Medical Malpractice in Canada, 1971 - 1987 *

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1. Introduction

For some years there has been a perception that health care professionals and the institutions that assist in the delivery of health care, in Canada, are facing a malpractice "crisis". This perception led to the appointment, in 1987, of the Health Provider Liability Task Force headed by Dean Prichard of the Faculty of Law at the University of Toronto. The task force was given a threefold mandate: first, to review liability and compensation issues as they relate to the delivery of health care in Canada; second, to advise various levels of government on possible legal reforms designed to compensate the victims of an iatrogenic injury; and third, to ameliorate the cost of liability claims on the Canadian public health care system.

The purpose of our aspect of the larger research enterprise is a two-fold exercise in positive analysis: (1) to describe the trends in physician and hospital civil liability experience (frequency and severity of claims and outcomes) in Canada since 1971; and (2) to attempt to explain the determinants of these trends. This aspect of the larger research enterprise does *not* attempt to analyse whether the impact of malpractice liability on the practice of medicine has increased or decreased social welfare. This crucial question will be addressed by other researchers for the task force before particular policy prescriptions can be formulated.

With respect to the two questions of interest to us, obviously the first is a necessary prelude to the second. That is, we must first describe the phenomena on liability trends in sufficient detail that an evaluation of all possible determinants of those trends is rendered feasible. Dr. Frank Sellers (1986) has done invaluable work in describing these trends in Canada over the past decade and a half in aggregate terms, but decomposition of the data in various respects is necessary in order to permit the testing of various hypothesis shaping these trends. This kind of data has never before been assembled or analysed in Canada.

* The views expressed in this paper are those of the authors and do not necessarily represent those of the Federal/Provincial/Territorial Health Provider Liability Task Force. This paper was written for a Conference on The Law and Economics of Professional Liability Insurance sponsored by The Geneva Association held in March, 1988. We are grateful to Pat Danzon, Lois Quam, Greg Stoddart and seminar participants at the University of Alberta for their helpful comments.

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While empirical research of this kind has progressed further in the United States, the complexity of the exercise continues to present analysts with severe problems in drawing robust inferences as to the determinants of malpractice liability trends and therefore appropriate policy prescriptions that such inferences might be viewed as supporting. However, we are optimistic that with success in gathering the necessary data, we can illuminate many of the central issues. Potentially, we are better placed, in terms of data, than U.S. researchers in two important respects: (1) only one major organization has dealt with the vast majority of malpractice claims against physicians in Canada (the Canadian Medical Protective Association), while many insurers have been involved in the United States; and (2) provincial health insurance plans contain very detailed data on changes in patterns of medical practice and procedures. Access to these data will allow us to perform analyses that could not be performed in the United States.

In this paper, we focus on medical malpractice. After providing an overview of Canada's health care and tort systems in Section II, we derive a general theoretical framework in Section III that describes both the malpractice process as well as the pattern of medical practice in Canada. The pattern of medical practice is of interest to us since it has been shown to change in the United States in response to increased litigation, Rizzo (1987). In addition, the economic effects of the trends in malpractice claims are greatly underestimated if one focuses exclusively on premiums, Reynolds, Rizzo and Gonzalez (1987). The theoretical framework is amended in Section IV in the light of the data available for our research. Section V indicates, in a highly tentative way, what hypotheses we plan to test and which data are required in order to test them. The existing aggregate data on malpractice claims in Canada are discussed in Section VI. Section VII offers some concluding observations.

2. An overview of Canada's health care and tort systems

In this section, we provide a brief overview of both Canada's health care system and the tort system as it relates to malpractice litigation in Canada. These overviews provide the basis for the theoretical framework developed in Section III. This Framework is used to analyse the determinants of the frequency of malpractice claims, the size of settlements and the response by physicians to the perceived malpractice "crisis".

Although the provision of health care is a provincial concern enshrined in Canada's constitution, the federal government has been able to influence the development of this sector. Beginning over thirty years ago and culminating on January 1, 1971, all the ten provinces and the two territories have a public health insurance plan which covers all necessary medical and hospital services. Since the federal government covers approximately 50 percent of all health care expenditures, it has been able to establish certain criteria that the provinces (and territories) must meet if they are to qualify for their full share of federal payments for the insured services. Suffice it to say, reasonable access by all residents to the full range of insured services without financial impediments to utilization captures the essence of the federal funding criteria.

Funding for the provision of health care services is derived from both general taxation and health insurance premiums. Consumers do not presently face out-of-pocket expenses when utilizing health care services, though in some provinces (mainly Alberta and Ontario) user charges though small (representing less than five percent of total billings by physicians

to the provincial health insurance plan) were in effect until 1987. Hospitals, which are owned and operated on a not-for-profit basis by voluntary agencies, municipalities and other institutions, receive prospective global budgets and are liable for any excess expenditures. In spite of this liability, hospital over-runs do occur and these costs are frequently borne by the provincial ministries of health. In contrast to the use of global budgets for hospitals, the overwhelming majority of Canada's practicing physicians are both self-employed and reimbursed by the provincial health insurance plans on a fee-for-service basis. These fees are determined by negotiation between each provincial government and each provincial medical association.

Canada's tort system differs from that in the United States in several important ways. The major differences have recently been highlighted by Prichard (1988):

1. Canadian tort cases typically are determined by judge alone and not by juries;
2. the contingent fee system for financing plaintiffs' legal costs, which arguably leads both to more speculative actions and inflation of awards by juries sensitive to the net value of awards to plaintiffs, is not widely utilized anywhere in Canada and is prohibited in Ontario;
3. the British cost rule applies in Canada, whereby the loser in a civil suit must compensate the winner for a high proportion of the latter's legal costs, again arguably discouraging speculative suits (this contrasts with the American cost rule whereby each side bears its own costs);
4. awards for pain and suffering, which are a major component of United States personal injury awards, are subjected to a relatively modest judicially-imposed cap of less than \$ 200,000 in Canada;
5. discount rates employed to convert foregone future income streams to present value terms for purpose of a lump sum award apparently are subject to wide variations in judicial practice in the United States, but at least in Ontario follow a rate standardized by a formal Rule of Court;
6. punitive damages, which can constitute a significant component of damage awards in the United States, are very rarely granted by Canadian courts;
7. the movement from negligence to strict liability in the products liability context in the United States, which has expanded the parameters of liability of manufacturers, has not occurred in most Canadian provinces, including Ontario;
8. United States workers' compensation laws in most cases permit employees to sue third parties (such as manufacturers of defective products) in tort despite their workers' compensation entitlements (many products liability actions in the United States arise in this way, for example, the asbestos litigation), whereas in Ontario most third party actions are legally foreclosed and the employee is confined to his workers' compensation benefits;
9. The rules governing aggregation of individual claims as class actions as entailed in the United States in mass toxic tort claims, such as the asbestos, DES, and Agent Orange litigation, are much more permissive than in Canada where in all provinces, other than Quebec, class actions are subject to severe legal constraints;
10. the U. S. Supreme Court does not hear appeals on matters of purely state law, which includes most aspects of tort law, thus leaving open the potential for substantial diversity

