Defensive medicine in neurosurgery: the Canadian experience

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OBJECTIVE Recent studies have examined the impact of perceived medicolegal risk and compared how this perception impacts defensive practices within the US. To date, there have been no published data on the practice of defensive medicine among neurosurgeons in Canada.

METHODS An online survey containing 44 questions was sent to 170 Canadian neurosurgeons and used to measure Canadian neurosurgeons' perception of liability risk and their practice of defensive medicine. The survey included questions on the following domains: surgeon demographics, patient characteristics, type of physician practice, surgeon liability profile, policy coverage, defensive behaviors, and perception of the liability environment. Survey responses were analyzed and summarized using counts and percentages.

RESULTS A total of 75 neurosurgeons completed the survey, achieving an overall response rate of 44.1%. Over one-third (36.5%) of Canadian neurosurgeons paid less than \$5000 for insurance annually. The majority (87%) of Canadian neurosurgeons felt confident with their insurance coverage, and 60% reported that they rarely felt the need to practice defensive medicine. The majority of the respondents reported that the perceived medicolegal risk environment has no bearing on their preferred practice location. Only 1 in 5 respondent Canadian neurosurgeons (21.8%) reported viewing patients as a potential lawsuit. Only 4.9% of respondents would have selected a different career based on current medicolegal risk factors, and only 4.1% view the cost of annual malpractice insurance as a major burden.

CONCLUSIONS Canadian neurosurgeons perceive their medicolegal risk environment as more favorable and their patients as less likely to sue than their counterparts in the US do. Overall, Canadian neurosurgeons engage in fewer defensive medical behaviors than previously reported in the US.

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KEY WORDS defensive medicine; Canada; malpractice; liability; neurosurgery

DEDEFENSIVE medicine (DM) is defined as a deviation from regular medical practice because of medicolegal fears.^{16,18} DM presents in 2 forms: 1) assurance behavior, or positive DM, which involves supplementing additional medical services for fear of liability risk and thereby deterring patients from filing malpractice claims; and 2) avoidance behavior, or negative DM,

which reflects the physicians' efforts to distance themselves from a potential lawsuit.^{15–17} In 1 study, assurance behavior was found to be more prevalent in emergency physicians (59%) in comparison with other physicians in high-risk specialties, whereas avoidance behavior was less practiced by emergency physicians (17%) in comparison with orthopedic surgeons (39%).¹⁶ The practice of

ABBREVIATIONS CMPA = Canadian Medical Protective Association; DM = defensive medicine.

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DM contributes to rising health care costs, and the estimate of excess health expenditures due to DM is roughly \$60.2 billion per year.¹⁴ Thus, malpractice health debates have often focused on the movement of providers toward a cost-effective system by reducing the practice of DM. This, however, is difficult because it requires the shifting of motivations. Did the physician order a certain test to avoid litigation, or was there some other motivation unrelated to legal fears (e.g., reimbursement)?

Historically, there have been several approaches to estimating the cost of tort reform and, thus, DM by extension. The most common sources of data used to assess DM costs include direct physician surveys,¹⁰ medical record analyses,⁴ malpractice insurance premium rates, malpractice claims paid out, Medicare data across various liability risk groups, and the percentages of overall legal costs for tort cases.¹³

In this paper, we studied the Canadian health care system and, more specifically, the neurosurgeons practicing within it. The impact of perceived medicolegal risk was surveyed, as well as any potential correlation with DM practices in neurosurgery in Canada. This paper can be regarded as one of the first steps to comparing the practice of DM internationally.

Methods

Study Design

An online survey containing 44 questions on DM was used to measure Canadian neurosurgeons' perception of liability risk and their practice of DM (see *Appendix*). The questionnaire was developed with input from numerous societies within neurosurgery (the Canadian Neurological Society, the American Association of Neurological Surgeons, the American Board of Neurological Surgery, the Congress of Neurological Surgeons, the Society of Neurological Surgeons, the Neurosurgical Society of America, the Society of University Neurosurgeons, the Council of State Neurosurgical Societies, and the Illinois State Neurosurgical Society).

The survey included questions on 8 domains: surgeon demographics, patient characteristics, type of physician practice, insurance type, surgeon liability profile, reimbursement, defensive behaviors, and perception of the liability environment.

Study Procedures

This study involved an online survey of 44 questions. This survey took, on average, less than 10 minutes to complete. The survey was entirely confidential and open to responders for 60 days.

Statistical Analysis

Survey data were collected anonymously and analyzed using IBM SPSS version 22 (IBM, Inc.). Basic patient demographics were summarized using counts and percentages for nominal variables and means, medians, and standard deviations/ranges for continuous variables.

