base @ ICES Ontario Drug Benefit database (@ICES)
Community mental health treatment costs	Community Mental Health Evaluation Initiative (CMHEI) "The Estimates" of MOHLTC budget, Ministry of Finance
Specialized Substance Abuse Programs	MOHLTC
Acute Care Hospitals	Ontario Case Costing Initiative (OCCI) Discharge Abstract Database (DAD) from the Canadian Institute for Health Information (CIHI)
Provincial Psychiatric Hospitals	CIHI's Hospital Mental Health Data Base (HMHDB) Ontario Case Costing Initiative (OCCI)
Residential Care facilities	Continuing Care Record System (CCRS) @ CIHI CIHI's MIS data base (CMDB - Canadian MIS database, Ontario data)
Drug Costs	Canadian Drug and Therapeutic Index (CDTI) from IMS Canadian Drug Store and Hospital Purchase Audit @ IMS
Law enforcement costs (police, courts and prosecution and incarceration)	Statistics Canada: Canadian Crime Statistics cat.85-205 XIE Criminal Justice Indicators Youth Custody and Community Services Data Tables Police Resources in Canada Criminal Prosecution Resources, Expenditures and Personnel Corrections and Conditional Release Statistical Overview Courts Personnel and Expenditures Adult Correctional Services CANSIM Data Series The Social Costs of Substance Abuse in Canada 2006 by J.Rehm et al The Prevalence, Nature and Severity of Mental Health Problems Among Federal Male Inmates in Canadian Penitentiaries by L.L.Motiuk and F.J.Porporino Crime Associated with Alcohol and Drugs Among Offenders in Ontario Provincial Prisons by Serge Brochu et al 2005 Proportions of Crimes Associated with Alcohol and Other Drugs in Canada" by K. Pernanen, M-M.Cousineau, S.Brochu and Fu Sun.
Capital Costs - Replacement Costs of Hospital Buildings	Ontario Hospital Association (OHA) CIHI's MIS data base Council of Academic Hospitals of Ontario
Costs of supportive housing	MOHLTC
Research, Education and Prevention Costs	Canadian Mental Health Association (CMHA) MOHLTC The Social Costs of Substance Abuse in Canada 2002, Rehm et al
Fire Damage	The Annual Report on Fire Losses in Ontario 2000 by Council of Canadian Fire Marshals and Commissioners
Productivity Cost due to Premature Mortality	Statistics Canada: "Causes of Death" 1999 and 2000 Causes of Death 1999 Causes of Death 2000 Earnings of Canadians (Labour Force Survey - Salaries by Profession) 1998 General Social Survey on Time Use Households' Unpaid Work - Measurement and Valuation CANSIM - Labour Force Participation Rates by age group, gender and province 2000 Life Tables Aetiological Fractions Tables - The Social Costs of Substance Abuse in Canada 2002, J.Rehm et al WHO - Life Tables
Productivity Cost due to Premature Morbidity	CCHS 1.2 Earnings of Canadians (Statistics Canada Labour Force Survey - Salaries by Profession) Aetiological Fractions Tables - The Social Costs of Substance Abuse in Canada 2002, J.Rehm et al The DAD The HMHDB The CCRS

Table 2: Cost of non-physician mental health and substance abuse services by gender and disorder in Ontario 2000

TYPE OF SERVICE	Severe mental illness	Mood disorders	Anxiety disorders	Alcohol abuse	Illicit drug abuse	TOTAL
Males						
Social Workers	4,874,289	2,633,781	0	538,336	1,166,470	9,212,876
Psychologists	622,256	8,821,142	3,287,587	958,473	0	13,689,459
Religious Leaders, Nurses and Other Professionals	3,341,803	10,674,837	7,256,906	0	0	21,273,545
Total males	8,838,349	22,129,760	10,544,492	1,496,809	1,166,470	44,175,880
% of total male visits	20.01%	50.09%	23.87%	3.39%	2.64%	100.00%
Females						
Social Workers	1,562,054	14,318,330	1,763,593	0	1,113,329	18,757,305
Psychologists	3,932,074	9,882,476	5,163,783	0	0	18,978,333
Religious Leaders, Nurses and Other Professionals	2,899,713	8,616,596	3,803,355	209,949	569,955	16,099,566
Total females	8,393,840	32,817,402	10,730,730	209,949	1,683,283	53,835,205
% of total female visits	15.59%	60.96%	19.93%	0.39%	3.13%	100.00%
Both genders						
Social Workers	6,436,343	16,952,111	1,763,593	538,336	2,279,799	27,970,181
Psychologists	4,554,330	18,703,618	8,451,370	958,473	0	32,667,792
Religious Leaders, Nurses and Other Professionals	6,241,515	19,291,433	11,060,260	209,949	569,955	37,373,112
Total both genders	17,232,189	54,947,162	21,275,223	1,706,758	2,849,754	98,011,085
% of total both genders	17.58%	56.06%	21.71%	1.74%	2.91%	100.00%