of doctrine among the fifty states (and consequent uncertainty for insurers of firms operating in a number of state markets), whereas the Supreme Court of Canada is the ultimate adjudicator of all legal issues, including those of a private law nature, subject of course to the ability of provincial legislatures (not courts) to adopt distinctive legal rules within their own jurisdictions;

11. social security programs in Canada are in many cases more generous and comprehensive than in the United States (for example, universal health care insurance), and thus there is a reduced need to look to the tort system to serve a social insurance function.

Besides these important differences in the two tort systems, there is also a major difference in the organizations that cover both the litigation costs and the possible malpractice settlements. In Canada, over 95 percent of medical malpractice claims are handled by the Canadian Medical Protective Association (CMPA). This professional liability association has been in existence for over 50 years and provides coverage to over 85 percent of all physicians, Canadian Medical Protective Association (1987).¹ In contrast, in the United States claims are largely handled through insurance companies at the local, state and national level. This proliferation of organizations employed to settle claims and defend physicians leads to an array of litigation and settlement policies. In Canada, the CMPA has the opportunity to offer a more homogeneous method of handling malpractice claims than that attainable in the U. S.

The Canadian Medical Protective Association (CMPA) sets fees for malpractice coverage for each specialty (Figure 4), it hires and provides payment to lawyers to defend physicians named in malpractice cases and it ultimately compensates the victims of medical misadventure either out-of-court or at the conclusion of a trial if the plaintiff brings a successful claim. Before 1983 all practicing physicians faced the same CMPA fee whether or not a claim(s) of malpractice was made against them. The only change to fees since 1983 has been to specify fees for particular specialties. Experience rating within a particular specialty has not been pursued.

In spite of the formal differences between the U. S. and Canadian tort systems, Trebilcock (1987, p. 982) has argued that the trends in both the determination of liability and the quantification of damages indicates an increasing congruence. Recent Canadian negligence decisions appear more concerned with the determination of compensation for the plaintiff than the finding of negligence.² These results are therefore similar to the conclusions reached in United States strict liability decisions. Two recent developments which concern the qualification of damages have taken place since 1978 when the Supreme Court of Canada laid out the general principles of damage calculation in personal injury cases.³

¹ A small fraction of physicians purchase private malpractice insurance coverage though coverage for malpractice is not mandatory in the Canadian medical profession.

² In a recent Ontario Supreme Court decision, Justice Henry said "In my opinion the time has come to extend the policy of the law so that the plaintiff is not obliged to prove negligence on the part of the defendant which may be a difficult and costly burden to discharge; in such circumstances, negligence becomes virtually a presumption, if not a judicial fact". *Biancale v. Petro-Lon Canada Limited* Ins. L. Rep. (CCH) 92, 544 (Ont. 1986).

³ The three important 1978 decisions were *Andrews v. Grand and Toy Alberta Ltd.*, 2 S.C.R. 229, 83 D.L.R. 3d 452 (1978); *Thornton v. School Dist. No. 57 (Prince George)*, 2 S.C.R. 267, 83 D.L.R. 3d 480 (1978); and *Arnold v. Teno*, 2 S.C.R. 287, 83 D.L.R. 3d 609 (1978).

First, although the 1978 decisions of the Supreme Court of Canada imposed ceilings on all pain and suffering awards in personal injury cases, the Ontario Family Law Reform Act of 1978 extended recovery for pecuniary and non-pecuniary damages to a wide range of relatives of a victim involved in a fatal accident or in a case involving bodily damage. Second, personal injury awards have recently been “grossed-up” so that the investment income derived from a lump-sum award, net of income tax, is sufficient to compensate the plaintiff for his or her injury.⁴ Rea (1987) argues that these changes have increased the size of awards and stimulated an increase in claims. By recalculating the damages in a well-known 1978 Supreme Court of Canada decision, *Andrews v. Grand and Toy Alberta Limited*,⁵ Rea concludes that in the light of subsequent doctrinal changes in methods of calculating damages in personal injury cases, the 1978 award would have increased by over 200 percent in real terms had it been made in 1986.

Although the doctrinal changes identified above have occurred in the past ten to twenty years, each is difficult to quantify in our examination of their impact on the practice of medicine and medical malpractice. In contrast, changes to the doctrine of informed consent and alterations in the statutes of limitations are easier to measure empirically.

With two 1980 Supreme Court of Canada decisions,⁶ the Canadian courts have moved away from arguing that a physician’s duty “is to explain what he intends to do, and its implications, in the way a careful and responsible doctor in similar circumstances would have done”,⁷ to that which obliges the physician to disclose to the patient those risks that are deemed material. Material risks are those risks that a physician knows (or should reasonably have known) play a significant role in the patient’s decision whether or not to forego the proposed therapy. This expansion of the doctrine of informed consent has been viewed as an important variable in the American malpractice “crisis” of the mid-seventies (Danzon [1985, p. 77]) and may provide an explanation for the increase in such claims in Canada.

The statutes of limitations in malpractice cases vary throughout Canada and over time. For some provinces, like Ontario, the limitation period is one year, while other provinces have a more generous limitation period of two years. Ontario, in 1975, adopted the common tort approach to limitation periods by defining this period from the time at which the plaintiff acting reasonably could have known both of the injury and of the involvement of the defendant. Consequently, since Danzon (1986, p. 71) found that a decrease in the limitation period in the United States was associated with a fall in both the total number of claims and the number of paid claims, the variation in these limitation periods across Canada may account for a portion of the variation in the frequency of malpractice claims.