Results

Seventy-five of the 170 Canadian neurosurgeons reg-

istered in the directory of the Canadian Neurological Society completed the questionnaire (thereby achieving a 44.1% response rate), and 85.2% and 9.4% of respondents were male or female neurosurgeons, respectively. In total, 27.4% of neurosurgeons were younger than 40 years, whereas 40.5% of the participating physicians were between 40 and 60 years of age. Neurosurgeons from every Canadian province participated in this survey, with the majority (41.9%) living in Ontario. Almost 70% of respondents reported that the majority of their patients were classified as Caucasian. In terms of medical experience, 25.7% of the participating physicians had 10 to 20 years of experience in neurosurgery. Only 21.6% were still in neurosurgery training, including residency or fellowship, and at least 27% had more than 20 years of experience in neurosurgery (Table 1).

The largest percentage of respondents was in academic practice (77%), with the vast majority practicing either spine surgery (43.2%) or general neurosurgery (45.9%). At least 10% were practicing in a community setting or academic affiliate, and 6.7% of the respondents were retired. In total, 27% of the neurosurgeons were in trauma neurosurgery, 16.2% were practicing functional neurosurgery, 23% were cerebrovascular neurosurgeons, 30% were operating on tumors, and 25.7% were also operating on the pediatric population (Table 2). In total, 35% of the neurosurgeons operated on 200 to 300 patients annually, and almost the same number of neurosurgeons operated on 100 to 200 cases annually. Only 5.4% operated on fewer than 50 cases per year, while 2.7% operated on more than 500 cases per year. The number of lifetime operations was also surveyed and found to be almost equally distributed among our groups. Of note, 14.9% of neurosurgeons had operated on 5000 to 10,000 patients throughout their lives (Table 1).

The average annual cost of indemnity insurance was \$19,600 (SD \$11,900 in 2014 USD). Almost 65% of the respondents reported that less than 5% of their income goes to malpractice insurance, almost 20% spent around 6% to 10%, 5.4% spent 10% to 19%, and only 1.4% reported that 20% to 29% of their income goes to malpractice coverage. Interestingly, over 50% of the neurosurgeons reported that liability insurance is not a burden at all and that the liability premiums have not significantly changed in the last 3 years. However, 4.1% of neurosurgeons reported current liability insurance to be a major burden (Tables 3 and 4). The cost of liability insurance was also surveyed. In total, 16.2% paid less than \$1000, 20.3% paid \$1000 to \$5000, and 4% paid \$5000 to \$10,000. Interestingly, the majority (25.7%) still paid more than \$30,000 (Table 3).

The level of confidence in malpractice insurance was found to be 1 of the 2 most important predictors of DM behavior. In Canada, 74.3% of surveyed neurosurgeons were "very" confident in their coverage, and only 1.4% answered "not at all" when asked about their level of confidence in their insurance coverage. Moreover, 51.3% of surveyed neurosurgeons reported no change in liability premiums over the last 3 years. However, 20% reported an increase and about 10% reported a decrease over the last 3 years (Table 4). The neurosurgeons were also asked what

TABLE 1. Demographic characteristics of board-certified Canadian neurosurgeons

Characteristic	Percentage
Sex	
Male	85.2%
Female	9.4%
Unreported	5.4%
Age in yrs	
21–29	5.40%
30–39	23%
40–49	24.30%
50–59	16.20%
60–69	17.60%
70–79	4%
>79	2.70%
Unreported	6.70%
Clinical status	
In residency training	16.20%
In fellowship training	5.40%
<5 yrs in practice	6.70%
5–10 yrs in practice	12.20%
10–20 yrs in practice	25.70%
20–30 yrs in practice	12.20%
>30 yrs in practice	14.90%
Other (e.g., retired)	6.70%
No. of annual operative cases	
<50 cases	5.40%
50–100	8.10%
100–200	33.80%
200–300	35.10%
300–400	8.10%
400–500	2.70%
>500	2.70%
Unreported	4%
No. of lifetime operative cases	
<500	6.80%
501–1000	14.90%
1001–2000	16.20%
2001–3000	10.80%
3001–4000	13.50%
4001–5000	6.80%
5001–10,000	14.90%
>10,000	12%
Unreported	4.1%

the appropriate malpractice premium should be annually, and around 70% agreed that it should not exceed \$30,000, but 2.7% found it still reasonable to pay up to \$50,000 for annual malpractice insurance (Table 4).