Table 3: Number and cost of visits for mental disorders and substance abuse with physicians by diagnostic group and specialty type in Ontario 2000

	Severe mental illness	Mood disorders	Minor Depression & Anxiety disorders	Heterogeneous disorders	Alcohol Abuse	Illicit Drug Abuse	Tobacco Abuse	TOTAL
Costs								
Psychiatrists	13,051,033	36,611,043	96,485,198	4,323,294	1,048,091	1,101,131	14,474	152,652,162.5
GPs or FPs	4,072,478	15,314,605	124,386,034	2,109,182	3,930,964	8,945,038	249,379	169,793,971.7
Other MDs	558,625	1,039,446	14,655,005	4,716,320	684,799	432,073	2,130	25,048,766.1
Total physicians costs	17,682,135	52,965,094	235,526,237	11,148,796	5,663,855	10,478,242	265,984	347,494,900
Cost % of total	5.09%	15.24%	67.78%	3.21%	1.63%	3.02%	0.08%	100.00%
Number of visits								
Psychiatrists	254,062	685,466	1,728,379	75,454	19,521	20,802	223	2,783,908
GPs or FPs	150,360	413,089	3,510,556	57,448	127,105	290,211	5,172	4,785,365
Other MDs	12,966	22,122	214,777	92,845	17,846	12,814	44	456,333
Total physicians visits	417,388	1,120,677	5,453,712	225,747	164,472	323,827	5,439	8,025,606
Visits as % of total	5.20%	13.96%	67.95%	2.81%	2.05%	4.03%	0.07%	100.00%

Table 4: Community mental health costs by disorder in Ontario 2000

Severe mental illness	Mood disorders	Anxiety disorders	Heterogenous disorders	Substance abuse disorders	OVERALL
259,135,848	45,352,561	31,913,225	67,096,239	7,058,027	410,555,900

Table 5: MOHLTC's expenditure on substance abuse treatment programs in 2000

Program Type	Ministry's Treatment Programs
Drug/Alcohol Treatment Programs	
Non-Residential	$35,173,758
Withdrawal Management	$20,430,522
Residential	$34,544,596
TOTAL	$90,148,876

Table 6: Acute care hospital days due to mental disorders and substance abuse by age group and gender in Ontario 2000

	Severe mental illness	Mood disorders	Minor depression and anxiety disorders	Heterogenous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
Males								
0-14	368	1,117	1,209	1,839	1,016	119	19,093	24,761
15-29	23,639	16,438	4,686	1,491	5,637	2,521	1,872	56,283
30-44	27,477	24,763	4,607	1,362	12,695	2,263	11,500	84,667
45-59	12,923	21,649	2,515	1,640	21,015	1,126	50,647	111,515
60-69	3,532	9,208	578	2,805	15,817	395	59,786	92,121
70-79	2,924	8,229	343	6,816	19,643	243	59,018	97,216
80+	2,503	2,308	324	6,323	10,137	91	34,672	56,358
Unknown	0	0	2	0	3,169	137	43,493	46,800
Total Males	73,366	83,712	14,264	22,276	89,129	6,894	280,081	569,722
% of total male	12.88%	14.69%	2.50%	3.91%	15.64%	1.21%	49.16%	100.00%
Females								
0-14	263	1,880	3,909	881	682	83	13,952	21,650
15-29	10,456	25,728	14,039	1,307	2,395	1,004	1,765	56,694
30-44	25,831	46,134	10,952	772	6,840	1,602	7,194	99,325
45-59	21,460	39,732	4,527	1,274	11,559	855	25,297	104,704
60-69	8,500	15,714	1,094	2,114	7,562	495	32,404	67,882
70-79	6,230	15,749	1,302	5,368	8,491	312	38,595	76,047
80+	5,562	6,741	724	13,061	6,036	227	28,904	61,255
Unknown	11	6	4	0	2,535	111	34,543	37,210
Total Females	78,313	151,684	36,551	24,777	46,102	4,689	182,653	524,769
% of total female	14.92%	28.90%	6.97%	4.72%	8.79%	0.89%	34.81%	100.00%
Total both genders	151,679	235,396	50,815	47,053	135,231	11,583	462,734	1,094,491
% of total both genders	13.86%	21.51%	4.64%	4.30%	12.36%	1.06%	42.28%	100.00%