3. A simple model of medical malpractice and the practice of medicine

In this section, we introduce a theoretical framework that provides the basis for our inquiry into the possible determinants of both the trends in malpractice claims and settlements, and their impact on the practice of medicine in Canada.

⁴ The “grossing-up” of awards appears to go against the 1978 Supreme Court of Canada’s decision in which tax factors were not to be considered in the quantification of damages, Trebilcock (1987, p. 980).

⁵ 2 S.C.R. 229, 83 D.L.R. 3d 452 (1978).

⁶ *Hopp v. Lepp*, 112 D.L.R. 3d 67 S.C.C. (1980); and *Reibl v. Hughes*, 114 D.L.R. 3d 1 S.C.C. (1980).

⁷ *Chatterton v. Gerson*, 1 All E.R. 257 at 266 (1981).

Consumers present illness symptoms (or medical demands) to health care providers. These providers combine factor inputs to produce medical services, s , and medical care, c . Medical care captures the diagnostic services and consultation time spent by physicians in caring for the patient, while medical services represent more invasive activities (such as surgery) that are more likely to expose the patient to an iatrogenic injury. Within a representative consumer-provider framework, each dimension of the practice of medicine is defined in terms of its effect on the probability that the consumer will experience an adverse outcome (or a medical misadventure).⁸ These adverse outcomes occur whenever an index of predisposition, $a(s, c, X_a) + e_a$, exceeds some threshold value, a^* :

$$(1) \quad a(s, c, X_a) + e_a \geq a^*,$$

where X_a is a vector of variables other than medical services and medical care that influence adverse outcomes, while e_a is a random term. Since medical services capture a consumer's exposure to an iatrogenic injury and since medical care reduces this exposure, we assume that the deterministic portion of the index of predisposition is increasing in medical services and decreasing in medical care.

The consumer's utility function is defined as:

$$(2) \quad U(W, e_o),$$

where W is the consumer's wealth and e_o is a random variable that captures the severity of an adverse outcome. Utility is assumed to be increasing in wealth, but decreasing in the severity of the adverse outcome. Severity is defined (for simplicity) as:

$$(3) \quad e_o = \begin{cases} a(s, c, X_a) - a^* + e_a & \text{if } a(s, c, X_a) - a^* + e_a \geq 0 \\ 0 & \text{otherwise.} \end{cases}$$

This formulation is not unreasonable since it assumes that an increase in exposure to an adverse outcome is, in the event of an iatrogenic injury, associated with an increase in severity.

If the consumer files a malpractice claim, the claim is successful if an index of success, $w(c, X_w) + e_w$, exceeds some threshold value, w^* :

$$(4) \quad w(c, X_w) + e_w \geq w^*,$$

where X_w is a vector of variables other than medical care that influence the success of the litigation, while e_w is a random term that captures the stochastic process that generates a successful malpractice claim. Medical care is assumed to reduce the deterministic portion of the index of success since many activities undertaken by the provider, such as laboratory tests and other diagnostic procedures etc., which may be inherently valuable or essential to the health of the consumer, may also be used to defend the provider in the event of a malpractice claim. A successful malpractice claim results in a damage award (or settlement) to

⁸ As Shavell (1978, p. 15) has indicated, the misadventures we are concerned with are iatrogenic, those due to medical treatment itself. An adverse outcome includes any physical or psychological injury, whether or not it was accidental in nature. A similar operational definition is used by the Harvard Medical Practice Study Group (1987, p. 36).

the plaintiff,⁹ while an unsuccessful claim results in the payment of legal costs. The outcomes are defined as:

$$(5) \quad D = d(X_d) + e_d,$$

for damages and:

$$(6) \quad L = 1(X_1) + e_1,$$

for legal costs. The stochastic process in each equation is captured by the random terms, e_d and e_1 , while the deterministic process is influenced by two vectors of variables, X_d for damages and X_1 for legal costs.

After observing the severity of the iatrogenic injury (if one exists at all), the consumer's choice problem solely concerns whether or not to pursue a claim of malpractice. An affirmative litigation decision is made if the expected utility derived from such a claim exceeds the expected utility in its absence. Since malpractice claims in the absence of an adverse outcome are likely to represent a small fraction of all successful claims, we suppose that a medical misadventure is a necessary condition for a successful malpractice claim. This assumption implies that the consumer who suffers an iatrogenic injury litigates whenever:

$$(7) \quad E[U(W_o + D - L, e_o) \mid e_o] \geq U(W_o, e_o),$$

where W_o is the consumer's initial wealth and E is the expectations operator.

Since the inequality defined by equation (7) depends on the severity of the adverse outcome, a binary litigation indicator can be defined where:

$$(8) \quad m(e_o) = \begin{cases} 1 & \text{if equation (7) is satisfied,} \\ 0 & \text{otherwise.} \end{cases}$$

Before the random variables that determine the severity of the iatrogenic injury and its occurrence are observed, the probability of malpractice litigation can be defined as:

$$(9) \quad M = [1 - F(a^* - a(s, c, X_a))] \int m(e_o) h(e_o) de_o,$$

where $F(\cdot)$ is the cumulative density function for e_a and $h(\cdot)$ is the probability density function for e_o in the event of an adverse outcome.¹⁰

To maintain the simple theoretical framework, we suppose the provider decides on the practice of medicine and offers the consumer medical services, s , and medical care, c , to maximize his expected utility. The provider's expected utility is defined as the excess of revenues over production costs and the costs associated with both litigation and adverse outcomes:

⁹ Although we do not distinguish between out-of-court settlements and court awards, others have made this distinction. Danzon and Lillard (1983) have tested a model of the disposition process based on the work by Landes (1971), Gould (1973) and Posner (1973). Danzon and Lillard show out-of-court settlements to be strongly influenced by the potential verdict, with the average out-of-court settlement at 74 percent of the potential verdict. In a later research endeavour, we will consider the disposition process for Canada, however at this stage we abstract from this complication.

