The Economic Costs of Depressive Disorders in Ontario, 1990

by

William H. Gnam

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Department of Community Health,
University of Toronto

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Abstract

Objective: To estimate the direct and indirect costs of depressive disorders (major depression and dysthymia) in Ontario in the year 1990.

Design: A prevalence-based cost of illness study using the Friction cost method to calculate the costs associated with premature mortality and morbidity attributable to depressive disorders.

Data sources: The Mental Health Supplement to the Ontario Health Survey for prevalence rates, disability, and outpatient utilization; Statistics Canada for inpatient utilization and mortality figures.

Results: The total cost of depressive disorders in Ontario in 1990 was $475.7 million dollars, or $1583 dollars per prevalent case. 58.4% of this cost was related to morbidity and premature death.

Conclusion: The indirect costs of depressive disorders are greater than the direct costs. More research is needed to obtain better estimates of morbidity costs.

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Dedication

To Wusun.

CHAPTER 1
The Economic Costs of Depressive Disorders in Ontario, 1990

1.1 Introduction

Governments and health service planners make complex health policy decisions that require systematic modes of policy analysis to inform them. The need for cost containment shapes the current context for such decisions, as the availability of health-related interventions dramatically outstrips society's collective ability to pay. In this contemporary setting, traditional decision-making methods which result in health resource allocations are unlikely to produce the greatest benefit for the population. The economic analysis of health care has proliferated in this context, as policy makers demand better evidence to guide allocation priorities.

A fundamental part of any economic analysis involves the measurement of costs. Costin studies typically examine the resource implications of specific interventions, health programs, o diseases. Cost-of-illness (COI) studies attempt to characterise the economic burden of particular diseases by quantifying the resources applied to diagnosis, treatment, and research, as well as estimating productivity losses caused by illness-related disability and premature death. COI studies can identify categories of heavy resource use or large productivity losses associated with illness. They are also used to compare diseases according to the relative societal burdens they impose (Rice, 1966; Rice et al, 1985; Wigle et al, 1991; The World Health Organisation, 1996). These comparisons can be helpful in directing future investment and research towards areas which show the greatest potential gain.

The most comprehensive and global efforts to compare the burdens of disease report that depressive disorders represent major causes of morbidity and mortality world wide, and impose substantial burdens on individuals and societies at large (The World Bank, 1993; The World

Health Organisation, 1996). Using disability-adjusted life years (DALYS) as their measure, the World Health Organisation calculated that unipolar depression is the second largest cause of lost DALYS in developed countries. In developing countries, it ranks fourth. Depressive disorders are prevalent world wide (The World Health Organisation, 1996), and recent evidence suggests that in industrialised countries they have a prominent association with work disability and absenteeism (Conti & Burton, 1994). Numerous psychological post-mortem studies from severa countries report that depressive disorders are causally implicated in the majority of suicides (Henriksson et al, 1993; The World Health Organisation, 1996) and thereby contribute to a massive loss of life-years. Depressive disorders also lead to a reduced quality of life, as sufferers typically experience as much or more limitation in multiple aspects of daily functioning than is associated with most chronic medical conditions (von Korff et al, 1992). Despite these findings, surprisingly few studies have rigorously estimated the costs associated with depressive disorders, and none has been conducted in Canada.

Our knowledge of mental disorders in Canada suggests that depressive disorders carry an impact in Canada comparable to the international profile. Evidence from two community surveys of mental health suggest that depressive disorders are prevalent in Canada. The Mental Health Supplement to the Ontario Health Survey reported that the one-year prevalence of major depression in 15 to 64 year olds was 4.1%, and the one-year prevalence of dysthymia (a chronic form of depression – see Appendix I) was 0.8% (Offord et al, 1996). The one-year prevalence of major depression in Edmonton was 4.6% (Bland et al, 1988).

The primary objective of this thesis is to perform a COI study of depressive disorders in Ontario for the year 1990. Several factors motivate this topic, the most immediate of which is the

absence of previous Canadian studies. COI studies performed in other countries may not be representative of the Canadian situation. The economic costs of depressive disorders may vary substantially among countries, reflecting differences in prevalence rates and rates of detection, but also variations in mental health services, variations in unit costs, and idiosyncratic interactions between depressive disorders, disability, and the labour market. A COI study of depressive disorders also makes a timely contribution to the broad policy debate over mental health reform, particularly in Ontario. The most recent blueprint for reform (Ontario Ministry of Health, 1993) suggests that mental health spending be reallocated towards populations with severe and chronic mental disorders, such as schizophrenia. One useful way to evaluate such proposals is by serious consideration of their opportunity cost -- that is, the best alternative use to which marginal dollars could be allocated. And the case for reallocation to improve the detection and treatment of depressive disorders has considerable appeal (Rupp, 1995).

Evidence suggests that depressive disorders have a low treated prevalence rate. The adequacy of treatment is also often questionable. Analysis of the Mental Health Supplement to the Ontario Health Survey (the Supplement) indicates that 45% of those who had experienced two or more episodes of major depression were untreated (Ontario Ministry of Health, 1994). No published Canadian data exist on the adequacy of treatment. However, using as indicators the number of visits to a physician and use of antidepressant medication, one preliminary analysis of the Ontario Mental Health Supplement (E. Lin, personal communication) suggests that the treatments of many respondents fail to meet minimum standards established by published guidelines on depression (Depression Guideline Panel, 1993). These findings are particularly compelling given the widespread availability of several standardised psychological and

pharmacological interventions, whose efficacy have been validated through numerous controlle trials (Depression Guideline Panel, 1993).

While these findings might constitute a prima facie rationale for the reallocation of marginal resources to improve the detection and treatment of depressive disorders, recent proposals for mental health reform suggest vastly different priorities (Ontario Ministry of Health 1994). Of course, the merits of reallocation towards specific interventions are more properly appraised by the paradigms of efficacy, effectiveness, and cost-effectiveness, or by other considerations, such as equity. Nonetheless, cost-of-illness studies serve as useful background cost data for these paradigms, and for broader planning purposes. Representative cost data on depressive disorders would better inform the debate over reallocation of funding in mental health.

1.2 Thesis organisation

Chapter 2 offers a brief introduction to the COI literature. All past studies COI studies involving depressive disorders are critically reviewed.

Although hundreds of disease-specific COI studies have been performed, debate regarding the appropriate evaluation methodology continues unabated (Hodgson, 1983). Every costing study must explicitly consider several methodological issues. Chapter 3 describes the major methodological considerations, and offers a defence of the choices made. Chapter 4 presents the results of the analysis. Chapter 5 highlights the major findings of the study, and contrasts these findings with earlier COI studies. This Chapter also reviews the limitations of thi work, and identifies some of the relevant questions for future research.

CHAPTER 2

Background and Literature Review

2.1 Cost-of illness studies

Although the basic principles of the human capital method (the most common economic framework for COI studies) were recorded as early as the seventeenth century, they were not applied to the health field until Fein's early work on the cost of mental disorders (Fein, 1958). These principles were formalised in economic theory with Mushkin's work on health as an investment (Mushkin, 1962). In 1966 a basic framework and detailed procedures were presented for allocating total personal health care expenditures and indirect costs among disease categories in a consistent manner that avoided double counting, and revealed the relative economic burden of each disease (Rice, 1967). These methods have proliferated and have resulted in hundreds of disease-specific studies. However, serious disagreements remain among some economists about basic methodological issues (Hodgson, 1983; Robinson, 1986). The desire for more convergence in analytical techniques has recently spawned attempts to establish guidelines for the analysis and reporting of costing, particularly in cost-effectiveness studies (Weinstein et al, 1996).

2.2 COI studies of mental illness and depressive disorders

To our knowledge only three prior studies have comprehensively evaluated the costs of depressive disorders (Greenberg et al, 1993; Rice & Miller, 1995; Stoudemire, 1986). However, several other studies have contributed to the state of our current knowledge, and these are briefly reviewed first.

The first COI studies performed specifically for psychiatric disorders were those of Malzberg (Malzberg, 1950) and Fein (Fein, 1958). Although ground-breaking, by contemporary criteria these studies suffered from limited diagnostic specificity between various mental disorders. They also lacked reliable population-based data upon which to calculate social costs.

A study conducted jointly by the World Health Organisation and the World Bank (The World Bank, 1993; The World Health Organisation, 1996) calculated the global burden of disease by quantifying morbidity and mortality related to illness into a common unit, the Disability-adjusted life year (DALY). Using data from many sources, they estimated both mortality attributed to specific diseases, and translated morbidity into lost years using disease severity weights. Several methodological assumptions were arbitrary, including the calculation of disease-specific morbidity weights. Nonetheless, the study did highlight unipolar depression as a prominent world-wide causes of death and morbidity.

The first contemporary study to estimate the costs of depressive disorders was Stoudemir et al (1986). It was also the earliest study to base some cost calculations on data from a representative population survey of mental health (the Epidemiologic Catchment Area study (Regier et al, 1984)). Using the human capital model they estimated the economic burden of depression in the United States in the year 1980 to be $16.3 billion. Indirect (time) costs accounted for 87% of total costs.

This study had several limitations. Missing variables in their epidemiological data set led the authors to restrict their costing to the acute form of depression (major depression), omitting dysthymia, the chronic form of depression. The costs of all lithium prescribed in the United States were attributed to the treatment of major depression, when in fact only a minority of the

drug would have been used for this purpose. Most significantly, the investigators had no estimates of the number of days that the depressed population were either completely or partially disabled. This led them to make several arbitrary assumptions in order to calculate productivity losses attributable to depressive disorders. They also made broad assumptions concerning the number of treated and untreated individuals, the duration of depressive episodes, and the relationship between episode and disability. Morbidity costs comprised more than 60% of the overall costs of depressive disorders, and yet these estimates had the weakest empirical support.

The basic methodology of Stoudemire was extended and updated by Greenberg et al (1993), who published a COI study of all affective disorders (major depression, dysthymia, and bipolar disorder) for the year 1990 in the United States. They estimated the economic burden of all affective disorders to be $43.7 billion, with indirect costs representing 72% of the total. Their analysis may have suffered from double-counting: the majority of respondents with a one-year history of dysthymia also have major depression concurrently, but the investigators appear to treat respondents with dysthymia and major depression as separate groups, without explicitly considering overlap.

Greenberg et al (1993) employed arbitrary assumptions similar to Stoudemire et al (1986) in order to estimate the costs associated with the diminished productive capacity of untreated depressed individuals who continued to work, and to estimate the number of disability days attributable to all affective disorders. Morbidity costs were the largest single component of costs attributable to all affective disorders, and yet again the empirical support for the estimates was weakest in this area. Other limitations of their study were failure to consider family burden costs, and failure to consider the value of lost non-marketed production (in housekeeping and

other leisure activities) when estimating mortality and morbidity costs.