Table 7: Acute care hospitalizations costs due to mental disorders and substance abuse by age group and gender in Ontario 2000

(millions of dollars)

	Severe mental illness	Mood disorders	Minor depression and anxiety disorders	Heterogenous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
Males								
0-14	0.3	0.6	0.6	1.5	1.0	0.1	8.9	12.9
15-29	10.9	8.2	2.3	1.1	5.1	1.5	2.1	31.1
30-44	12.6	12.7	2.2	1.0	11.6	1.8	14.1	56.0
45-59	5.9	11.4	1.2	1.0	18.9	1.1	61.4	100.9
60-69	1.6	4.9	0.3	1.6	15.4	0.5	67.2	91.5
70-79	1.5	4.5	0.1	3.6	20.8	0.6	59.0	90.1
80+	1.3	1.3	0.2	3.4	10.9	0.2	32.2	49.5
Unknown	.	.	0.0	.	37.0	0.1	10.3	47.3
Total Males	34.0	43.5	6.8	13.3	120.6	6.0	255.1	479.4
% of male total	7.10%	9.08%	1.43%	2.77%	25.15%	1.24%	53.22%	100.00%
Females								
0-14	0.1	1.0	1.9	0.7	0.7	0.1	6.1	10.6
15-29	4.7	13.6	6.7	1.0	2.2	0.6	2.0	30.9
30-44	11.4	24.1	5.1	0.5	5.9	1.1	8.1	56.2
45-59	9.6	20.9	2.2	0.7	10.5	0.7	28.2	72.8
60-69	3.9	8.3	0.5	1.2	7.5	0.6	33.5	55.5
70-79	3.0	8.6	0.6	3.0	9.7	0.5	36.8	62.1
80+	2.9	3.8	0.3	7.1	9.1	0.9	26.7	50.8
Unknown	0.0	0.0	0.0	.	29.8	0.1	7.3	37.1
Total Females	35.7	80.3	17.3	14.2	75.4	4.5	148.6	376.0
% of female total	9.49%	21.35%	4.60%	3.79%	20.05%	1.20%	39.53%	100.00%
Total	69.7	123.8	24.1	27.5	196.0	10.5	403.8	855.4
% of both genders total	8.15%	14.48%	2.82%	3.22%	22.91%	1.22%	47.20%	100.00%

Table 8: Psychiatric hospital costs due to mental disorders and substance abuse by age group and gender in Ontario 2000