¹⁰ In general, the claims probability may be written as: $M = P(\text{Adverse Outcome}) \cdot P(\text{Claim} \mid \text{Adverse Outcome}) + P(\text{No Adverse Outcome}) \cdot P(\text{Claim} \mid \text{No Adverse Outcome})$. The assumption that an adverse outcome is necessary for a successful claim implies $P(\text{Claim} \mid \text{No Adverse Outcome}) = 0$, hence: $M = P(\text{Adverse Outcome}) \cdot P(\text{Claim} \mid \text{Adverse Outcome})$.

$$(10) \quad P_s s + P_c c - C(s, c, X_c) - [1 - F(a^* - a(s, c, X_a))] \int \{m(e_o) [R_{nw} + (R_w - R_{nw}) \int g(e_w | e_o) de_w] + [1 - m(e_o)] R\} h(e_o) de_o, \\ w^* - w(c, X_w)$$

where P_s and P_c are the reimbursement parameters, $C(\cdot)$ is the cost of production that depends on medical services, medical care and a vector of other factors, X_c , and $g(e_w | e_o)$ is the conditional probability density function for e_w . Finally, the monetary equivalent of the psychic (or other) costs due to an adverse outcome with no litigation, with unsuccessful litigation and with successful litigation are defined as R , R_{nw} and R_w respectively.¹¹

By solving the provider's optimization problem, we obtain a system of two equations, one for medical services:

$$(11) \quad s = s(\cdot),$$

and one for medical care:

$$(12) \quad c = c(\cdot),$$

that depend on the reimbursement parameters, production and psychic costs, and on the process that generates malpractice claims.¹² Various comparative statics could be discussed; however, for brevity, we postpone commentary until Section V.

The claims probability, defined by equation (9), depends on (amongst other things) the probability of successful litigation, the size of the expected settlement and the expected legal costs.¹³ Since settlements are only observed if the malpractice claim is successful and since legal costs are only observed if the claim fails, observed settlements are:

$$(13) \quad D = \begin{cases} d(X_d) + e_d & \text{if } w(c, X_w) + e_w \geq w^* \text{ and } m(e_o) = 1, \\ 0 & \text{otherwise,} \end{cases}$$

and observed legal costs are:

$$(14) \quad L = \begin{cases} l(X_l) + e_l & \text{if } w(c, X_w) + e_w < w^* \text{ and } m(e_o) = 1, \\ 0 & \text{otherwise.} \end{cases}$$

By estimating the selection rules and correcting both the settlements and the legal cost equations for the possibility of selection bias, estimates of the expected damages, the expected legal costs, and the determinants of the probability of successful litigation are obtained. These results are then used to estimate the claims probability, equation (9). Finally, since the determinants of the claims probability and the probability of successful litigation may influence the practice of medicine, the predicted values of each probability are used in estimating both the medical service and the medical care equation, (11) and (12).

¹¹ These costs may represent lost earnings due to court attendance, lost customers due to bad publicity, psychic effects due to both litigation and adverse outcomes, etc.

¹² There is a presumption that the availability of liability insurance undermines the deterrent effect of malpractice litigation. Indeed, in the Canadian context, if the psychic costs (or lost present and future earnings) due to litigation were zero, then both medical services and medical care are unaffected by malpractice litigation. By analysing the effect of litigation on the pattern of medical practice we capture the size of the possible deterrent effect.

¹³ Although, in general, the claims probability depends on the distribution of damages and legal costs rather than merely their first moment, we simplify the problem of estimating the claims probability by imposing the assumption that the consumer is risk neutral.

4. The simple model as applied to Canada

Section III outlines an ambitious agenda for those conducting research into medical malpractice. Previous studies have fallen short primarily in the lack of data brought to bear on this issue. In our study we utilize a more extensive data set than that previously available. Namely, the data used is derived from the claims files held by the Canadian Medical Protective Association (CMPA). This professional liability association covers over eighty-five percent of all physicians practicing in Canada, Trebilcock (1987, p. 947). The data drawn from these claims files are supplemented with information regarding the practice of medicine provided by each of the ten provincial health insurance plans over the seventeen year period, 1971-1987. This combined data set forms the basis of the empirical work we are currently undertaking on the determinants of the frequency of malpractice claims, the size of settlements and the response by physicians to the perceived malpractice "crisis".

There are two important problems with the data on Canada's experience with medical malpractice. First, the CMPA claims files do not provide information regarding the legal costs incurred by unsuccessful claimants. Second, the claims files provide us with a censored sample since information on consumers who decided not to pursue a malpractice claim is unavailable. In the light of these problems the simple model developed in Section III must be amended.

Despite the provision of disaggregated claims data, the problems associated with the censored sample can be handled by viewing the malpractice process in its aggregate form. Namely, by maintaining the representative consumer-provider framework advanced in Section III, equations (11) and (12) yield the determinants of the level of both medical services and medical care per capita. With the assumption that the process that generates malpractice claims is independent across consumers, equation (9) provides the determinants of malpractice claims per capita. To obtain estimates of the expected damages and the probability of successful litigation, which influence both claims per capita and the practice of medicine, we estimate the selection rule (probability of successful litigation) and then we correct the damage award equation for potential selection bias. This estimation procedure yields unbiased estimates of both the expected damages and the determinants of a successful malpractice claim if the severity of the iatrogenic injury (e_o) and the random variables in the damage award equation (e_d) and the process that determines the success of the litigation (e_w) are independent, Heckman (1976) and Catsiapis and Robinson (1982).¹⁴ Unfortunately, given our data on malpractice claims this maintained hypothesis is not testable.

5. Estimation and explanation of liability trends and the practice of medicine

Our empirical enquiry into the determinants of the practice of medicine and medical malpractice is based on the general framework discussed in Section III. This framework was subsequently amended in Section IV in the light of our data. In this section, we highlight the equations to be estimated and the variables employed in our analysis.

¹⁴ Under these conditions, variations in unobservable characteristics that make litigation more likely are assumed to neither influence the unobservable determinants of the success in litigation nor the unobservable determinants of the damages awarded.