Another limitation of Greenberg et al (1993) is that their estimates consider depressive disorders in aggregate with bipolar disorder. Many strands of evidence suggest that unipolar depressive disorders (major depression and dysthymia) are distinct from bipolar disorders, with different clinical, treatment, and socioeconomic implications (Goodwin and Jamison, 1990). Disaggregation of the costs according to type of affective illness would have been desirable, particularly since those with bipolar disorders may incur higher direct and indirect costs compared to depressive disorders. The bipolar disorder cost figures on a per case or per capita basis may not be representative of the cost of depressive disorders taken separately, but there is no way to derive separate estimates using the data presented in the paper.

The only other COI study examining affective disorders was the study of Rice and Mille (1993; 1995). In these papers estimates of the economic burden of all affective disorders (major depression, dysthymia, and bipolar disorder) are offered. Their work does not provide separate cost estimates for bipolar disorder and depressive disorders (major depression and dysthymia), s again the cost of depressive disorders taken separately is not available.

These authors also make three strong assumptions which are supported by little evidence. First, they assume that affective disorders are causal factors in some crime, and include in their calculations crime, punishment, and law enforcement costs. However, scant evidence suggests that bipolar disorders contributes to criminal behaviour, and virtually no evidence directly implicates major depression or dysthymia (this issue is reviewed in Section 3.3.4.6). Including costs related to crime or law enforcement is therefore questionable. When calculating the family burden costs of affective disorders, the authors use figures from a study of chronically ill

psychiatric patients who were recently discharged from hospital care in Massachusetts (Franks, 1987). In this study more than 80% of patients in that study had primary diagnoses of psychotic disorders. The authors offer no justification in assuming that the family economic burden of psychotic disorders is comparable to that of depressive disorders. Finally, Rice and Miller (1995 develop a model of income loss associated with depressive disorders which grossly underestimated morbidity costs (this issue is reviewed in Section 3.3.5.4).

2.3 Summary of previous studies

In summary, our knowledge of the economic costs of depressive disorders rests upon three studies conducted in the United States. Only one these studies attempted to estimate the costs of major depression separately from bipolar disorder. However, this study did not include costs related to dysthymia, and does not represent the complete costs of all depressive disorders. The limitations of these studies are also clear: Stoudemire et al (1986) and Greenberg et al(1993), have weak empirical support for their estimates of morbidity costs. Greenberg et al. dc not explicitly consider the coexistence of major depression and dysthymia, and may have double counted some individuals in their calculations. Rice and Miller (1995) base family burden estimates on questionable data, and make strong assumptions regarding the relationship of affective disorders to criminal behaviour.

Notwithstanding these limitations, the results of these U.S. studies may not be applicable to Canada. With the paucity of relevant cost information on depressive disorders outside of the United States, and the limitations of prior studies, a COI study of depressive disorders in Ontario makes an original contribution to this literature.

CHAPTER 3

Methodology

3.1 General design

From a comprehensive perspective, this study attempts to measure the economic costs associated with all residents of the Province of Ontario who suffered from depressive disorders for the year 1990. This study therefore adopts a prevalence approach to COI analysis, rather than an incidence-based approach. In economic analysis a comprehensive perspective is often referred to as a societal perspective, even though others may use the term "societal" to refer to economic activity that is financed from a public (or government) source. From the viewpoint of welfare economic theory, societal welfare is represented by the aggregation of individual utilities or welfares. It is therefore consistent with welfare economic theory that all costs borne by private and public sources be aggregated. However, for other purposes (such as cost-effectiveness analyses) a different perspective may be relevant. The economic definition of societal should be borne in mind when considering the cost tables in the results section (Chapter 4).

Ontario in 1990 represents a convenient geographical region and year because the Mental Health Supplement to the Ontario Health Survey, a major epidemiological survey of the mental health of Ontarians (Boyle et al, 1996), was conducted in 1990-91. Generalizing the analysis to all of Canada would have compelled us to make arbitrary assumptions about service utilization rates in several provinces, since these data would have been unavailable or beyond the resources of this study to acquire. The year 1990 is the same one chosen by Greenberg et al (1993) and Rice and Miller (1995) for their studies. Cost estimates of the third study (Stoudemire et al,

1986) were also updated recently to the year 1990 (Greenberg et al, 1993). Comparisons with U.S. results are facilitated by studying the same time period, because clinical practices have changed over the last eight years, and the treated prevalence of depressive disorders may have increased. Choosing the same year "controls" for this evolution in mental health services, allowing more focus on other factors which may account for cost differences.

3.2 Definition of depressive disorder

The definition of depressive disorder used in this study includes major depressive disorder and dysthymic disorder, classified according to the Diagnostic and Statistical Manual o Mental Disorders, 3rd Edition Revised (DSM-III-R), the predominant diagnostic system in North America (American Psychiatric Association, 1987). The diagnostic criteria for these disorders are presented in Appendix I. Bipolar disorders and primary psychotic disorder are excluded. Th COI study of Stoudemire et al (1986) only considered major depressive disorder, while the othe two studies developed estimates based upon the combined prevalence of major depression, dysthymia, and bipolar disorder.

The rationale for considering depressive disorder separately from bipolar disorder was covered in Chapter 2. Several lines of evidence suggest that bipolar disorders are distinct from unipolar forms of depression, and imply different symptom patterns, disability levels, treatments and life courses (Goodwin & Jamison, 1990). The economic resource implications of bipolar disorders may therefore differ substantially from depressive disorders.

Major depression and dysthymia are considered together because with most data sets (including ours) it is impossible to reliably separate them. Moreover, many scientists believe tha

these disorders are related, since the majority of persons with dysthymia will also develop major depressive episodes over their lifetime (Akiskal & Weise, 1992).

Although this study confines its attention to depressive disorders, complications arise because different diagnostic systems for mental disorders are often used by researchers, clinicians, and statistical agencies. Further complications occur because psychiatric disorders may coexist. For example, some depressive disorders are complicated by psychotic symptoms, which when present may change the precise psychiatric diagnosis (American Psychiatric Association, 1986). The diagnostic information contained within some data sets (particularly Statistics Canada data) do not allow separation of these cases from uncomplicated depressive disorder.

Two important data sources used in this study (Statistics Canada, and Intercontinental Medical Statistics) used the International Classification of Disease, 9th edition (ICD-9) to classify diagnostic information (The World Health Organization, 1994). Using these data compel us to make assumptions regarding the correspondence between the DSM-IIIR and ICD-9 diagnostic systems. While the overlap and psychometric properties of both diagnostic systems have been studied to a limited degree, arbitrary assumptions must still be made to determine which ICD-9 codes closely correspond to the DSM-III-R definitions of depressive disorders. An inclusive approach was adopted for this study; all diagnostic codes under ICD-9 which are related to a depressive disorder were included. The relevant ICD-9 codes included were 300.4 (Neurotic depression), 300.5 (Neursasthenia), 301.1 (Affective personality disorder), 311 (depressive disorder, not elsewhere classified). Any diagnosis primarily related to bipolar disorders or primary psychotic disorders were excluded.

3.3 General economic framework and assumptions

3.3.1 Units of measure, establishing baseline cost figures, and sensitivity analysis

All dollar figures are given in 1990 Canadian dollars. When figures for 1990 were unavailable, the estimates were adjusted for inflation using the health sector consumer price index for Ontario, or the all-item consumer price index for Ontario (Statistics Canada, 1992; 1995). For most cost categories, the lowest estimate was taken as the baseline (most representative) value, used in the calculation of baseline results. The parameters yielding the highest cost estimates were also used in order to establish an upper limit of the cost of depressive disorders.

In costing studies sensitivity analysis is often used to model uncertainty regarding the value various data or economic parameters (such as discount rate). In this thesis sensitivity analysis was used only to explore the sensitivity of the Friction cost model to various modeling parameters; extensive further sensitivity analysis could have been performed, but it would have extended beyond the requirements of this thesis.

3.3.2 The human capital approach

Although COI studies have proliferated, fundamental disagreements over methodology persist, as does confusion over what precisely these studies estimate. COI studies attempt to calculate in money terms all resources consumed or lost which are attributable to specific diseases. To some authors the calculation of lost productivity with premature death is erroneously assumed to place a dollar figure on the value of human life. The underlying

theoretical model for this thesis is the human capital approach, which historically has been the most common model for COI studies. People have individual characteristics, assets, and skills for hire. The human capital approach considers the productive contributions a person makes to society, and argues that in a competitive labor market the value of these productive contributions is best measured by the market wage. This implies that the productive value of a human resource is the cumulative lifetime earnings of an individual expressed on a present value basis. The productive potential of these personal productive characteristics and assets is reduced by a depressive disorder.

The traditional human capital approach may be problematic when market imperfections cause wages to depart systematically from productive contributions. This could arise if wage discrimination exists, such that women and men making identical contributions are paid differently, or if the labor market is not in equilibrium. In this decade Canada has witnessed a significant labor surplus, which may alter the valuation of lost productive capacity. A new mode (the Friction cost approach), has been promulgated as a refinement to the human capital approach, in that future lost productive capacity is valued in a labor market featuring surplus labor (Koopmanschap et al, 1993; Koopmanschap, 1995). This model is adopted to calculate time (indirect) costs in this thesis.

The second major framework used in COI studies considers how much a person would pay to avoid an illness or reduce the probability of death. Unlike the human capital paradigm, the willingness-to-pay (WTP) approach can incorporate the effects of pain and suffering, or other quality-of-life issues, as well as the possible willingness of sufferers to pay more than their expected earnings loss if they could avoid an illness. However, this approach creates imposing

practical barriers to empirical estimation, since it requires prediction of the anticipated duration and course of the specific illness, as well as estimates of the future out-of-pocket costs and impact on work-place activity among new sufferers. Adopting the WTP approach for this thesis would have precluded any meaningful comparisons with earlier U.S. studies.

3.3.3 Discount rate

Broad agreement exists that future costs should be stated in terms of their present value to society. This involves discounting -- adjusting the dollar amounts to reflect the time value of money, by assigning lower values to dollars paid in the future than to dollars paid in the present. While discounting meets little resistance in principle, in practice the choice of discount rate is controversial, raising both theoretical and empirical issues (Krahn & Gafni, 1993).

Theoretical considerations raise two distinct questions: whether a societal or individual perspective should be taken, and the appropriate theoretical stance from which to determine the discount rate. If the individual perspective was adopted, a higher discount rate (than the societal rate) might be more appropriate, since the depressed group has a greater than average likelihood of committing suicide at some point in the future. (In general, the riskier the income or cost stream, the higher the rate at which it should be discounted). However, the stated goal of this analysis is to calculate the value of the lost resources *to society* on a present value basis. Accordingly we assumed that from a societal perspective the loss of a human resource prior to the suicide is not valued any less for a depressed individual than for a healthy person simply because that loss may be more likely to occur.

Accepting a societal perspective still leaves complicated considerations on how economi theory can inform the choice of a societal discount rate. Debate persists over what constitutes th correct theoretical underpinnings of the discount rate. Related to this debate are questions on how the discount rate for health studies should be estimated, an issue which any empirical work must address.

Two separate strategies have been proposed over the years for selecting the appropriate rate for economic evaluations of social programs. Consistent with modern welfare economics, one strategy posits that the societal discount rate be derived on the basis of revealed preferences in the marketplace. Market interactions between producers and consumers yield information about interest rates, returns on capital, and similar values. Long-term interest rates, which theoretically reflect expectations regarding future time preferences and returns on investment, ar generally thought to convey the relevant information needed to derive a social rate of discount (Harberger, 1971).