	Severe mental illness	Mood disorders	Minor depression and anxiety disorders	Heterogeneous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
Males								
0-14	0	48,586	9,837	68,128	0	0	0	126,551
15-29	8,382,134	2,227,818	1,760,770	2,312,120	1,102,714	1,160,714	0	16,946,270
30-44	20,094,063	4,214,082	2,208,560	2,969,438	2,723,904	1,424,091	0	33,634,139
45-59	10,573,001	3,280,947	1,040,112	2,790,757	1,770,089	445,229	21,000	19,921,135
60-69	1,560,754	1,318,868	257,866	726,331	812,730	25,345	0	4,701,894
70-79	1,562,687	1,886,737	94,619	1,964,131	444,868	44,618	0	5,997,660
80 +	364,145	364,300	22,612	1,520,068	0	0	0	2,271,124
Unknown	117,052	110,265	35,202	143,027	0	0	0	405,546
Total Males	42,653,836	13,451,603	5,429,578	12,494,000	6,854,305	3,099,997	21,000	84,004,319
% of male total	50.78%	16.01%	6.46%	14.87%	8.16%	3.69%	0.02%	100.00%
Females								
0-14	0	38,450	30,024	34,268	0	0	0	102,742
15-29	3,005,098	2,544,437	1,739,583	552,298	383,957	385,256	0	8,610,629
30-44	7,931,737	5,942,986	2,471,090	1,855,212	793,852	605,454	0	19,600,332
45-59	6,210,055	5,216,921	1,131,362	1,121,903	726,854	201,878	0	14,608,972
60-69	1,892,253	2,425,862	80,909	433,410	275,364	19,752	0	5,127,550
70-79	1,741,434	2,178,360	169,846	1,042,987	180,622	9,000	0	5,322,249
80 +	622,392	616,701	59,534	642,645	0	0	0	1,941,272
Unknown	420,873	133,781	53,369	190,881	144,601	0	0	943,504
Total Females	21,823,842	19,097,498	5,735,717	5,873,604	2,505,250	1,221,340	0	56,257,250
% of female total	38.79%	33.95%	10.20%	10.44%	4.45%	2.17%	0.00%	100.00%
Total both genders	64,477,678	32,549,101	11,165,295	18,367,604	9,359,555	4,321,337	21,000	140,261,569
% of total for both genders	45.97%	23.21%	7.96%	13.10%	6.67%	3.08%	0.01%	100.00%

Table 9: Long-term care hospitalization costs due to mental disorders and substance abuse by age group and gender in Ontario 2000

	Schizophrenia	Depression	Anxiety disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	Total
Males							
0-14	0	5,460	2,586	0	0	0	8,046
15-29	9,626	293,098	87,786	28,590	0	201	419,302
30-44	210,629	1,072,539	11,063	47,849	8,596	113,418	1,464,094
45-59	217,669	2,599,668	440,366	131,115	8,430	234,959	3,632,206
60-69	253,875	2,637,886	584,616	219,480	0	451,736	4,147,593
70-79	216,232	5,709,241	760,619	419,277	0	629,348	7,734,717
80+	360,482	4,316,593	814,929	211,526	0	532,097	6,235,626
Unknown	105,889	571,829	179,738	4,506	0	20,256	882,218
Males in total	1,374,402	17,206,314	2,881,704	1,062,342	17,027	1,982,015	24,523,803
Males as % of all causes	5.60%	70.16%	11.75%	4.33%	0.07%	8.08%	100.00%
Females							
0-14	0	2,730	0	0	0	0	2,730
15-29	0	113,504	0	2,313	0	5,480	121,297
30-44	44,683	945,530	216,088	37,655	21,146	15,035	1,280,137
45-59	449,274	2,846,072	408,757	41,976	0	343,545	4,089,624
60-69	405,165	3,015,609	194,393	24,813	0	210,022	3,850,002
70-79	554,588	5,852,342	1,040,356	4,952	0	350,692	7,802,930
80+	249,565	7,637,800	2,330,707	-1,193	4,152	426,667	10,647,698
Unknown	61,206	850,847	142,383	926	0	21,260	1,076,622
Females in total	1,764,481	21,264,435	4,332,684	111,442	25,298	1,372,700	28,871,041
Females as % of all causes	6.11%	73.65%	15.01%	0.39%	0.09%	4.75%	100.00%
Overall	3,138,883	38,470,749	7,214,388	1,173,784	42,325	3,354,715	53,394,844
Overall as % of all causes	5.88%	72.05%	13.51%	2.20%	0.08%	6.28%	100.00%

Table 10: Cost of drugs used to treat mental disorders and substance abuse in Ontario 2000

	Severe mental illness	Mood disorders	Minor depression and anxiety disorders	Heterogeneous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
TOTAL PURCHASES ($)	73,940,718	187,568,656	86,409,556	36,172,078	1,086,629	9,689,463	18,112,868	412,979,969
% of Total	17.90%	45.42%	20.92%	8.76%	0.26%	2.35%	4.39%	100.00%

Table 11: Law enforcement costs by disorder type and cost category in Ontario 2000