There are five equations that form the basis of our empirical study. First, conditional on a malpractice claim we seek the determinants of the probability of successful litigation :

$$(15) \quad P(e_w \geq w^* - w(c, X_w)).$$

Second, conditional on a successful malpractice claim we estimate the determinants of the damages awarded, correcting for any potential selection bias :

$$(16) \quad D = d(X_d) + e_d.$$

Third, after estimating (15) and (16) with disaggregate data we estimate an aggregate claims probability, knowing from (9) that this probability is determined as the product of the probability of an adverse outcome and the conditional probability of litigation :

$$(17) \quad M = M(\hat{P}(\cdot), \hat{d}(\cdot), s, c, \dots) + e_m,$$

where $\hat{P}(\cdot)$ and $\hat{d}(\cdot)$ are derived from disaggregate estimates of (15) and (16) evaluated using aggregate data, and e_m is a disturbance term capturing various measurement errors. The level of both medical services, s , and medical care, c , may influence the claims probability directly through their impact on adverse outcomes. Fourth, since the practice of medicine may be influenced by malpractice litigation, the level of medical services is specified as :

$$(18) \quad s = s(\hat{P}(\cdot), \hat{M}(\cdot), \dots) + e_s,$$

where $\hat{P}(\cdot)$ and $\hat{M}(\cdot)$ are derived from estimates of (15) using disaggregate data and estimates of (17) using aggregate data, respectively. Both of these probabilities are evaluated using aggregate data. The disturbance term captures measurement errors or errors in optimisation. Finally, the level of medical care is estimated with the same variables as (18), hence :

$$(19) \quad c = c(\hat{P}(\cdot), \hat{M}(\cdot), \dots) + e_c,$$

where e_c is a disturbance term.¹⁵

To estimate each of the five equations that form the basis of our empirical analysis, data are required on several explanatory variables. For each equation in turn, we highlight the variables of interest and the hypotheses to be tested.

Probability of successful litigation

Four main sets of variables are important in explaining movements in this probability: liability rules; medical care; characteristics of plaintiffs and physicians; and the type of adverse outcome.

1. Liability rules

Many legal doctrines evolve slowly without abrupt changes. Over the last twenty years there has been a relaxation in both the liability and customary practice rules, an enlargement of *res ipsa loquitur*, movements to strict liability on insurance grounds, enlarged scope for jury determinations, erosion of the technical expertise/common knowledge distinction in defining standards of care, etc. However, many of these changes are difficult to measure.

¹⁵ By examining the effect of the risk of tort liability on the behaviour of providers, we are able to answer some of the questions posed by the Harvard Medical Study Group (1987, p. 139). Namely, if the relevant liability risk to the provider is the chance of a claim being filed, $\hat{M}(\cdot)$ may be significant, while $\hat{P}(\cdot)$ may not. Alternatively, if the success of the claim is important, $\hat{P}(\cdot)$ may be significant, while the pattern of medical practice may be invariant to $\hat{M}(\cdot)$.

Two changes that are easier than others to identify concern the more stringent requirements for informed consent, which was changed by a 1980 Supreme Court of Canada decision, and the more generous limitation periods. Both of these variables are expected to increase the rate of litigation success.

2. Medical care

Certain activities by physicians may reduce the risk of successful litigation while providing benefits to patients that are less than their costs. Laboratory tests, consultations with other physicians, more detailed record keeping, more frequent mammograms or computed tomography are examples of procedures which are inherently valuable or essential to the health of the consumer, but may also be used increasingly in response to litigation. To capture the impact of these variables, we will gather data from the provincial health insurance plans on billings for these procedures, adjusted by an index of medical cost.

3. Characteristics of plaintiffs and physicians

By collecting data on the age, sex, income and place of residence of plaintiffs and the age, sex, place of graduation and place of practice of physicians, we may capture factors that are intrinsic to the malpractice case. For instance, income may capture the cost of the adverse outcome and any tendency of courts to move towards strict liability on insurance grounds would show up in more successful claims by those with higher incomes.

4. Type of adverse outcome

The removal of the wrong lung or limb is an adverse outcome due to surgery that is relatively straightforward to document. An adverse outcome brought about through a pharmaceutical product is less clear cut. By categorizing adverse outcomes into a series of relatively homogeneous groups, we may empirically identify not only those outcomes that are easier than others to document, but also whether such outcomes increase the rate of litigation success.¹⁶

Damages awarded to successful litigants

Three main sets of variables are important in explaining movements in damages awarded by courts and out-of-court settlements: compensation rules; characteristics of plaintiffs and physicians; and the type of adverse outcome.

1. Compensation rules

Doctrinal changes that bear on the quantification of damages have evolved slowly throughout the past twenty years. The 1978 “trilogy” decisions by the Supreme Court of Canada laid out the general principles of damage calculation in personal injury cases. Many of these principles and recent changes to the assessment of non-pecuniary damages, pre-judgement interest, gross-up, and dependents’ damages under Ontario’s Family Law Reform Act are difficult to quantify though Rea (1987) has made such an attempt for one

¹⁶ The principal allegations of negligence are classified by the U.S. General Accounting Office (1987) and will be obtained from the claims files of the Canadian Medical Protective Association. Since settlements in the U.S. depend systematically on these allegations, comparison with Canadian data may prove insightful.

of the well-known “trilogy” cases. A similar exercise will be conducted in our research to test the hypotheses that doctrinal changes that increase the assessment of both pecuniary and non-pecuniary damages are positively associated with the value of both settlements and court awards.

2. Characteristics of plaintiffs and physicians

By collecting data, as outlined earlier, on the characteristics of plaintiffs and physicians, we may capture the effect of factors that are intrinsic to the malpractice case. For instance, income may proxy the cost of the injury as well as the time costs in pursuing litigation. Since patients are assumed only to litigate when expected benefits exceed expected costs, settlements may be positively associated with the plaintiff’s income for both sample selection and injury cost reasons.

3. Type of adverse outcome

Since some adverse outcomes result in more permanent and more costly injuries than others, it is likely that these costly adverse outcomes will account for the larger settlements. We therefore classify adverse outcomes into a series of relatively homogeneous groups and examine whether these outcomes bear any relationship to the value of settlements.

Claims probability

Following our discussion in Section III, the claims probability is determined as the product of the probability of an adverse outcome and the conditional probability of litigation. We examine the determinants of each of these probabilities in turn. We focus on adverse outcomes rather than negligently caused adverse outcomes since recent Canadian negligence decisions appear more concerned with the determination of compensation for the plaintiff than the finding of negligence. Consequently, since the determination of liability in Canada appears to have moved towards strict liability on insurance grounds, the gateway to a malpractice claim now occurs at the stage of an adverse outcome.

A. Probability of an adverse outcome

Five main variables are important in explaining movements in the probability of an adverse outcome: utilization of health care services; type of physician; quality of physician; workload of physician; and professional discipline.