A dissenting approach to revealed preference argues that the social rate of discount should be derived through the political process. One argument against revealed preference is tha current market rates reflect an inadequate concern for future generations; this implies that the social rate needs to be set lower than the prevailing market rates. The second argument (Sen, 1982) is that individuals tend to have preferences for societal outcomes, such as the distribution of health or wealth across nations; these preferences are distinct from those preferences which drive private consumption or investment activity. Some philosophers have challenged the normative foundations of any attempt to derive the social discount rate on the basis of the private market transactions of individuals (Krahn & Gafni, 1993). While these arguments have merit,

the absence of a collective process for determining the social rate of discount precludes using thi approach in applied work. Estimation strategies which rely on current market transactions provide much more explicit guidance for choosing a rate.

This thesis adopts the shadow-price-of-capital (SPOC) approach to estimating the societa discount rate, which economists generally regard as superior to its predecessor, the social opportunity cost approach. The basic premise here is that the ultimate purpose of all economic activity (including private investment) is consumption. Thus, the value of income forfeited by premature death is the present value of the consumption that would be given up. One discounts these streams to present value using the social rate of time preference, the rate at which the socia decision maker is willing to trade off present for future consumption. The social rate of time preference has been estimated as the real return of risk-free long-term assets, such as governmen bonds. This estimate has been placed as low as 2% (Lind, 1982). In light of these findings and others, the traditional discount rate for health studies of 5% is viewed by many as too high (Viscusi, 1995; Weinstein et al, 1996). Although the SPOC approach has strong advocates among many economists, empirical estimation still suggests a range of possible values. Others (Krahn & Gafni, 1993; Weinstein, 1996) have suggested that methodological guidelines for discounting be established for health care evaluations. In keeping with the most current recommendations for cost-effectiveness analysis, based on a consensus panel (Weinstein et al, 1996), the baseline discount rate of 3% was chosen. The three contemporary COI studies of affective disorders (Greenberg et al, 1993; Rice & Miller, 1995; Stoudemire, 1986) used a discount rate of 6%. To facilitate comparisons with these studies, a sensitivity analysis of the discount rate was conducted between 0% and 7%.

3.3.4 Direct Costs

3.3.4.1 Pharmaceutical Costs

In 1990 the pharmacological treatment of depressive disorders was complex, involving many classes of drugs with vastly different chemical structures. Complicating the analysis of the expenditures on depressive disorders was the fact that antidepressant drugs had multiple clinical uses beyond treating depression. It would overstate drug costs to assume that all antidepressant drug costs were attributable to depressive disorders.

A broad variety of drugs with no primary antidepressant effect are prescribed for depressive disorders, either as adjunctive agents to promote sleep, or as augmenting agents to enhance the antidepressant effects of standard drugs. Further complicating matters, many patients are either misdiagnosed and inappropriately prescribed other drugs, or are correctly diagnosed but still prescribed inappropriate medications for primary treatment (Wells, 1997). Considered together these observations suggest that any cost estimates for depressive disorders using retail drug costs would be inaccurate unless linked in some manner to clinical data on prescribing practices.

Pharmaceutical data for this thesis were provided by Intercontinental Medical Statistics (IMS, 1992; 1993). Data on drug retail costs were obtained from the survey of retail pharmacies, conducted from a representative sample of pharmacies across Canada (IMS, 1992). Data on the percentages of specific drugs prescribed for depressive disorders was obtained from the Canadian

Drug and Therapeutic Audit (CDTA), a two-day representative sample of 645 physicians (both general practitioners and specialists) which link prescribed substances to particular ICD-9 diagnoses (IMS, 1993). The audit records the percentage of times that medications are recommended for particular diagnoses. A recommendation does not necessarily mean that a new prescription was dispensed, however. If for example a follow-up visit resulted in advice to remain on a particular medication, then this encounter would be recorded as a recommendation, but no new medication would be prescribed. The amount and dose of each agent recommended was not recorded.

For these reasons the percentage of recommendations that a drug received for a particular diagnosis does not precisely reflect the actual percentage of any product prescribed for that diagnosis. Nevertheless, in the absence of more complete data we assumed that the percentage of recommendations of a drug for depressive disorders roughly represented the percentage of the total expenditure for that drug attributable to depressive disorders. Approximately one quarter of the CDTA physician sample originated in Ontario. Restricting the sample to Ontario physicians would have resulted in very unreliable recommendation estimates for drugs that are infrequently prescribed for depression. We therefore assumed that national physician prescribing patterns accurately represented Ontario patterns, and the full national sample was used in determining the percentage of drug recommendations directed at depressive disorders. To arrive at an estimate of total outpatient drug costs, for each drug recommended for depressive disorder the percentage of recommendations for the drug for depressive disorders was multiplied by the retail cost of the drug (which include dispensing fees) for Ontario in 1990. The total retail figures for all relevant prescribed drugs for outpatients were obtained from a validated sample of sales from pharmacies

across Ontario (IMS, 1993). Inpatient drug costs are not calculated explicitly, but are incorporated in the per diem costs of hospital beds.

The total drug cost estimates presented in this thesis are likely to be conservative. Practitioners who did not recognize depressive disorder may have prescribed or recommended medications based upon an erroneous diagnosis. The CDTA did not validate the accuracy of physician diagnoses, and would not have attributed these costs towards depressive disorders. In addition, the CDTA did not record purchases of over-the-counter medications.

3.3.4.2 Inpatient costs

The numbers of inpatient bed-days attributable to depressive disorders in general hospitals and psychiatric hospitals in Ontario were obtained from the annual statistical reports on the number of bed-days and separations for depressive disorders in 1990 (Statistics Canada, 1992). Because provincial statistics by detailed psychiatric diagnosis were unavailable, we assumed that the proportions of national bed-days consumed by patients with a diagnosis of depressive disorder (by the ICD-9 codes) were representative of the proportions in Ontario. The cost of an inpatient day on a psychiatric ward in an Ontario Provincial Psychiatric hospital for the year 1993-94 was estimated as $302.84 (Loyd & Associates, 1995), based on an audit of 12 Ontario public psychiatric hospitals. This figure was adjusted to a 1990 value of $254.04 using the Ontario health-sector CPI (Statistics Canada, 1994). The unit cost of a bed-day on a general hospital psychiatric ward in 1990 for the diagnosis of depression was $281.37, obtained from the Ontario Case Costing Project (OCCP, 1992), which included a sample of 10 general hospitals in Ontario. The OCCP figures include allocated overhead and drug costs, are adjusted to exclude

outpatient costs, but do not include physician services. Physician services were not included in these estimates. To estimate physician services to inpatients, a model representing "typical" physician practice was introduced. Since this model is based only upon expert opinion, conservative estimates were adopted. From discussions with inpatient psychiatrists, a typical patient admitted for depression at a provincial psychiatric hospital would incur an initial consultation fee, followed by a daily visitation fee 3 out of 7 days per week, with a longer assessment fee (for 16 to 30 minutes of psychiatric care) 2 out of 7 days per week. In a general hospital, a typical patient would incur the same initial consultation fee, followed by daily visitation fees 2 out of 7 days per week, and a longer service fee 3 out of 7 days per week. The larger weekly fees for general hospitals reflect the presumption of more intensive services in the acute care settings. The total number of separations was taken to reflect the total number of admissions (and therefore the total number of new admission assessment fees charged). For chronic psychotic patients, separations and length of stay figures are misleading, because the length of stay data for patients who have been in hospital for years are truncated to no more than one year. For depressive disorders, stays in excess of one year were rare (Statistics Canada, 1992). Under these conditions, the number of separations serve as a reasonable proxy for the number of admissions.

3.3.4.3 Outpatient costs

Outpatient costs were calculated from data from the Ontario Mental Health Supplement (the Supplement). The Supplement was a community survey of 9,953 Ontario residents conducted in 1990-1991 (Boyle et al, 1996), based on a stratified probability sample of

households. The methodology has been described in detail elsewhere (Boyle et al, 1996). For our estimations, rates of depressive disorders, outpatient utilization rates, the numbers of complete or partial disability ("cut-down") days, and the primary occupation or activity of the depressed individuals were all taken from the Supplement.

Respondents to the Supplement were asked to recall visits made to a wide variety of health professionals and informal health providers for a span of thirty days before the interview. For respondents with a depressive disorder who reported visits for mental health purposes, the numbers of visits were inflated to population figures using the population weights for age and gender to arrive at population estimates. The unit costs of visits were estimated from different sources, according to the identity of the provider. The costs of visiting a general practitioner were calculated from the Schedule of Benefits (Ontario Ministry of Health, 1986), assuming (after discussing this issue with several providers) that ninety percent of visits were billed as intermediate assessments, and ten percent of visits were for psychotherapy, consisting of a forty-six to sixty minutes of psychotherapy. For visits to a psychiatrist, it was conservatively assumed that each visit was billed as 16 to 30 minutes of psychiatric care or psychotherapy, and that eleven percent of the total treatment time was devoted to the initial assessment. The latter assumption was developed from a study of psychiatric practice in Canada conducted in 1989 (Richman, 1991), which reported that eleven percent of all services provided by psychiatrists wa devoted to assessment. Unit costs of visits to other providers were calculated by assuming that visits lasted on average one hour. The approximate hourly wages of providers were calculated from earned income figures provided in the Statistics Canada census from 1990-91 (Statistics Canada, 1994), assuming each provider worked their occupation-average number of hours per

week, and assuming that each provider worked 48 weeks per year. These figures were then adjusted for benefits. In the Supplement some respondents also identified a location of service. For physician-related services given in a private office, the costs of overhead are included in the fee. For non-physician services, some respondents with a depressive disorder reported visits to community mental health clinics and social service facilities. We were unable to estimate the overhead costs of visits to these facilities. Data on the total annual number of visits to welfare offices and accurate accounting information on the operating costs could not be obtained from the Ontario Ministry of Health. Conservatively the overhead costs of these facilities were specified as zero, recognizing that this omission likely comprises only a small proportion of total direct costs.

3.3.4.4 Research costs

Total research costs were estimated by reviewing all grants (including research grants, and training fellowships when the training was clearly related to research on depressive disorders) awarded to Ontario recipients by all funding agencies for the years 1989-90 (April-April) and 1990-1991 (April-April). Since the accounting year the grants run from April to April, the research money available for the calendar year 1990 was estimated by applying weights of 0.25 and 0.75 (respectively) to the dollar amount of grants awarded in the years 1989-90 and 1990-91.

3.3.4.5 Emergency room visits

The Supplement also contained figures on the number of emergency room visits made by depressed respondents over a thirty day period prior to the survey. Assuming that this sample is representative of emergency room visits over a calendar year, these figures were inflated to population figures using the population sample weights. The average cost of an emergency room visit to a general hospital, excluding physician fees but including the costs of overhead and drugs, was estimated to be $144.00 for the Chedoke-McMaster hospitals in the year 1992-3 (R. Goree, personal communication). This figure was considered to be the most accurate of figures over several years. This figure was adjusted to $120.70 in 1990 dollars, using the health-index component of the Ontario CPI (Statistics Canada, 1995).