CONDITION	Costs in millions of dollars						TOTAL
	Policing	Court	Prosecution	Legal Aid	Custody Adults	Custody Youth	
Psychosis	4.6	0.7	0.2	0.2	1.0	0.4	7.1
Psychosexual disorders	195.5	28.2	9.2	8.5	42.7	17.0	301.2
Alcohol abuse	710.7	119.5	39.1	35.8	176.6	59.2	1,141.0
Illicit drug abuse	512.5	77.0	102.2	45.1	124.1	47.6	908.5
TOTAL	1,423.4	225.4	150.7	89.6	344.4	124.2	2,357.7

Table 12: Costs of capital for mental disorders and substance abuse treatment in Ontario hospitals apportioned by hospital type and diagnostic group in 2000

(millions of dollars)

	Severe mental illness	Mood disorders	Minor depression and anxiety disorders	Heterogeneous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
Acute Care Hospitals	21.2	32.9	7.1	6.6	18.9	2.1	64.7	153.5
Provincial Psychiatric Hospitals	12.4	6.8	2.0	2.4	1.2	0.7	0.0	25.5
Long Term Care Facilities	0.3	3.1	0.6	-	0.1	0.0	0.3	4.4
TOTAL	33.8	37.9	15.7	8.9	20.2	2.8	64.7	183.4

Table 13: Mortality attributable to mental disorders and substance abuse by age group and gender in Ontario 1999

	Severe mental illness	Mood disorders	Minor depression and anxiety disorders	Heterogeneous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
Males								
15-29	0	87	0	0	229	43	16	375
30-44	2	144	0	1	316	103	217	784
45-59	3	97	0	3	375	76	1,298	1,852
60-69	13	29	0	6	213	15	1,899	2,176
Total Males	18	357	0	10	1,134	237	3,431	5,187
% of Males Total	0.35%	6.88%	0.00%	0.20%	21.86%	4.56%	66.14%	100.00%
Females								
15-29	1	17	1	0	42	14	15	90
30-44	1	41	1	0	102	32	130	308
45-59	4	34	0	1	142	18	597	797
60-69	12	10	1	2	74	9	823	931
Total Females	18	103	3	4	361	72	1,565	2,127
% of Female Total	0.85%	4.83%	0.14%	0.20%	16.99%	3.40%	73.59%	100.00%
Total Both Genders	36	460	3	15	1,495	309	4,996	7,313
% of Total Both Genders)	0.49%	6.29%	0.04%	0.20%	20.44%	4.22%	68.31%	100.00%

Table 14: Years of life lost due to mental disorders and substance abuse by age group and gender in Ontario 1999

	Severe mental illness	Mood disorders	Minor depression and anxiety disorders	Heterogeneous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
Males								
15-29	18	4,880	0	0	12,974	2,357	902	21,129
30-44	64	6,076	0	54	13,177	4,326	8,624	32,321
45-59	79	2,832	0	96	10,669	2,258	35,152	51,085
60-69	228	526	0	108	3,757	277	33,182	38,077
Total Males	389	14,313	0	258	40,577	9,217	77,859	142,613
% of all Male YLL	0.27%	10.04%	0.00%	0.18%	28.45%	6.46%	54.59%	100.00%
Females								
15-29	66	1,059	47	27	2,643	843	899	5,583
30-44	73	1,914	48	10	4,723	1,479	5,545	13,793
45-59	114	1,170	10	41	4,685	594	18,736	25,351
60-69	239	213	17	47	1,624	197	17,568	19,906
Total Females	492	4,356	122	125	13,675	3,113	42,749	64,632
% of all Female YLL	0.76%	6.74%	0.19%	0.19%	21.16%	4.82%	66.14%	100.00%
Total Both Genders	881	18,669	122	383	54,252	12,330	120,608	207,245
% of all causes	0.43%	9.01%	0.06%	0.19%	26.18%	5.9%	58.20%	100.00%

Table 15: Productivity losses due to premature mortality attributable to mental disorders and substance abuse in Ontario 2000 - Main estimate using 5% discount rate

(millions of dollars)