1. Utilization of health care services

Although increased utilization of health care services, in general, may be associated with an increase in iatrogenic injuries, some procedures may be more prone to adverse outcomes than others.¹⁷ Indeed, some procedures, which clarify more precisely both the patient’s illness and the appropriate course of treatment, such as those associated with laboratory tests and diagnostic radiology, may actually reduce the patient’s exposure to an iatrogenic injury. Consequently, besides examining the effect of general activity levels on

¹⁷ It is possible that advances in medical technology have increased the risk of iatrogenic injury, Robinson (1986, p. 11). By disaggregating medical and surgical procedures into those due to technological innovations and all others, we may test whether the rise in claims may be attributed to the introduction of sophisticated technology.

adverse outcomes (and hence, on litigation), we also consider the effect of more specific procedures such as those associated with major and minor surgery and those associated with laboratory tests and diagnostic radiology. The volume of these various procedures is measured by total billings to each provincial health insurance plan, adjusted by an index of medical cost.¹⁸

2. *Type of physician*

The type of physician may affect the probability of an adverse outcome in either of two ways. As between a solo practitioner and one in a group practice, there may be differences in quality control. Unfortunately, we believe that the actual arrangements between physicians are sufficiently varied that considerable errors of interpretation arise in trying to measure the proportion of solo or group practitioners in Canada. We foresee no feasible test of this relationship.

Another distinction is between the generalist and the specialist. Presumably the specialist offers higher quality care, but is held to a higher standard of care. More confusingly, the specialist may deal with the majority of the difficult cases in which adverse outcomes are more likely. Studying the effect of the degree of specialization of the medical profession should indicate which of these effects dominate.

3. *Quality of physician*

Despite the presumption that high quality physicians experience fewer adverse outcomes, more complex cases may be treated by these physicians. As a result, quality (as measured by physician age, place of training, degree of training, years of experience, place of practice etc.) has an ambiguous effect on the probability of an adverse outcome. By studying the effect of quality on the claims frequency we estimate which of the two effects noted above dominate.

4. *Workload of physician*

If a physician handles a large volume of work, he or she may be unable to give adequate time to each patient. Thus, above some threshold, more activity per physician per year (whether measured by either more activity per hour or more hours of work) may be associated with an increased rate of adverse outcomes. Under the assumption that physicians have similar workloads, this hypothesis can be tested by examining the relationship between the claims probability and the average billings by physicians, adjusted by an index of medical cost.

5. *Professional discipline*

If the disciplinary process seeks to actively correct the problems brought about through medical malpractice, then an increase in adverse outcomes that leads to increased discipline may result in an eventual reduction in the probability of an adverse outcome. We believe, however, that the disciplinary process may penalize rather different behaviour than that

¹⁸ In the absence of billing data, Danzon (1984) used physician density as her measure of exposure. Despite finding a positive association between this variable and the frequency of claims, the use of this variable implies constant physician workloads. Specifically, physician density may be defined as the ratio of medical services per capita to medical services per physician. By examining each effect separately the possibility of mis-specifying the claims frequency equation is reduced.

which is dealt with by the tort system.¹⁹ If this presumption is correct, we should find that the frequency of malpractice claims is invariant to the number of formal disciplinary proceedings by the provincial colleges of physicians and surgeons.

B. Conditional probability of litigation

Six main variables are important in explaining movements in the conditional probability of litigation: expected success of litigation; expected damage awards; expected legal costs; characteristics of plaintiffs; general propensity to litigate; and specific propensity to litigate.

1. Expected success of litigation

An increase in the expectation of success may increase the likelihood of claims being filed. In spite of our inability to directly observe these expectations, we will have estimates of the probability of successful litigation, equation (15). Since these estimates provide insights into the process that generates litigation outcomes, consumers may use the predictions derived from this equation to estimate their probability of successful litigation.

2. Expected damage awards

An increase in the expected damage award when the malpractice claim is successful may increase the likelihood of claims being filed. Estimates of the damage award equation, equation (16), provide insight into the general principles that determine damages. Consumers may use the predictions derived from this equation to estimate their expected award.

3. Expected legal costs

Because we are unable to observe the legal costs incurred by unsuccessful litigants, we are unable to estimate a legal cost equation and thereby predict the expected legal costs for possible litigants. To approximate the movement in expected legal costs we employ changes in the cost and fee rules. Specifically, we examine the availability of both legal aid and contingent fees in malpractice cases.²⁰ In addition, attention may be paid to the state of the market for lawyers under the hypothesis that excess supply lowers the fee schedule thereby making litigation more attractive, Danzon (1984 and 1985).

4. Characteristics of plaintiffs

To test the effect of patient characteristics on litigation we include various age, sex and income groups as possible explanatory variables. For example, age may be important either for indicating the general robustness of the patient or for indicating the cost of an adverse outcome. In addition, income may be important as a proxy for both the cost of the injury (in terms of lost earnings) and the opportunity cost of time involved in bringing a lawsuit.

¹⁹ Trebilcock (1987, p. 992) indicates that in California in 1976 despite 1,500 paid malpractice claims only six disciplinary actions for incompetence or gross negligence took place.

²⁰ Prohibitions on the use of contingency fees have an ambiguous effect on the number of claims, however, if lawyers are more able to absorb the risk of losing the case than consumers, then this prohibition lowers the number of malpractice claims, Shavell (1978, p. 53) and Reder (1978). Although some provinces do restrict the use of this method of reimbursement, lawyers may adopt sufficiently flexible fee schedules that they act as if they set contingency fees. As a result, in our empirical work the invariance of claims to regulations regarding contingency fees may merely capture the ineffectiveness of the prohibition, rather than the effect of the fees per se.

5. *General propensity to litigate*

As a society, we may be settling more of our problems with tort litigation. If this is true, an increase in medical malpractice claims should be mirrored by similar increases in claims in other areas. The most sensible comparisons should be with other self-governing professions (for example, lawyers, architects and accountants) and other personal injury claims (for example, automobile accidents).

6. *Specific propensity to litigate*

Aside from the general trend in litigations, there may be factors that increase medical malpractice litigation in particular. These include a less personal relationship between the patient and the physician, both socially and professionally, and rising expectations regarding the successful outcome of medical treatment. Although urbanization might be employed as a proxy for social distance, it is a crude measure and one that is correlated with many other social variables that might be the actual causative agents. We will consider whether we can specify a social variable more specific than urbanization, such as the mobility of the population.