3.3.4.6 Crime, punishment , and law enforcement costs

The causal association between depressive disorders and suicide has been widely accepted, but few studies have examined the possible relationship between depressive disorders and crime, particularly homicide or other violent crime. Teplin et al. (1990) reported that the prevalence of major depression was 3 to 4 times higher among inmates from the California Department of Corrections than in the general population. However, their data do not indicate whether the disorder was present at the time of the crime, which is a critical consideration in mental disorders such as depression, which are intermittent in nature. Studies examining the mental disorder present at the time of homicide conducted in Northern Sweden (Lindqvist, 1986) and Copenhagen (Gottlieb et al, 1987) report high rates of intoxication with substances, and high rates of psychotic disorders, but little evidence of a primary depressive disorder. A study of 495 Canadian penitentiary inmates (Cote et al, 1992) found that the group convicted of at least one

homicide had higher rates of lifetime psychiatric disorder. The study lacked diagnostic specificity, and again there was no indication whether the disorders were present at the time of the crime. Although the need for further study of these issues has been advocated by at least one author (Malquist, 1995), in the absence of any credible evidence of association, the costs of crime related to depressive disorders are assumed to be negligible.

3.3.5 Time (Indirect) costs

3.3.5.1 General considerations

From the viewpoint of economic theory, time is a limited resource of individuals, and valuable whether spent in marketed or non-marketed activities. A complete analysis of the costs of illness should therefore include costing the time lost to marketed production and household production (housekeeping, child-rearing, and related activities), as well as the value of lost leisure. Calculating the monetary value of time presupposes that there is a method for converting time costs into dollar values. One approach to valuing the time spent in home production is to value the time of its market equivalent service. This is done often in COI studies. The other approach is to calculate the value of non-marketed production using the opportunity cost approach, which values time by its best alternate use. This thesis uses the opportunity cost approach, for both theoretical and practical reasons.

In labor economics a central theme is the dollar valuation of time. It is central to understanding unemployment, job turnover, hours of work, and retirement. The primary organizing concept in labor economics is opportunity cost. The fundamental assumption is that people take their opportunity costs into account when allocating their time, choosing to devote it

to the activities that produce the greatest utility. For instance, an individual chooses an extra hour of work if the compensation she receives exceeds the value that she places on other activities. The theory of tradeoff between labor and leisure in economics suggests that agents will consume leisure up to the point that the marginal value of an additional hour of leisure equals the hourly wage that he or she can receive by working. The model in its purest sense assumes perfectly competitive markets, declining marginal utilities of leisure, diminishing marginal utilities of income, and that the quantity of labor supplied is a continuous variable. Although these assumptions are not likely to be met in practice, all variations on the model (allowing for various imperfections in the market) build upon the central concept of opportunity cost.

To the degree that wages reflect opportunity costs, it follows from the theory that the tim of persons who have lower-paying occupations would be valued less. This is an ethically controversial stance, since, for example, it typically values the time of women less than men. Nonetheless, this is the implication of the model. For this thesis, the opportunity cost approach was adopted, in view of its consistency with labor economic theory.

In the absence of any data which could be used to assess the value of leisure, the lost value of leisure is not included in these calculations. Canadian census figures have been used t estimate the opportunity cost of housekeeping services, using data on the time spent by various age and gender groups on housekeeping, and the opportunity costs of time according to market rates (Jackson, 1992). Based upon these figures, the opportunity cost of housekeeping services for men in Ontario in 1990 was calculated to be $11.35, and the opportunity cost for women wa $8.98. The discounted present value of housekeeping services was calculated over the whole lif

cycle using gender and age-specific estimates of daily hours consumed by housekeeping activities (Jackson, 1992) multiplied by the hourly opportunity costs.

3.3.5.2 Mortality-related costs

Depressive disorders have consistently been documented as primary causal factors in suicide in many countries (Henriksson et al, 1993; The World Health Organisation, 1996). Careful psychological autopsies have determined that many persons who complete suicides were depressed at the time of the act. Establishing the temporal association is important, because depressive disorders occur intermittently, typically featuring long intervals of remission, during which previously afflicted individuals are usually well.

Suicides are highly stigmatized, and generally are under-reported (Desjarlais et al, 1995; The World Health Organisation, 1996). The mortality cost estimates presented in this thesis are therefore likely to be conservative. Depressive disorders are often not enumerated as causes of mortality in suicide statistics, as determination of psychiatric disorder retrospectively is difficult and time-consuming. In most countries accurate psychiatric diagnosis at the time of suicide is generally unavailable to national statistical organisations, and therefore not recorded (The World Health Organisation, 1996). The central role of depressive disorders in suicide has become established through careful psychological autopsies performed on random or consecutive samples of suicides.

A literature search was conducted to recover all retrospective studies of suicide published in English which fulfilled certain criteria. The inclusion criteria were as follows: 1) the study must have been based on an unbiased sample of all suicides (for all ages, or for a pre-specified

age range) within a specified geographical location and time period – either a random sample of all cases, or a consecutive series of cases spanning at least one year in a specified geographical region; studies based on clinical populations were rejected; 2) the study must have featured systematic retrospective psychological assessment with structured or semi-structured interviewing instruments; 3) the retrospective assessment must have produced psychiatric diagnoses from explicit standardized criteria; and 4) the literature report must have indicated at least the prevalence rates of depressive disorders from the sample, or provided raw data from which estimates could be made.

A literature review using a variety of strategies and keywords was performed, and the reference lists of retrieved articles were also scanned. This process yielded 16 articles, 14 of which met all of the inclusion criteria. One article (Shafii et al, 1985) did not perform diagnostic assessments for mental disorders, and one article (King, 1994) used only psychiatric records to determine psychiatric diagnosis (assuming that those without psychiatric record were free of mental disorder). The remaining 14 articles are summarized in Table 2.1 (on page 29). Several pre-1975 articles provided percentages of all affective disorders (i.e. depressive disorders and bipolar disorders) without further breakdown. Based upon a review of these studies (giving more subjective weight to more recent articles employing DSM-system or other standardized diagnostic criteria), it was assumed that sixty percent of all suicides were attributable to depressive disorders. This assumption represents an approximate mid-point figure in the estimates, and also coincides with the assumptions made by two recent COI studies of depressive disorders conducted in the United States (Greenberg et al, 1993; Rice and Miller, 1995).

Sensitivity analysis was conducted assuming that depressive disorders were responsible for 45 percent or 70 percent of all suicides.

Table 3.1: The prevalence of depressive disorders in epidemiological studies of suicide.

Study Citation/ Location, Time	Sample Size	Suicides due to DDs (%)	Comments
Robins et al, 1959. United Kingdom	119	50.4	Percentage includes bipolar disorder.
Dorpat et al, 1960. Seattle Area	108	24.0	Consecutive suicides in King County over 12 months
Barraclough et al, 1974. Sussex & Portsmouth	100	70.0	Semi-structured assessment instruments
Beskow J, 1979. Sweden	271	45.0	83% had depressive symptoms
Chynoweth et al, 1980. Brisbane, Australia	135	55.0	Consecutive series of suicides
Rich et al, 1986. San Diego	283	44.2	
Arato et al, 1988. Budapest	200	63.5	Depressive disorder by RDC criteria
Brent et al, 1988. Metro Pittsburgh	27	55.6	Consecutive sample of children & adolescents (< 19 yrs.)
Runeson B, 1989. Gottenberg, Sweden	58	64.0	Age range 15 to 29 yrs.
Asgard U, 1990. Sweden	104	59.0	Sample women > 14 yrs.
Marttunen et al, 1991. Finland	53	64.0	DSM-III-R diagnostic criteria
Henriksson et al, 1993. Finland	229	59.0	Random sample of Finnish suicides; DSM-III-R criteria
Cattell & Jolley, 1995 Manchester, England	89	60.0	Elderly (>65 yrs) sample; ICD-9 diagnostic criteria
Cheng AT, 1995 Taiwan.	116	64.5	Consecutive suicides; DSM-III-R criteria

Suicide rates for Ontario for 1990 were obtained from mortality statistics compiled by Statistics Canada (Statistics Canada, 1992a). While total numbers of suicides per province are recorded, the age distribution of suicides are only given by composite national figures. We assumed that the national age distribution of suicides holds for Ontario.

Most studies have calculated mortality costs as the discounted present value of future earnings and housekeeping productivity, assuming that had subjects not succumbed to their disease, they would have had life expectancy for future years matching the cross-sectional pattern observed for the entire age cohort in the year of study (Rice, 1967). Three methods have been then used to establish the value of the lost productivity. Rice (1967) and others have assumed that the value of lost years reflects the productivity of average gender-specific wage rates, adjusted for age and gender-specific labor force participation rates. A second closely related method values the lost years of mortality by calculating a shadow price of labor for those not in the labor force, using the method of Heckman (1974).

The equations used to calculate mortality costs with the traditional human capital model assume the following form: (with separate sets of coefficients for each gender)

(equation 3.1)

$$\sum_{q=1}^{x} \sum_{n=a}^{100} \frac{(X_{qn} W_{qn} P_{q/n} + H_{qn} K_{qn} P_{q/n})}{(1+i)^{n-a}}$$

where:

x is the number of completed suicides for a given gender

i is the discount rate

a is the midyear age for a given age cohort of persons closest to person **q**'s midyear age at death;

$\mathbf{X_{qn}}$ for person **q** is the mean annual earnings for all persons with earnings in an age cohort with the midpoint **n**;

$\mathbf{W_{qn}}$ is the average labor force participation rate in the age group with midyear age **n**;

$\mathbf{P_{q/n}}$ is the conditional probability that person **q** survives to the next year, given survival to age **n** (Specified by life tables from Statistics Canada (1993));

$\mathbf{H_{qn}}$ is the annual mean value of housekeeping production, for all persons in an age group with midpoint **n**;

$\mathbf{K_{qn}}$ is the average housekeeping participation rate in the age group with midpoint **n**;

These methods implicitly assume that the labor market is at full employment, and that the loss of a worker cannot be made up by other workers, or by changing work patterns within firms. Given the persistent high levels of unemployment in Canada over the last decade, this assumption is rather unrealistic. Recently Koopmanschap and collaborators (Koopmanshcap et al, 1995; Koopmanschap & Rutten, 1996) have developed the Friction cost model, a modified human capital approach which assumes labor market disequilibrium when calculating the indirect costs of illness caused by premature death or disability. In this model productivity losses due to death are limited to the period of time required to hire a new worker to replace the

deceased one, or for the firm to adapt work practices to replace the productivity of the lost worker. While the friction cost method represents a more suitable model to calculate these costs with current economic conditions, there are few estimates of the time required for labor market adaptation to a death. This replacement time will likely vary according to the amount of education required to perform the job of the deceased worker (Koopmanschap, 1995), and could range from a few days for unskilled workers to several months or years for highly trained and specialized workers. The equation representing the Friction cost method for this thesis is specified in equation 3.2 as follows:

(equation 3.2)

$$\sum_{q=1}^{x} \left[X_q W_q F_q + \sum_{n=a}^{100} \frac{(H_{qn} K_{qn} P_{q/n})}{(1+i)^{n-a}} \right]$$

where:

F_q is the friction period (in years), and

all other variables are defined as in equation 3.1.