	Severe mental illness	Mood disorders	Minor depression & anxiety disorders	Heterogeneous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
Males								
15-29	0.1	21.1	0.0	0.0	55.2	10.9	4.3	91.6
30-44	0.4	38.8	0.0	0.3	84.6	27.7	56.7	208.5
45-59	0.5	18.9	0.0	0.6	69.9	15.2	223.3	328.5
60-69	0.4	1.2	0.0	0.3	8.2	0.7	70.0	80.9
Total Males	1.4	80.0	0.0	1.3	217.8	54.5	354.3	709.4
% of Males Total	0.20%	11.28%	0.00%	0.18%	30.71%	7.68%	49.95%	100.00%
Females								
15-29	0.3	5.5	0.3	0.1	13.3	4.4	4.7	28.6
30-44	0.5	14.1	0.4	0.1	35.0	10.9	42.1	103.0
45-59	0.8	8.9	0.1	0.3	34.8	4.5	134.3	183.7
60-69	0.3	0.4	0.0	0.1	3.4	0.4	33.7	38.4
Total Females	1.9	28.9	0.8	0.6	86.6	20.1	214.8	353.7
% of Females Total	0.53%	8.18%	0.22%	0.17%	24.49%	5.69%	60.73%	100.00%
Total Both Genders	3.3	108.9	0.8	1.9	304.4	74.6	569.1	1,063.1
% of Total Both Genders	0.31%	10.25%	0.07%	0.17%	28.64%	7.02%	53.53%	100.00%

Table 16: Summary of productivity losses due to mental disorders and substance abuse in Ontario 2000

	(millions of dollars)							
	Severe mental illness	Mood disorders	Minor depression & anxiety disorders	Heterogeneous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
Productivity losses due to morbidity								
due to long-term disability	949.7	11,665.2	7,077.1	0.0	2,232.8	1,583.1	3,797.4	27,305.3
due to short-term disability (days in bed)	0.0	47.8	17.9	0.0	6.0	8.3	12.4	92.5
due to short-term disability (days with reduced activity)	0.0	116.2	30.2	0.0	9.0	0.0	18.7	174.0
due to hospitalizations in acute care hospitals	9.1	11.8	3.0	0.7	5.4	0.8	10.4	41.2
due to hospitalizations in psychiatric hospitals	11.2	4.5	1.7	1.4	1.1	0.7	0.0	20.6
due to hospitalizations in long-term care facilities	0.6	5.2	0.8	0.0	0.2	0.0	0.5	7.4
Total morbidity	970.6	11,850.7	7,130.7	2.1	2,254.5	1,592.9	3,839.5	27,640.9
% of total morbidity	3.51%	42.87%	25.80%	0.01%	8.16%	5.76%	13.89%	100.00%
Total productivity losses due to premature mortality	3.3	108.9	0.8	1.9	304.4	74.6	569.1	1,063.1
Total	973.9	11,960.1	7,131.7	4.0	2,559.0	1,667.6	4,408.7	28,705.0
Total per capita (in $)	83.5	1,024.9	611.1	0.3	219.3	142.9	377.8	2,459.9
% of Total productivity losses	3.39%	41.67%	24.84%	0.01%	8.91%	5.81%	15.36%	100.00%

Table 17: Utilization and direct health care costs attributable to major depression in Ontario 2000

	Service utilization (number of units)	Cost (millions $)	% of Total Costs
Non-physician services (visits)	1,922,158	50.3	12%
Social workers	721,273	15.7	4%
Psychologists	564,102	18.9	4%
Nurses, other health professionals and religious leaders	636,783	15.8	4%
Physician services (visits)	1,120,677	53.0	12%
Psychiatrists	685,466	36.6	8%
GP/FPs	413,089	15.3	4%
Other MDs	22,122	1.0	0%
Acute care hospitals (bed days)	84,123	30.2	7%
Psychiatric hospitals (bed days)	32,324	11.4	3%
Long-term care facilities (bed days)	267,761	38.5	9%
Prescription drugs	N/A	187.6	43%
Community mental health	N/A	45.4	10%
Capital costs	N/A	17.7	4%
Acute -care hospitals	N/A	11.8	3%
Psychiatric hospitals	N/A	2.8	1%
Long-term care facilities	N/A	3.1	1%
Total	3,427,043	433.9	100%