Medical services and medical care

Since medical services and medical care depend on the same variables, we, for brevity, discuss the determinants of each together. Gone are the days (if they ever existed) of the naive medical technician who took a set of symptoms and prescribed one method of treatment. Physicians have discretion in the practice of medicine and many different methods of diagnosing and treating illnesses exist. Because of this degree of discretion the practice of medicine is likely to be influenced by a number of variables. Seven variables are considered in this section: probability of an adverse outcome; expected litigation; expected success of litigation; reimbursement parameters; competition in the medical market; characteristics of patients; and characteristics of the physicians' practice environment.

1. *Probability of an adverse outcome*

Variables that increase the probability of an adverse outcome may influence the practice of medicine by discouraging the provision of medical services and encouraging medical care. In our discussion of the claims probability we highlighted the variables deemed important in explaining movements in the probability of an adverse outcome. These same variables will be used to capture the effect of changes in the probability of an iatrogenic injury on the practice of medicine.

2. *Expected litigation*

Physicians may respond to an increase in the propensity to litigate by being more careful in the supply of medical services and possibly withdrawing those services that increase the claims probability, Rottenberg (1978, p. 11). In spite of our inability to directly observe the expected chance of litigation, we will have estimates of the claims probability, equation (17). Since these estimates provide insight into the process that generates litigations, physicians may use the predictions derived from this equation to estimate their probability of facing a malpractice claim. An increase in the predicted claims probability may be associated with increased medical care and decreased medical services, see Rizzo (1987) for U.S. evidence on this hypothesis.

3. *Expected success of litigation*

An increase in the expected success of malpractice litigation may affect the practice of medicine. In spite of our inability to directly observe these expectations, we do have estimates of the probability of successful litigation, equation (15). Since physicians may use this equation to estimate their probability of facing a successful malpractice claim, we will use the predictions from this equation in our explanation of the pattern of medical practice.

4. *Reimbursement parameters*

An increase in the reimbursement of medical services may encourage the provision of these services and discourage the provision of medical care. By examining the movement in the provincial benefit schedule in real terms for an array of procedures, we may analyse the effect that these reimbursement parameters have on the practice of medicine.

5. *Competition in the medical market*

Increased competition in the medical market as proxied by a larger physician density may result in increased supplier-induced demand effects, Evans (1974), lower time costs for physician visits, Sloan and Loran (1977), increased responsiveness of physicians to consumer demands or even a decrease in the responsiveness of physicians to consumer demands, Pauly and Satterthwaite (1981). By studying the effect of physician density on the practice of medicine the combined effect of each hypothesis may be estimated.

6. *Characteristics of patients*

By examining the impact of various age, sex and income groups on the practice of medicine, we capture the effect of both the lifestyle of the patient and his or her general robustness.²¹ To the extent that some age or income groups are more likely to experience an adverse outcome, we anticipate a decrease in the supply of medical services and an increase in supply of medical care offered to these groups.

7. *Characteristics of the physicians' practice environment*

Variations in the supply of hospital beds per capita, the availability of hospital admitting privileges, technical change in the provision of medical, surgical and diagnostic procedures and changes in the cost of producing medical services and medical care may influence the practice of medicine. By identifying these variables, we may examine their impact on the practice of medicine in Canada.

6. **Medical malpractice liability trends in Canada**

The existing aggregate data on medical malpractice in Canada that lies in the public domain concerns the writs served against physicians, the average size of the paid writs, the disposition of legal actions and malpractice fees. In this section, we present and compare this aggregate Canadian data to that available in the United States.

The trends in the frequency of malpractice litigation in Canada since 1971 are shown in Figure 1. This figure indicates a slow, but steady, upward trend in writs filed against physicians until 1979 and a slightly more rapid increase thereafter. Table 1 adjusts this trend for the increase in the membership of the CMPA and provides a similar trend to that shown in

²¹ For example, services related to athletic injuries, allergy treatments and cosmetic surgery appear to be more popular today than twenty years ago.

Figure 1. More interestingly, this table indicates that despite the United States' larger frequency of claims, Canada's experience with malpractice litigation has grown in line with that in the United States.²²

The average paid writ, whether due to out-of-court settlements or court awards, is shown in Figure 2. Although these payments appear to follow a rapid upward trend, the rate of increase is reduced when we adjust for inflation, see Table 2.²³ The variance in the real value of paid writs may stem from the aggregation of out-of-court settlements (which are generally relatively small) and court awards. As shown in Figure 3, there has been a decrease in the fraction of paid writs through court awards. Although this decrease appears to have stemmed the *rapid* rise in the average paid writ, the severity of Canada's writs (as shown in Table 2) has moved in line with the severity of malpractice claims in the United States.²⁴

The general rise in both the writ frequency and the real value of paid writs have brought an increase in the fees paid by physicians for malpractice insurance. Figure 4 shows the fees set by the CMPA for various specialties, while Table 3 indicates the average fees paid by physicians in Canada and the United States. Although Canadian malpractice fees have more than tripled in real terms since 1980, the fees set in the United States are more than ten times higher. In addition, separate CMPA fees for various specialties are a recent phenomenon in Canada and no geographic variation in fees presently takes place. In contrast, in the United States fees vary both geographically and across specialties.²⁵

7. Conclusion

Our current study for the Health Provider Liability Task Force is an exercise in positive analysis. It describes Canada's experience with malpractice liability, it examines the determinants of the liability trends and it considers how the pattern of medical practice is affected by these trends. In the present paper, we highlight the framework we plan to employ in undertaking our study for the task force. In this paper, we present an array of potential explanations for the trends in malpractice litigation and we discuss the data pertaining to each hypotheses.

²² The U.S. data derived from St. Paul Fire and Marine Insurance Company understates the national average since they exclude such relatively litigious states as California and New York, Danzon (1985, p. 60). Despite this underestimate, one explanation for the higher claims frequency recorded in the U.S. stems from the claims process. In Canada, the claims files of the CMPA are organized such that each claim represents a single medical event, involving one or more physicians. In contrast, since many underwriters of malpractice insurance exist in the U.S., a separate claim is made for each physician named in a lawsuit. Thus, meaningful cross-country comparisons at a point in time are difficult, while comparisons over time hinge on the assumption of a "stable" claims process.