For the purposes of this study, the Friction cost method was used to calculate the baseline figures, since the model more closely reflects the realities of the recent Canadian labor market. The national average friction period was assumed to be 3 months, since this is the only figure available from an industrialized country similar to Canada (Koopmanschap et al, 1995). It was further assumed that the education and skill level of the cohort who committed suicide due to

depressive disorder had mean levels of education and training identical to the national average. To model the uncertainty in the value of this parameter, however, sensitivity analysis was performed assuming a friction period of 1 or 5 months.

In order to enhance the comparability of our results to previous U.S. studies, the mortalit calculations were repeated using the traditional human capital method . For these estimates, we calculated the present value of lost earnings and housekeeping services, according to the average industrial wage, adjusted by labor participation rates, and assuming a marketed productivity increase of 2% per annum over the work life of the worker.

3.3.5.3 Productivity losses due to time spent in treatment

It was conservatively assumed that each outpatient visit required 2 hours in total (visit time plus travel time), and that visits occurred seventy-five percent of the time during working hours. For marketed production, 5 days of productivity loss were assumed for every 7 days of hospitalization. Productivity losses were valued at the average industrial wage, and the value of housekeeping services were valued at their opportunity costs cost, based upon Statistics Canada figures (see above).

3.3.5.4 Productivity losses due to disability days.

The number of disability days (where it was assumed that respondents could not perform household or marketed work activities) was derived from the Supplement, which asked respondents whether or not they suffered incapacity days due to mental disorder. Those respondents who had a recent (within the last year) diagnosis of major depression or dysthymia

were assumed to have disability due to their depressive disorder. Each day which depressed respondents had to "cut-down" their main activity due to their mental disorder was assumed to result in 0.5 days of disability. Days identified as requiring "extra effort" were arbitrarily assumed to carry zero productivity loss. In the absence of other data which provide evidence of income loss with depression, or marketed productivity losses while still depressed and working (or residual disability after recovery), these phenomenon were assumed to incur no cost.

Because morbidity costs comprise a large cost category, our approach deserves careful contrast with the approach of past investigators. Greenberg et al (1993) made assumptions on the productivity of depressed workers who continue to attend work while depressed, with little empirical support. Rice and Kelman (1993; 1995) took a different approach, by assuming that past or current depressive illness would reduce income at the time of the survey. This approach makes the strong theoretical assumption that past disability (and, presumably, potential future disability) would be reflected perfectly in current market wages. Theoretical considerations aside, their approach created formidable econometric modelling problems (Miller & Kelman, 1992). These investigators attempted to calculate the income loss attributable to depressive disorders using cross-sectional data from the Epidemiological Catchment Area Survey, a major epidemiological survey of mental health across five regions of the United States (Regier et al, 1984). They created several limited dependent variable models which attempted to measure the income loss associated with mood disorders. Their approach actually produced a result inconsistent with the human capital approach -- namely that having a depressive disorder actually increased the income of respondents who had depressive disorders (Miller & Kelman, 1992). The authors reported income losses with other mental disorders, such as drug abuse, and

schizophrenia, but attribute their results with depressive disorders to nonresponse bias. However, their statistical model suffered from omitted variables bias, because important variables such as education level were not included. The authors omitted such variables because the data set was not large enough to allow a simultaneous equation model to be estimated, which would allow better modelling of the interdependence of income on education, and past history of mood disorder. Because the Supplement data set is inadequate to specify a simultaneous equations model, we assumed that the productivity losses associated with morbidity with depression were restricted to the number of days which respondents reported complete inability to perform their main activity, or days when they had to "cut-down" their major activity. Although this approach may understate the disability related to depressive disorders, it acknowledges the limitations of current empirical data, and avoids the highly arbitrary assumptions of Greenberg et al (1993).

3.3.5.5 Family burden costs

Psychiatric disorders impose burdens on family members, who often act as informal caregivers to the family member afflicted. Economic costs are one dimension of these burdens. However, to our knowledge no data set exists which would allow one to estimate the family burden costs of depressive disorders. The study of Rice et al (1995) inappropriately assumed that earlier work on the family burden costs associated with serious mental disorders (Franks, 1990) would be applicable to affective disorders. This assumption is questionable, because more than 80% of the sample from this U.S. study suffered from schizophrenia. There are no reasons to assume that the family costs incurred by schizophrenia are comparable to those imposed by

depressive disorders. Moreover, family burden costs are likely culture-specific, and hence U.S. figures are not necessarily applicable to Ontario. In the absence of any relevant data, these costs are not included in our estimates.

3.4 Unmeasured Costs

This study was unable to estimate the administrative overhead costs associated with visits to community mental health clinics, or other facilities where respondents with depressive disorders received outpatient care. Nevertheless, these costs likely reflected a very small proportion of total outpatient costs. We cannot rule out that some chronically depressed patients may reside in nursing homes or long-term care facilities. Statistical data on nursing homes in Canada (Statistics Canada, 1991a) do not provide detailed information on psychiatric diagnoses.

We were also unable to estimate the increase in general medical costs when depressive disorders coexist with chronic medical conditions. Some evidence suggests that utilization of general medical services increases with depression (Manning & Wells, 1992; von Korff et al, 1992), but to our knowledge there are no Canadian data which allow direct estimation of these costs. As noted in the preceding section, we were also unable to measure the economic costs of family burden. The magnitude of this omitted cost category is unknown, but may be significant. Finally, we were unable to estimate the costs of catastrophic side-effects from antidepressant treatments, such as their contributions to motor vehicle accidents.

Compensation payments made to persons with disabilities related to depressive disorders do not represent either direct or indirect costs, but rather transfer payments. Sometimes these figures are tabulated for purposes of comparison with other studies. However, since no earlier

studies have reported these sums, for the purposes of this thesis transfer payments are not considered.

CHAPTER 4

Results

4.1 Cost Overview

Using conservative assumptions and an indirect costing method which more accurately reflects features of the Canadian labor market, the total costs of depressive disorder in Ontario for the year 1990 was $475.7 million dollars. (See Table 4.1 on the next page). Direct costs accounted for 41.6% of all costs, and indirect costs accounted for 58.4%. The largest single cost category was morbidity-related costs.

For policy purposes, it would be desirable to separate costs according to those borne by the government, and those borne by private individuals. Unfortunately this breakdown remains incomplete in our figures, because the respective proportions of pharmaceutical costs borne by private payers and goverments were not available. However, we can state that the public costs of depressive disorders in Ontario (including publicly-funded outpatient services, hospitalizations, and research) exceeded $140.76 million – at least 71.1% of total direct costs.

Table 4.1: The economic costs of depressive disorders in Ontario, 1990, using baseline assumptions and the Friction Cost Method.

Cost Category	Cost, 000s $	Percentage of Total Cost*
Pharmaceuticals	43,443	9.1
Hospitalizations	49,327	10.4
Outpatient Visits	102,878	21.6
Emergency Room Visits	1,435	0.302
Research	801	0.168
Mortality	68,606	14.4
Morbidity	209,214	44.0
TOTAL	**475,714**	100.0

*Percentages do not sum to 100% because of rounding.

4.2 Direct costs

4.2.1 Outpatient pharmaceutical costs

The costs of prescribed medications used in the treatment of depression are listed in Tabl 4.2. The total outpatient drug cost attributed to the treatment of depressive disorders in Ontario in 1990 was $43.4 million dollars, a figure which includes dispensing fee charges.

In 1990 the largest single medication cost in the treatment of depressive disorders was for fluoxetine (prozac), which accounted for 27.6% of the total drug costs attributable to depressive disorders. This was followed by doxepin (9.6%), desipramine (7.6%), and amitriptyline (7.0%). Tricyclic antidepressants were the largest component of drug costs for depressive disorders according to therapeutic class.

Multiple chemical and therapeutic categories of medications were used in the treatment c depression. 18.8% of medication costs in the treatment of depression were attributable to drugs which would not be considered standard or atypical antidepressants (i.e., benzodiazepines, chlorpromazine, methotrimeprazine, choral hydrate, buspirone). Due to data limitations, it cannot be determined whether these drugs were used as adjunctive treatment of depressive disorders (to promote sleep, or as anxiolytics), or (inappropriately) as primary treatment.

Table 4.2: Outpatient drug costs attributable to depression, Ontario, 1990[1]

DRUG	$Prescriptions 000s	Fraction due to Depression	$ Total 000s
oxazepam	5554.00	0.181	1005.27
lorazepam	15029.00	0.095	1427.76
diazepam	6992.00	0.049	342.61
alprazolam	7487.00	0.235	1759.45
bromzopam	3191.00	0.164	523.32
chlordiazepoxide	1561.00	0.015	23.42
flurazepam*	2014.97	0.17	342.54
triazolam*	24321.50	0.06	1459.29
temazepam*	2003.70	0.2	400.74
clorazepate	1409.00	0.097	136.67
SUBTOTAL BENZODIAZIPINES:	**69563.17**		**7421.07**
amitryptyline	6665.00	0.457	3045.91
doxepin	5632.00	0.744	4190.21
trimipramine	3803.00	0.699	2658.30
desipramine	4538.00	0.731	3317.28
imipramne	1735.00	0.581	1008.04
clomipramine	3273.00	0.487	1593.95
maprotil	2341.00	0.761	1781.50
nortriptyline	1731.00	0.969	1677.34
amoxapine	310.00	0.74	229.40
protriptyline	161.00	1	161.00
SUBTOTAL TRICYCLICS:	**30189.00**		**19662.91**
fluoxetine	15277.00	0.786	12007.72
trazadone	2921.00	0.808	2360.17
fluvoxamine	54.00	1	54.00
nardil	359.00	0.629	225.81
parnate	392.00	1	392.00
SUBTOTAL OTHER ANTIDEPRESSANTS:	**19003.00**		**15039.70**
chlorpromazine	897.00	0.051	45.75
thioridazine	841.00	0.071	59.71
methotrimeprazine	1129.00	0.204	230.32
SUBTOTAL MAJOR TRANQUILIZERS:	**2867.00**		**335.77**
etrafon	1294.00	0.333	430.90
methylphenidate	2267.00	0.056	126.95
chloral hydrate*	598.14	0.2	119.63
buspirone	1206.00	0.254	306.32
SUBTOTAL OTHER DRUGS:	**5365.14**		**983.81**
TOTALS	**126987**		**43443.26**

* figures based on Ontario data on prescription numbers and average National cost per prescription.

[1] from Compuscript (Ontario) and the Canadian Disease and Therapeutic Audit (Canada), 1990.