Table 18: Summary of productivity losses due to major depression in Ontario 2000

	Major depression (millions $)	OVERALL (millions $)
Productivity losses		
due to long-term disability	8,756.3	27,305.3
due to short-term disability (days in bed)	49.1	92.5
due to short-term disability (days with reduced activity)	93.4	174.0
due to hospitalizations in acute care hospitals	4.4	41.2
due to hospitalizations in psychiatric hospitals	1.7	20.6
due to hospitalizations in long-term care facilities	5.2	7.4
Total morbidity	8,910.1	27,640.9
due to premature mortality	108.9	1,063.1
Total	9,019.0	28,704.0
Total per capita (in $)	773	2,460
% of total	31.42%	100.00%

Table 19: Summary of direct costs attributable to mental disorders and substance abuse in Ontario 2000

(in millions dollars)

	Severe mental illness	Mood disorders	Minor depression and anxiety disorders	Heterogeneous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	TOTAL
Direct health care costs: total	505.3	535.7	417.6	160.3	262.4	85.3	427.9	2,394.5
Non-physician services	17.2	54.9	21.3	-	1.7	2.8	-	98.0
Social workers	6.4	17.0	1.8	-	0.5	2.3	-	28.0
Psychologists	4.6	18.7	8.5	-	1.0	-	-	32.7
Nurses, religious leaders and other health professionals	6.2	19.3	11.1	-	0.2	0.6	-	37.4
Physician services	17.7	53.0	235.5	11.1	5.7	10.5	0.3	333.7
Psychiatrists	13.1	36.6	96.5	4.3	1.0	1.1	0.0	152.6
GP/FPs	4.1	15.3	124.4	2.1	3.9	8.9	0.2	159.0
Other MDs	0.6	1.0	14.7	4.7	0.7	0.4	0.0	22.1
Acute care hospitals	69.7	123.8	24.1	27.5	196.0	10.5	403.8	855.4
Psychiatric hospitals	64.5	32.5	11.2	18.4	9.4	4.3	0.0	140.3
Long-term care facilities	3.1	38.5	7.2	-	1.2	0.0	3.4	53.4
Prescription drugs	73.9	187.6	86.4	36.2	1.1	9.7	18.1	413.0
Substance abuse treatment programs	-	-	-	-	45.1	45.1	-	90.1
non-residential	-	-	-	-	17.6	17.6	-	35.2
withdrawal management	-	-	-	-	10.2	10.2	-	20.4
residential	-	-	-	-	17.3	17.3	-	34.5
Community mental health	259.1	45.4	31.9	67.1	2.4	2.4	2.4	410.6
Other direct costs: total	135.3	43.2	10.1	310.5	1,224.3	917.3	117.7	2,758.4
Law enforcement costs	7.1	-	-	301.2	1,141.0	908.5	-	2,357.7
Policing	4.6	-	-	195.5	710.7	512.5	-	1,423.4
Court	0.7	-	-	28.2	119.5	77.0	-	225.4
Prosecution	0.2	-	-	9.2	39.1	102.2	-	150.7
Legal aid	0.2	-	-	8.5	35.8	45.1	-	89.6
Custody adults	1.0	-	-	42.7	176.6	124.1	-	344.4
Custody youth	0.4	-	-	17.0	59.2	47.6	-	124.2
Capital costs	33.9	42.9	9.7	8.9	20.2	2.8	65.0	183.4
Acute -care hospitals	21.2	32.9	7.1	6.6	18.9	2.1	64.7	153.5
Psychiatric hospitals	12.4	6.8	2.0	2.4	1.2	0.7	0.0	25.5
Long-term care facilities	0.3	3.1	0.6	-	0.1	0.0	0.3	4.4
Supportive housing	94.0							94.0
Research Education and Prevention	0.4	0.4	0.4	0.4	19.4	6.0	28.5	55.4
Fire losses	-	-	-	-	43.7	-	24.2	67.9
Total in mln $	640.7	578.9	427.7	470.8	1,486.7	1,002.6	545.6	5,152.9
Total per capita $	54.9	49.6	36.7	40.3	127.4	85.9	46.8	441.6

Table 20: Summary of all societal costs attributable to mental disorders and substance abuse in Ontario 2000