²³ Although adjusting these payments for the consumer price index is reasonable in Canada where medical costs comprise a minor portion of the award, in the U.S. deflating by this index does not yield an accurate estimate of the real value of the award since medical costs form approximately twenty five % of the award and these costs have increased at a rate in excess of that for consumer prices.

²⁴ At a latter stage in our research efforts we will consider both the method of dispute resolution (out-versus in-court) and how the size of these paid claims may differ. The results driven may then be compared with those obtained by Danzon and Lillard (1983).

²⁵ An Obstetrician/Gynaecologist purchasing \$ 1 million coverage for a single claim and \$ 3 million coverage against all claims incurred in 1985 would pay \$ 68,116 if he practiced in Long Island, New York, while the premium would be \$ 13,376 if he practiced in Utah, United States. Government Accounting Office (1986a, p. 24).

Table 1
Writs and Claims Filed Against Physicians

	Canada Writs Filed Per 100 Physicians ¹ (1)	United States Claims Filed Per 100 Physicians ² (2)	Ratio (2) to (1) (3)
1970		4.5 ³	
1971	0.55		
1972	0.60		
1973	0.62		
1974	0.77		
1975	0.77	7.0 ⁴	9.0
1976	0.76		
1977	0.85	7.5 ⁵	8.8
1978	1.00		
1979	1.03		
1980	1.31	10.6 ⁶	8.1
1981	1.42	11.4 ⁶	8.0
1982	1.38	13.3 ⁶	9.6
1983	1.55	15.1 ⁶	9.7
1984	1.60	16.5 ⁶	10.3
1985	2.13	17.8 ⁷	8.4
1986	1.84		
1987	1.81		

¹ The number of writs filed is obtained from Figure 1. The number of physicians is the membership of the Canadian Medical Protective Association. Since the population per active civilisation physician in Canada has fallen from 791 to 542 between 1971 and 1987, the writ frequency per 100,000 population has grown more rapidly than that shown per 100 physicians. Specifically, writs per 100,000 population have increased from 0.6 to 3.5 between 1971 and 1987.

² These figures are derived from St. Paul Fire and Marine Insurance Company, the leading U.S. underwriter of malpractice insurance.

³ Danzon (1985, p. 60) reports the number of claims pending per 100 physicians. This figure overstates the claim frequency in 1970 since it includes both the claims filed in that year as well as the unresolved claims filed in prior years.

⁴ Danzon (1986, p. 63).

⁵ Danzon (1985, p. 60).

⁶ United States General Accounting Office (1986b, Table 2.4).

⁷ Weiler (1988, p. 7).

Table 2
Average Paid Writs and Claims

	Canada Average Paid Writs in '000s of 1981 Canadian Dollars ¹ (1)	United States Average Paid Claims in '000s of 1981 U. S. Dollars ² (2)	United States Average Paid Claims in '000s of 1981 Canadian Dollars ³ (3)	Ratio (3) to (1) (4)
1970		26.8 ⁴	28.0	
1971	19.2			
1972	14.0			
1973	18.9			
1974	25.9			
1975	31.1	44.9 ⁵	45.7	1.5
1976	59.7	42.7 ⁵	42.6	0.7
1977	49.2	52.2 ⁵	55.6	1.1
1978	20.2	63.0 ⁵	71.8	3.6
1979	60.0			
1980	30.5			
1981	38.2			
1982	35.1			
1983	45.6			
1984	82.9	70.7 ⁶	91.6	1.1
1985	72.2			
1986	60.5			
1987	84.8			

¹ Average paid claims are obtained from Figure 2, while the Consumer Price Index, derived from the *Bank of Canada Review*, various issues, was employed to convert the paid claims into 1981 dollars.

² The Consumer Price Index for the U.S., U.S. Bureau of Labor Statistics, *Monthly Labor Review*, various issues, was used to convert the paid claims into 1981 dollars.

³ The Canada-U. S. exchange rate, derived from the *Bank of Canada Review*, various issues, was employed to convert the U. S. dollar in column (2) to Canadian dollars.

⁴ Danzon, (1985, p. 151).

⁵ National Association of Insurance Commissions (1980).

⁶ United States General Accounting Office (1987, p. 2).

Table 3
Average Malpractice Fees

	Canada Average Fees in 1981 Canadian Dollars ¹ (1)	United States Average Fees in 1981 U. S. Dollars ² (2)	United States Average Fees in 1981 Canadian Dollars ³ (3)	Ratio (3) to (1) (4)
1974		4,616	4,517	
1975				
1976		7,519	7,415	
1977				
1978				
1979				
1980	337			
1981	300			
1982	451	5,467	6,667	14.8
1983	417	6,484	7,995	18.7
1984	1022	7,356	9,528	9.3
1985	983	8,754 ⁴	12,124	12.3
1986	944			
1987	1230			

¹ The CMPA fee for Family Medicine including Obs/Anaesth/Emerg/Surgery is obtained from Figure 4, while the Consumer Price Index, derived from the *Bank of Canada Review*, various issues, was employed to deflate these fees to 1981 dollars. The CMPA fee for Family Medicine closely matches the average malpractice fee for Canadian physicians and, consequently, is useful in order to compare international malpractice insurance premiums.

² The average malpractice fees for the U.S. were reported by Reynolds, Rizzo and Gonzalez (1987). These figures were derived from the American Medical Association's Periodic Survey of Physicians and Socioeconomic Monitoring System Survey. To deflate these figures to 1981 U.S. dollars we used the U.S. Consumer Price Index, U.S. Bureau of Labor Statistics, *Monthly Labor Review*, various issues.

³ The Canada-U.S. exchange rate, derived from the *Bank of Canada Review*, various issues, was employed to convert the U.S. dollars in Column (2) to Canadian dollars.

⁴ Department of Health and Human Services (1987) *Report at the Task Force on Medical Liability and Malpractice* (U.S. Government Printing Office; Washington, D. C.) pp. 169-172.

Figure 1
Number of Writs Filed Against Physicians¹

¹ The 1976-1987 figures were obtained from the Canadian Medical Protective Association, while F.J. Sellers, M.D., F.R.C.P.(C) compiled the figures prior to 1976 from the CMPA Annual Reports.

Figure 2
Average Paid Writs¹

¹ See note to Figure 1.

Figure 3
The Disposition of Legal Action¹

¹ See note to Figure 1.

Figure 4
CMPA Malpractice Fees¹

¹ See note to Figure 1.

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