4.2.2 Inpatient (hospitalization) costs.

Hospitalization costs are given in Table 4.3. In Ontario there were a total of 152,977 bed days attributable to depressive disorder in 1990. The average per day treatment cost, including physician services, was $331.48. The average per day treatment costs in provincial psychiatric hospitals (including physician services) was $281.87. Major depression and dysthymia were treated far more often (81.8% of the time) in a general hospital setting. Overall, the estimated expenses for depression-related psychiatric hospitalizations in Ontario was $49.33 million dollar for 1990.

Table 4.3: Hospitalization cost for depressive Disorders, Ontario, 1990.

Facility Type	Bed-days attributable to Depressive disorders	Hospital Costs (excluding MD services) $ 000s	Inpatient Physician Costs, $ 000s	Total Hospital Costs $ 000s
General Hospitals	125117	35204.17	6270.20	41474.37
PPHs	27860	7077.55	775.24	7852.79
TOTALS	152977	42281.72	7045.44	**49327.16**

4.2.3 Outpatient costs

Based on population estimates from the Supplement, Ontarians with depressive disorders made 1,918,132 visits to physicians for treatment of depressive disorders in 1990 (See Tables 4.4.1 and 4.4.2). Depressed subjects also made numerous visits to nurses, social workers, ministers, and a variety of other professionals. Visits to non-physicians accounted for 39.8% of all visits made by depressed Ontario subjects, and accounted for 23.7% of the costs of outpatient visits. The costs associated with non-physician services have been ignored or omitted in earlier COI studies of depression, but according to our estimates, these visits incur significant costs.

Table 4.4.1 provides estimates of outpatient costs by provider for public (government-funded) outpatient services, and table 4.4.2 provides outpatient costs by provider for services purchased privately. Because the Supplement did not provide information on the method of payment for outpatient services, several simplifying assumptions were made to divide the costs between private and public sources. We assumed that all physician, nursing, and social work services were publicly funded, and that all psychologist services were privately funded. While the vast majority of physician services are publicly funded, we cannot rule out that some proportion of nursing services were paid for privately, and some proportion of psychologist services were publicly funded.

The cost estimates of Tables 4.4.1 and 4.4.2 do not include all relevant costs associated with these visits, because they omit some facility overhead costs associated with various outpatient settings. Reliable estimates for the overhead costs could only be obtained for emergency room visits. Using Supplement estimates, Ontarians made 11,891 visits to emergency rooms related to depressive disorders, with a total cost of 11,891x$120.7 = $1.435 million

dollars. Adding this figure to the labor cost estimates brings to the total cost for outpatient services (private and publicly funded) attributable to depressive disorders to $104.3 million dollars. While we are unable to estimate the overhead costs of 53,320 other visits to social service departments, community mental health clinics, and other facilities, the average overhead cost per visit would be much lower than the emergency room figures. These costs in relation to the total outpatient cost figure are small.

Table 4.4.1: Costs of Public (Government-funded) Outpatient Visits by Provider Type for Depressive Disorders, Ontario, 1990

PROVIDER	NO. OF VISITS	COST PER VISIT ($)		$ TOTAL (000s)
Psychiatrist	482925	78.64		37977.22
G.P./F.P.	1311247	28.73		37672.13
Social worker	435202	18.64		8112.17
Nurse	151534	18.91		2865.51
Other MD	112069	22.90		2566.38
Emergency MD	11891	24.80		294.90
SUM VISITS =	2492977		**$TOTAL=**	89193.4

Table 4.4.2: Costs of Private Outpatient Visits by Provider Type for Depressive Disorders, Ontario, 1990

PROVIDER	NO. OF VISITS	COST PER VISIT ($)		$ TOTAL (000s)
Psychologist	318573	23.48		7480.09
Minister	250519	16.90		4233.77
Herbalist	87118	16.34		1423.51
Other professional	36564	14.96		547.00
SUM VISITS =	692774		**$TOTAL=**	13684.37

4.2.4 Research costs for depressive disorders

The total research costs in Ontario in 1990, including research grants and training fellowships (where the training was clearly designated as pertaining to depressive disorders) was $801,441 dollars in Ontario in 1990. The research costs borne by pharmaceutical companies are not included here, but are included in drug costs.

A breakdown of grants by agency is given in Table 4.5.

Table 4.5: Research expenditures on depressive disorders[a,b], Ontario, 1990

Funding Agency	**Expenditures 1989-1990** **$**	**Expenditures 1990-1991** **$**	**Weighted Expenditure, Calendar 1990** **$**
Canadian Psychiatric Research Foundation	74, 452	125,013	112,373
Ontario Mental Health Foundation	279,311	220,216	234,990
Ministry of Health, Ontario	32,238	126,940	103,264
Medical Research Council of Canada	372,833	225,795	262,554
Health & Welfare Canada	74,625	92,805	88,260
TOTALS	**759,007**	**790,769**	**801,441**

[a]Source: Medical Research Council of Canada (1992).
[b]Figures include all research grants, conference grants, and training fellowships designated specifically for depressive disorders, for investigators whose academic or institutional affiliation was to an institution in Ontario.

4.2.5 Physician costs

Physician costs were included in outpatient and inpatient costs. Table 4.6 examines these costs separately. Psychiatrists in outpatient settings accounted for a larger portion of physician service costs than family physicians, even though the number of visits was lower. Inpatient physician services accounted for 8.2% of total physician costs.

Table 4.6: Cost of physician services by provider type and setting, Ontario, 1990.

PROVIDER/ SETTING	TOTAL NUMBER OF VISITS	AVERAGE COST PER VISIT, $	TOTAL COST '000s $
Psychiatrist/ Outpatients	482925	78.64	37977.22
Psychiatrist/ Inpatients	109095	64.58	7045.44
Family MD/ Outpatients	1311247	28.73	37672.13
Other MD/ Outpatients	123960	23.08	2861.28
TOTALS:	2027227		**85556.07**

4.3 Time (Indirect) Costs

4.3.1 Mortality costs

The costs associated with premature mortality due to depression-related suicide (using baseline assumptions) by age group are given in Tables 4.7 - 4.12. Table 4.7 and 4.8 presents th mortality costs associated premature death using the Friction cost method, and Tables 4.9 and 4.10 present the same figures using the traditional human capital approach. Using the Friction cost method, the total mortality costs for females was $28.0 million dollars. The total costs for premature mortality due to depression-related suicide for males in Ontario in 1990 was $40.6 million dollars. The total costs for premature death for both sexes was $68.6 million (Table 4.11). The significance of including non-marketed production using the Friction cost method ca be appreciated: lost potential housekeeping production accounted for 96.4% of the total mortality costs.

The contrast with the human capital method is seen by comparing table 4.11 to 4.12. Table 4.12 repeats the cost breakdown by age group of Table 4.11, but employs the traditional human capital method with the same baseline assumptions (a discount rate 3 percent, and assuming that 60% of all suicides are attributable to depressive disorders) as earlier tables. With the human capital method, the total mortality cost attributable to depressive disorders was $284 million dollars, and 76.7% of these costs were related to lost marketed production.

Table 4.7: Mortality costs attributed to depressive disorders in Ontario by age group for males, 1990, using the Friction Cost Method*.

Age Group (years)	Number of Suicides Attributable to Depressive Disorders¶	Lost Person-Years to Life Expectancy	Lost Person Years to Retirement (65 years)	Present Value** of lost housekeeping $ 000s	Value* of lost marketed production $ 000s
10-14	3.48	216.20	184.44	330.570	0.00
15-19	27.54	1577.47	1321.92	2878.179	126.440
20-24	45.66	2398.04	1963.38	5093.175	249.332
25-29	52.5	2507.19	1995.00	5944.627	311.582
30-34	53.88	2316.61	1778.04	5956.430	319.772
35-39	45.84	1754.80	1283.52	4933.772	279.302
40-44	37.98	1276.43	873.54	3967.435	231.411
45-49	28.92	839.41	520.56	2821.492	170.113
50-54	21.00	516.93	273.00	1841.497	123.526
55-59	22.38	458.17	179.04	1733.121	97.590
60-64	17.1	285.19	51.3	1149.979	74.566
65-69	13.32	176.69	0	752.878	0.00
70-74	12.24	124.84	0	555.505	0.00
75-79	11.22	85.31	0	394.670	0.00
80-84	6.06	33.50	0	160.374	0.00
85+	5.28	20.69	0	102.039	0.00
TOTAL (10+)	**404.4**	**14587.47**	**10423.74**	**38615.743**	**1983.634**

* Assumes a Friction period of 3 months.

¶ Assumes that 60% of suicides are attributable to depressive disorders.

** Using opportunity costs of housekeeping production (Jackson, 1992), and a discount rate of 3%.

Table 4.8: Mortality costs attributed to depressive disorders in Ontario by age group for females, 1990, using the Friction Cost Method*.

Age Group (years)	Suicides Attributable to Depressive Disorders¶	Lost Person-Years to Life Expectancy	Lost Person Years to Retirement (65 years)	Present Value** of lost housekeeping production $ 000s	Value* of lost marketed production $ 000s
10-14	1.08	74.45	57.24	260.926	0.00
15-19	7.80	499.28	374.40	1985.260	34.218
20-24	9.24	546.14	397.32	2437.803	46.500
25-29	11.40	617.86	433.20	3000.115	54.817
30-34	16.5	813.54	544.50	4190.295	79.340
35-39	19.02	845.29	532.56	4635.779	95.718
40-44	15.00	594.43	345.00	3486.157	75.487
45-49	10.50	355.44	189.00	2270.016	48.484
50-54	8.52	258.14	110.76	1667.267	39.941
55-59	6.9	178.49	55.2	1195.423	17.317
60-64	4.86	105.18	14.58	723.608	12.197
65-69	6.00	105.79	0	755.360	0.00
70-74	4.86	67.58	0	507.145	0.00
75-79	2.34	24.71	0	194.344	0.00
80-84	2.16	16.59	0	136.310	0.00
85+	1.26	6.70	0	57.290.87	0.00
TOTAL	**127.44**	**5109.61**	**3053.76**	**27503.968**	**504.019**

* Assumes a Friction period of 3 months.

¶ Assumes that 60% of suicides are attributable to depressive disorders.

** Using opportunity costs of housekeeping production (Jackson, 1992), assuming a discount rate of 3%.

Table 4.9: Mortality costs attributed to depressive disorders in Ontario, by age group for males, 1990, using the Human Capital Method[a]

Age Group (years)	Suicides Attributable to Depressive Disorders[b]	Lost Person-Years to Life Expectancy	Lost Person Years to Retirement (65 years)	Present value of lost housekeeping production $ 000s	Present value* of lost marketed production $ 000s
10-14	3.48	216.20	184.44	330.570	2833.613
15-19	27.54	1577.47	1321.92	2878.179	22072.713
20-24	45.66	2398.04	1963.38	5093.175	33827.168
25-29	52.5	2507.19	1995.00	5944.627	34869.883
30-34	53.88	2316.61	1778.04	5956.430	31236.147
35-39	45.84	1754.80	1283.52	4933.773	22444.885
40-44	37.98	1276.43	873.54	3967.435	14964.600
45-49	28.92	839.41	520.56	2821.492	8582.411
50-54	21.00	516.93	273.00	1841.497	4143.547
55-59	22.38	458.17	179.04	1733.121	2499.596
60-64	17.1	285.19	51.3	1149.979	572.586
65-69	13.32	176.69	0	752.878	0
70-74	12.24	124.84	0	555.505	0
75-79	11.22	85.31	0	394.670	0
80-84	6.06	33.50	0	160.374	0
85+	5.28	20.69	0	102.039	0
TOTAL (10+)	**404.4**	**14587.47**	**10423.74**	**38615.744**	**178047.149**

[a]Uses baseline discount rate of 3 percent.
[b]Assumes that 60 percent of all suicides are attributable to depressive disorders.
*Using opportunity costs of housekeeping production (Jackson, 1992).