	(in millions dollars)							
	Severe mental illness	Mood disorders	Minor depression and anxiety disorders	Heterogeneous disorders	Alcohol abuse	Illicit drug abuse	Tobacco abuse	Total
Direct health care costs: total	505.3	535.7	417.6	160.3	262.4	85.3	427.9	2,394.5
acute care hospitalization	69.7	123.8	24.1	27.5	196.0	10.5	403.8	855.4
psychiatric hospitalization	64.5	32.5	11.2	18.4	9.4	4.3	0.0	140.3
long-term care	3.1	38.5	7.2	-	1.2	0.0	3.4	53.4
Non-physician services *	17.2	54.9	21.3	-	1.7	2.8	0.0	98.0
Social workers	6.4	17.0	1.8	-	0.5	2.3	0.0	28.0
Psychologists	4.6	18.7	8.5	-	1.0	0.0	0.0	32.7
Nurses, religious leaders and other health professionals	6.2	19.3	11.1	-	0.2	0.6	0.0	37.4
Physician services	17.7	53.0	235.5	11.1	5.7	10.5	0.3	333.7
Psychiatrists	13.1	36.6	96.5	4.3	1.0	1.1	0.0	152.6
GP/FPs	4.1	15.3	124.4	2.1	3.9	8.9	0.2	159.0
Other MDs	0.6	1.0	14.7	4.7	0.7	0.4	0.0	22.1
Prescription drugs	73.9	187.6	86.4	36.2	1.1	9.7	18.1	413.0
Substance abuse treatment programs	0.0	0.0	0.0	0.0	45.1	45.1	0.0	90.1
non-residential	0.0	0.0	0.0	0.0	17.6	17.6	0.0	35.2
withdrawal management	0.0	0.0	0.0	0.0	10.2	10.2	0.0	20.4
residential	0.0	0.0	0.0	0.0	17.3	17.3	0.0	34.5
Community mental health services	259.1	45.4	31.9	67.1	2.4	2.4	2.4	410.6
Other direct costs: total	135.3	43.2	10.1	310.5	1,224.3	917.3	117.7	2,758.4
Law enforcement costs	7.1	0.0	0.0	301.2	1,141.0	908.5	0.0	2,357.7
Policing	4.6	0.0	0.0	195.5	710.7	512.5	0.0	1,423.4
Court	0.7	0.0	0.0	28.2	119.5	77.0	0.0	225.4
Prosecution	0.2	0.0	0.0	9.2	39.1	102.2	0.0	150.7
Legal aid	0.2	0.0	0.0	8.5	35.8	45.1	0.0	89.6
Custody adults	1.0	0.0	0.0	42.7	176.6	124.1	0.0	344.4
Custody youth	0.4	0.0	0.0	17.0	59.2	47.6	0.0	124.2
Capital costs	33.9	42.9	9.7	8.9	20.2	2.8	65.0	183.4
Acute -care hospitals	21.2	32.9	7.1	6.6	18.9	2.1	64.7	153.5
Psychiatric hospitals	12.4	6.8	2.0	2.4	1.2	0.7	0.0	25.5
Long-term care facilities	0.3	3.1	0.6	0.0	0.1	0.0	0.3	4.4
Supportive housing	94.0							94.0
Research Education and Prevention	0.4	0.4	0.4	0.4	19.4	6.0	28.5	55.4
Fire losses	0.0	0.0	0.0	0.0	43.7	0.0	24.2	67.9
Indirect costs: productivity losses (main scenario)	973.9	11,959.6	7,131.4	4.0	2,558.9	1,667.5	4,408.6	28,704.0
due to long-term disability	949.7	11,665.2	7,077.1	0.0	2,232.8	1,583.1	3,797.4	27,305.3
due to short-term disability (days in bed)	0.0	47.8	17.9	0.0	6.0	8.3	12.4	92.5
due to short-term disability (days with reduced activity)	0.0	116.2	30.2	0.0	9.0	0.0	18.7	174.0
due to acute care hospital days	9.1	11.8	3.0	0.7	5.4	0.8	10.4	41.2
due to psychiatric hospital days	11.2	4.5	1.7	1.4	1.1	0.7	0.0	20.6
due to long-term care days	0.6	5.2	0.8	0.0	0.2	0.0	0.5	7.4
due to premature mortality	3.3	108.9	0.8	1.9	304.4	74.6	569.1	1,063.1
Total (in mln dollars)	1,614.5	12,538.6	7,559.2	474.8	4,045.6	2,670.1	4,954.1	33,856.9
Total per capita ($)	138.4	1,074.5	647.8	40.7	346.7	228.8	424.5	2,901.4