Table 4.10: Mortality costs attributed to depressive disorders in Ontario, by age group for females, 1990, using the Human Capital Method[a]

Age Group (years)	Suicides Attributable to Depressive Disorders[b]	Lost Person-Years to Life Expectancy	Lost Person Years to Retirement (65 years)	Present value of lost housekeeping production $ 000s	Present value* of lost marketed production $ 000s
10-14	1.08	74.45	57.24	260.926	725.654
15-19	7.80	499.28	374.40	1985.260	5093.834
20-24	9.24	546.14	397.32	2437.803	5446.128
25-29	11.40	617.86	433.20	3000.115	5926.600
30-34	16.5	813.54	544.50	4190.295	7405.615
35-39	19.02	845.29	532.56	4635.779	7070.017
40-44	15.00	594.43	345.00	3486.157	4337.669
45-49	10.50	355.44	189.00	2270.016	2182.854
50-54	8.52	258.14	110.76	1667.267	1075.728
55-59	6.9	178.49	55.2	1195.423	454.689
60-64	4.86	105.18	14.58	723.608	94.942
65-69	6.00	105.79	0	755.360	0
70-74	4.86	67.58	0	507.145	0
75-79	2.34	24.71	0	194.344	0
80-84	2.16	16.59	0	136.310	0
85+	1.26	6.70	0	57.291	0
TOTAL	**127.44**	**5109.61**	**3053.76**	**27503.099**	**39813.73**

[a]Uses baseline discount rate of 3 percent.
[b]Assumes that 60 percent of all suicides are attributable to depressive disorders.
*Using opportunity costs of housekeeping production (Jackson, 1992).

Table 4.11: Mortality costs attributed to depressive disorders in Ontario by age group for both sexes, 1990, using the Friction Cost Method*.

Age Group (years)	Present Value** of lost housekeeping production $ 000s	Value of lost marketed production $ 000s	Value of TOTAL lost production $ 000s
10-14	591.497	0.00	591.497
15-19	4863.439	160.659	5024.098
20-24	7530.978	295.831	7826.809
25-29	8944.742	366.398	9311.140
30-34	10146.725	399.112	10545.837
35-39	9569.552	375.019	9944.571
40-44	7453.592	306.898	7760.490
45-49	5091.508	218.597	5310.105
50-54	3508.764	162.867	3671.631
55-59	2928.544	114.907	3043.451
60-64	1873.587	86.763	1960.350
65-69	1508.238	0.00	1508.238
70-74	1062.650	0.00	1062.650
75-79	589.015	0.00	589.015
80-84	296.684	0.00	296.684
85+	159.330	0.00	159.330
TOTAL	**66118.845**	**2487.051**	**68605.896**

*Assumes that 60 percent of all suicides are attributable to depressive disorders.
**Using opportunity costs of housekeeping production (Jackson, 1992), and a discount rate of 3%.

Table 4.12: Mortality costs attributed to depressive disorders in Ontario by age group for both sexes, 1990, using the Human Capital Method*.

Age Group (years)	Present value** of lost housekeeping production $ 000s	Present value of lost market production $ 000s	Present value of TOTAL lost production $ 000s
10-14	591.497	3559.267	4150.764
15-19	4863.440	27166.55	32029.99
20-24	7530.977	39273.3	46804.277
25-29	8944.742	40796.48	49741.222
30-34	10146.725	38641.76	48788.485
35-39	9569.551	29514.9	39084.451
40-44	7453.592	19302.27	26755.862
45-49	5091.508	10765.27	15856.778
50-54	3508.764	5219.275	8728.039
55-59	2928.544	2954.285	5882.829
60-64	1873.587	667.528	2541.115
65-69	1508.238	0	1508.238
70-74	1062.651	0	1062.651
75-79	589.015	0	589.015
80-84	296.684	0	296.684
85+	150.330	0	150.33
TOTAL	**66109.845**	**217860.885**	**283970.73**

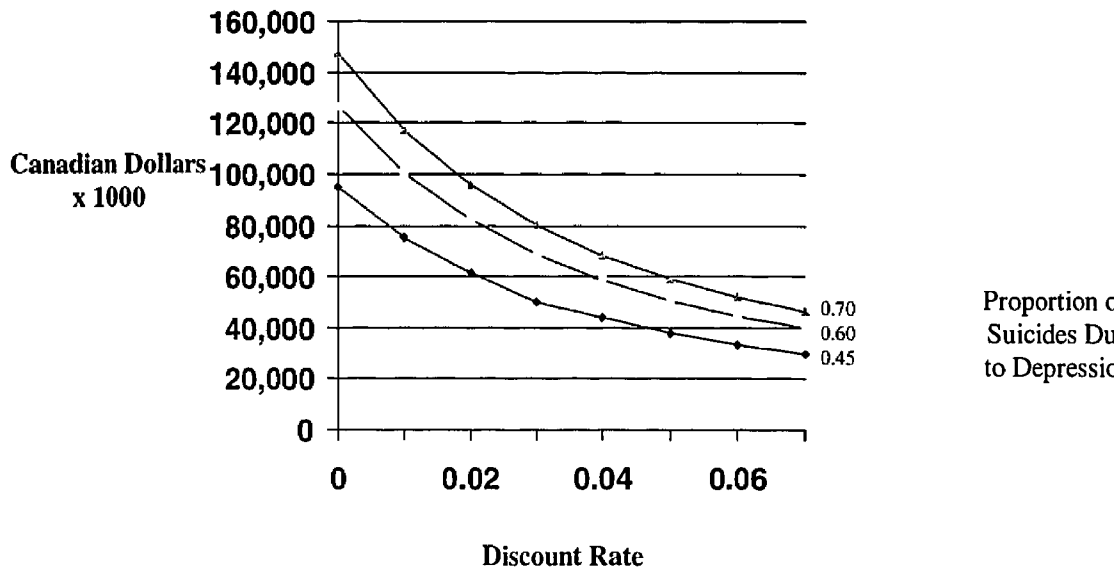
*Uses baseline discount rate of 3 percent and assumes that 60 percent of all suicides are attributable to depressive disorders.

**Using opportunity costs of housekeeping production (Jackson, 1992).

4.3.2 Sensitivity analysis

As inspection of equations 3.1 and 3.2 would suggest, mortality cost estimates are sensitive to both the discount rate and the proportion of suicides that are attributable to depressive disorders. The results of a two-way sensitivity analysis are presented in Figure 4.1, which plots the total mortality costs attributable to depressive disorders in Ontario in 1990 by discount rate, for the 3 assumed values of the proportion (0.45, 0.6, 0.7). With baseline assumptions, the total mortality costs are 68,605,896, with a range of $29,853,000 to $147,510,000 , depending on the discount rate and proportion assumption used.

Figure 4.1:Two-Way Sensitivity Analysis of Mortality Costs, by Proportion Deaths Attributable to Depression and Discount Rate, Friction Cost Method, Ontario 1990
Friction Period = 3 months



4.3.3 Morbidity costs

The morbidity costs of depressive disorder using the Friction cost method are given in Table 4.13. The total morbidity costs attributable to depressive disorders in Ontario in 1990 was $209.2 million dollars. The largest category of disability cost arises from population estimates based upon the Supplement, where respondents identified whether they were totally disabled due to emotional problems, temporarily disabled due to emotional problems, or had been disabled a certain number of the 30 days before the survey interview. While these costs are substantial, they are conservative in comparison to the traditional human capital method, which would value the lost productivity of those permanently disabled by the present value of a lifetime stream of work earnings.

Table 4.13: Morbidity costs attributed to depressive disorders in Ontario, 1990, using the Friction cost method.

Present value of Disability Days + Permanent Disability* **$ 000s**	**Morbidity Costs due to Psychiatric Hospitalization** **$ 000s**	**Morbidity Costs due to Outpatient Visits** **$ 000s**	**Total Morbidity Costs** **$ 000s**
147392	11918	49904	**209214**

*Assumes a friction period of 3 months.

CHAPTER 5

Summary and Conclusions

5.1 Summary of Results

Using generally conservative methods, the economic costs of depressive disorders for the Province of Ontario for the year 1990 were found to be $475.7 million dollars, with indirect costs comprising 58.4% of the total burden. Morbidity-related costs accounted for the largest component of costs at 44%.

Using Supplement prevalence estimates, the total number of Ontarians with major depression, dysthymia, or both (including those suicides attributed to depressive disorder) was 301,400. Thus, the total cost per prevalent case in Ontario for 1990 was $1583 dollars.

The economic costs of depressive disorders are likely to exceed our estimates, because some of the categories of cost could not be estimated. Evidence suggests that depressive disorders increase the utilization rate of general medical services (Manning & Wells, 1992 ; von Korff et al, 1992), but these costs could not be estimated for Ontario with existing data sets. Comorbidity costs include those arising from substance use disorders, chronic medical illnesses, and other psychiatric illnesses, where the presence of depressive disorders increases the disability and severity of the comorbid condition. To the extent that depressive disorders interfere with normal nonmarketed activity and create caretaking responsibilities for informal caregivers, there are family burden costs. The magnitude of these costs are unknown, and a priority for future research should be the measurement and estimation of family burden, using economic costs and

other metrics. Finally, the nature and extent of disability in marketed production with depressive disorders deserves extensive further investigation.

This thesis represents the first COI study to use actual estimates of disability days attributed to depressive disorders, based on the recent recall of respondents to a major epidemiological survey. Nonetheless, the population estimates are based upon a relatively small sample, and limited to the subjective recall of respondents. We were unable to measure the extent of reduced productive capacity for those who were depressed but continue to work for pay. Without empirical data, estimation of these costs remains arbitrary. The estimates of morbidity costs vary widely between Greenberg et al (1993), Rice & Miller (1995), and this study, and better estimates of these costs await more sophisticated survey or time series data designed to explicate the relationship between depressive disorders and productive capacity. The findings of such studies could have significant implications for the design of employee assistance plans, disability benefits, and clinical services.

5.2 Comparisons with prior studies

While the economic costs of depressive disorders in Ontario for 1990 were substantial, they become more meaningful by contrast with past COI studies for affective disorders. Table 5.1 summarizes several key finding from three earlier COI studies of affective disorders, and compares them with two estimates from this study. None of the previous studies provides estimates for exactly the same group of psychiatric disorders as this thesis, and unfortunately costs are not broken down by individual diagnosis. To allow more meaningful comparisons, the cost per prevalent case was estimated for each study, using estimates provided by Greenberg et al

(1993) and Rice & Miller (1995) of one-year prevalence of affective disorders in the United States. (The cost per case was chosen instead of cost per capita, in order to normalize the figures for differences in prevalence rates between the studies). While these figures are the only plausible approach to make comparisons, we are assuming that the total costs attributable to bipolar disorder were not so different from depressive disorders as to significantly alter the cost per case averages. This is an assumption, and cannot be verified on the basis of currently available data; the costs of bipolar illness relative to depressive disorders are unknown.

The paper of Rice & Miller (1995) appears to have used erroneous one-year prevalence estimates for affective disorders in their calculations; they tabulate far higher one-year prevalence rates than were published at the time of their study. Because their cost estimates were based upon these population figures, they were used to calculate a per case cost for their study.

To further facilitate comparisons, the final cost estimates for Ontario were recalculated, using the traditional human capital method and a discount rate of 6% (the method and discount rate used in all 3 earlier studies). The Canadian figures were then further adjusted to arrive at common dollars. Using the crude assumption of purchasing power parity, costs were adjusted by the average exchange rates between the United States and Canada in 1990 (1.17 Canadian dollars per U.S. dollar (Statistics Canada, 1994)). The results of these calculations are presented in Table 5.1.

Table 5.1: Comparative cost table for COI studies of depressive disorders, in 1990 U.S. dollars

Study	Total $, U.S. millions	Costs per Prevalent Case, $ U.S.			
		Direct (%)	Morbidity (%)	Mortality (%)	Total
Stoudemire	26000.0	666 (13)	3123 (61)	1331 (26)	5120
Greenberg	43700.0	1116 (28)	2191 (55)	667 (17)	3984
Rice & Miller	30400.0	861 (72)	97 (8)	239 (20)	1197
Gnam, Baseline	406.4	568 (42)	595 (44)	190 (14)	1353
Gnam, HC* model	996.6	568 (17)	2215 (67)	523 (16)	3306

• HC denotes Human Capital model

For the 1990 U.S population, Greenberg et al. reported the economic costs of affective disorders (major depression, dysthymia, and bipolar disorder) to be $43.7 billion dollars, and when the results of Stoudemire et al (1986) are inflated to 1990 levels, the estimated costs of major depression were $26 billion. Like the two other COI studies of depression (Stoudemire et al, 1986; Greenberg et al, 1993), indirect costs in this thesis accounted for the majority (58.4%) of total costs. However, this figure is considerably lower than these two earlier studies: Stoudemire et al (1986) found that 87.2% of total costs were indirects costs, and Greenberg et al (1993) found that 72% were indirect costs. Rice & Miller (1995) reported a much lower percentage for indirect costs, but their estimates are based upon a questionable regression model, which probably grossly underestimated morbidity costs.

Perusing Table 5.1, the most striking finding is the wide divergence of estimates of overall costs per case, and the differences in the various cost categories. Estimation of morbidity costs vary dramatically among the studies, and the disparities reflect differences in major methodological choices. As previously discussed, Rice & Miller (1995) adopted a dubious model which likely underestimated dramatically morbidity costs. Both Stoudemire et al (1986) and Greenberg et al (1993) employed many assumptions which lack empirical support. While the approach of this thesis relies on empirical data, the small sample size from which population projections were estimated remains a significant limitation. The morbidity costs associated with depressive disorders remain highly uncertain. The direct costs per case were lower for the Canadian results than each of the three U.S. studies. While some methodological differences may account for a portion of the difference (for instance, Rice & Miller included law enforcement and punishment costs in their study), the remainder reflects genuine lower per case spending in Canada. Although the published data do not allow careful comparisons, the lower direct costs are likely related to lower unit costs in Canada – particularly drug and provider unit costs. This speculation is supported by a recent intercountry comparison of utilization rates between the United States and Canada, which found that utilization of a variety of mental health services are comparable between the two countries (Kessler et al, 1997).

The final row of Table 5.1 presents the results of this thesis using the traditional human capital approach, with a discount rate of 6%. This model was used by Greenberg et al (1993) and Stoudemire et al (1986). In this case the estimates of morbidity and mortality costs are similar to the figures reported by Greenberg et al (1993). However, because Greenberg and colleagues

estimated their results for all affective disorders (major depression, dysthymia, and bipolar disorder), the precise per case costs attributable to depressive disorders is not known.

5.3 Limitations of this Study

In addition to the unmeasured costs enumerated above, several other limitations of this work should be discussed. We were unable to obtain physician service claims data, in order to have another method of measuring the direct costs associated with depressive disorders. If claims records were available, the direct cost estimates of physician services would likely have been higher. In a recent Canadian COI study of asthma, direct physician cost estimates based upon a community survey were smaller than those based upon claims data (Krahn et al, 1995). With psychiatric services in particular, it is not clear that claims records would have been more accurate. There are no incentives for accurate coding of diagnoses on billing records, and physicians may record non-psychiatric diagnoses on claims records to avoid stigma, or to preserve patient confidentiality.

In the year 1990 the Ontario Ministry of Health was in transition to a new style of health card and health number for the entire population. Claims data would have been difficult or impossible to analyze because of this change. Choosing a year more recent than 1990 would have opened the possibility of using claims records, but at the "price" of relying upon a community survey several years out of date. Inevitably COI studies involve acknowledging such trade-offs and making choices based upon multiple objectives.

5.4 Questions for future research

Although recent international reports have highlighted depressive disorders as prominent causes of morbidity and premature mortality (Desjarlais et al, 1995; The World Health Organisation, 1996), economic estimates of morbidity and mortality costs are widely divergent, and limited by the quality of existing epidemiological and statistical data sets. The most obvious areas to be addressed in future research are the family burden of depressive disorders, and the relationship between depressive disorders and the labor market. Past COI studies have demonstrated the benefit of including labor questions in major epidemiological surveys of menta health, but many relevant questions remain, including the productivity consequences of untreated depressive disorders. Given that morbidity costs are likely the largest component of the costs of depressive disorders, research in this area may reveal potential areas of cost savings with new approaches to detection and treatment. Of course, there may be other economic consequences of depressive disorders, such as school or training failure, resulting in sub-optimal investments in human capital. Estimation of these costs await further empirical confirmation.

This thesis does not address the potential economic impact of individuals who suffer fron sustained depressive symptoms, but who fail to meet criteria for a formal psychiatric disorder. While current data sources do not capture such individuals, some preliminary evidence suggests that many individuals report diagnostically subthreshold depressive symptoms, which may be associated with substantial morbidity (Judd et al, 1996). Measuring the economic impact of these symptoms on affected individuals represents one method by which to evaluate the importance of these recent findings.

The final considerations belong to the methods of COI studies. As the results of this thesis amply demonstrate, methodological differences lead to wide divergence in cost estimates. Although the Friction cost method represents an advance over earlier models, this innovation creates incompatibilities when compared to older studies. There may be compelling reasons to adopt specific features in a COI study which do not conform to past studies, but without some methodological standardization, comparisons between studies becomes problematic. One solution, proposed for cost-effectiveness studies (Weinstein et al, 1996) is to follow guidelines in calculating a "reference case", but then to repeat the calculations adopting any relevant variations from the reference model. If similar standards are developed and adopted in COI studies, the descriptive information such studies produce will become more comparable without restricting intellectual innovation, and more useful in broad health policy planning.

Appendix I

Diagnostic Criteria for Major Depressive Disorder and Dysthymia – from the Diagnostic and Statistical Manual of Mental Disorders, Third Edition Revised (The American Psychiatric Association, 1987)

Diagnostic Criteria for Major Depressive Episode

Note: A "Major Depressive Syndrome" is defined as criterion A below.

A. At least five of the following symptoms have been present during the same two-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood, or (2) loss of interest or pleasure. (Do not include symptoms that are clearly due to a physical condition, mood-incongruent delusions or hallucinations, incoherence, or marked loosening of associations.)

(1) depressed mood (or can be irritable mood in children and adolescents) most of the day, nearly every day, as indicated either by subjective account or observation by others

(2) markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated either by subjective account or observation by others of apathy most of the time)

(3) significant body weight loss or weight gain when not dieting (e.g., more than 5% of body weight in a month), or decrease or increase in appetite nearly every day (in children, failure to make expected weight gains)

(4) insomnia or hypersomnia nearly every day

(5) psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down)

(6) fatigue or loss of energy nearly every day

(7) feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick)

(8) diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others)

(9) recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without specific plan, or a suicide attempt or a specific plan of committing suicide.

B. (1) It cannot be established that an organic factor initiated and maintained the disturbance

(2) The disturbance is not a normal reaction to the death of a loved one (Uncomplicated Bereavement).

C. At no time during the disturbance have there been delusions or hallucinations for as long as two weeks in the absence of a prominent mood symptoms (i.e., before the mood symptoms developed or after they have remitted).

D. Not superimposed on Schizophrenia, Schizophreniform Disorder, Delusional Disorder, or Psychotic Disorder NOS.

Diagnostic Criteria for Dysthymia

A. Depressed mood (or can be irritable mood in children or adolescents) for most of the day, more days than not, as indicated either by subjective account or observation by others, for at least two years (one year for children and adolescents).

B. Presence, while depressed, of at least two of the following:
(1) poor appetite or overeating
(2) insomnia or hypersomnia
(3) low energy or fatigue
(4) low self-esteem
(5) poor concentration or difficulty making decisions
(6) feelings of hopelessness.

C. During a two-year period (one year for children and adolescents) of the disturbance, never without the symptoms in A for more than two months at a time.

D. No evidence of an unequivocal Major Depressive Episode during the first two years (one year for children and adolescents) of the disturbance.

E. Has never had a Manic Episode, or an unequivocal Hypomanic Episode.

F. Not superimposed n a chronic psychotic disorder, such as Schizophrenia or Delusional Disorder.

G. It cannot be established that an organic factor initiated and maintained the disturbance, e.g., prolonged administration of an antihypertensive medication.

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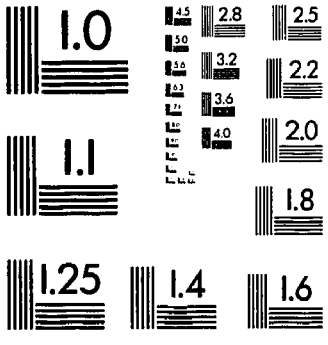

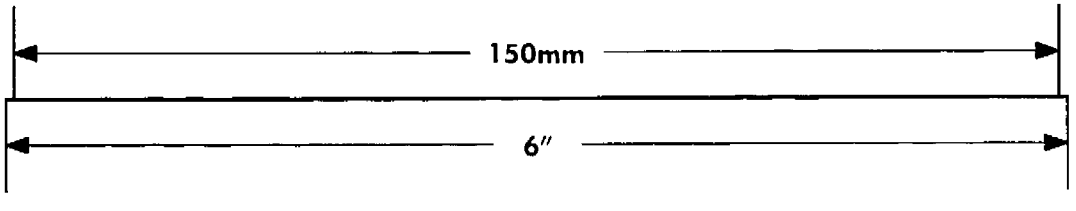

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