Almost 40% of the respondents reported that they have never been sued, and almost 20% were sued in the last 3 years (Table 5). Interestingly, 32.4% of surveyed neurosur-

TABLE 2. Characteristics of neurosurgical practices

Characteristic	Percentage
Type of practice	
General	45.90%
Functional	16.20%
Trauma	27%
Cerebrovascular	23%
Tumor	30%
Spine	43.20%
Pediatrics	25.70%
Setting	
Academic	77%
Academic affiliate	10.8%
Community	10.8%
Group practice	22.9%
Solo practice	6.7%
Retired	6.7%
No. of neurosurgeon colleagues	
Solo practitioner	4.10%
1–2	5.40%
3–5	21.6%
6–10	18.90%
>10	43.20%
Unreported	6.80%

geons said liability premiums affect where they practice, while the majority (48.7%) said liability premiums do not affect their location of practice (Table 5).

Imaging and laboratory tests, which are examples of positive DM, were found to be the most practiced type (85.2%) of DM. In total, 31.1% of respondents reported that they order imaging “sometimes” in order to avoid the potential risk of a lawsuit, and 35.1% admitted to ordering unnecessary laboratory tests. In addition, 43.2% of respondents referred patients that they saw as a potential lawsuit, which is an example of negative DM behavior. Neurosurgeons were also surveyed for what they would consider “high-risk” procedures. Head trauma and spine trauma were high on the list (32.4% and 41.9%, respectively). Epidural and subdural hematoma evacuations were moderately high (24.3% and 25.7%, respectively). Aneurysm coiling was not considered a high-risk procedure for lawsuits (8.1%) (Table 5).

Discussion

Canada has a publicly funded, single-payer health care system: the majority of the funding comes from income taxes and federal subsidies, and all citizens are allowed access to health care coverage regardless of income. Each of Canada’s provinces and territories runs its own insurance program, and these programs vary in terms of whether they cover supplementary services, such as dental coverage or prescription medication. Most citizens also take out private insurance plans to help cover these supplementary

TABLE 3. Burden of liability

Characteristic	Percentage
Minimum coverage by institution	
Not required	32.4%
Unknown	47.3%
\$250,000–\$500,000	1.4%
\$1–\$2 million	6.7%
>\$5 million	5.4%
Unreported	6.8%
Cost of liability insurance	
<\$1000	16.2%
\$1001–\$5000	20.3%
\$5001–\$10,000	4%
\$15,001–\$20,000	6.1%
\$20,001–\$25,000	13.5%
\$25,001–\$30,000	9.4%
>\$30,000	25.7%
Unreported	4.1%
Percentage of income going to malpractice	
<5%	64.9%
6–9%	20.3%
10–19%	5.4%
20–29%	1.4%
Unreported	8.1%
Burden of liability insurance	
Not a burden	52.7%
Minor burden	39.2%
Major burden	4.1%
Unreported	4.1%

services, and about 30% of health care financing comes from these private expenditures.³ Membership fees go toward covering insurance costs, although some provinces reimburse members for a portion of these costs: for instance, in 2008, Ontario reimbursed 83% of the insurance costs.⁶ About 95% of the country's physicians are members of the nonprofit Canadian Medical Protective Association (CMPA), which covers malpractice insurance for member physicians.¹² Membership in the CMPA is financially encouraged by the Canadian government through contractual relationships between physician organizations and the provincial health authorities. In most cases, the malpractice fees paid to CMPA by physicians are reimbursed (usually less than \$1000). CMPA also provides legal defense to physicians facing lawsuits and pays any financial compensation to patients.

This study marks the first survey to identify the perceptions among Canadian neurosurgeons of DM practices and their potential impacts on health care delivery. Neurosurgeons from every Canadian province participated in the survey, with the majority of responses coming from Ontario (41.9%). In total, 25.7% of our surveyed physicians had 10 to 20 years of experience in neurosurgery, and approximately one-third perform 200 to 300 operative cases

TABLE 4. Malpractice premiums

Characteristic	Percentage
Policy payout per occurrence	
<\$1 million	13.5%
\$1–\$3 million	5.4%
>\$3 million	39.7%
Unreported	41.4%
Policy payout maximum	
<\$1 million	8.1%
\$1–\$3 million	2.7%
\$3–\$5 million	4.1%
>\$5 million	33.8%
Unreported	51.3%
Level of confidence in policy coverage	
Very confident	74.3%
Somewhat confident	13.5%
Not at all confident	1.4%
Unreported	10.8%
Change in liability premiums over the last 3 yrs	
No significant change	51.35%
Decreased >10%	5.4%
Decreased >25%	4.1%
Increased >10%	14.9%
Increased >25%	5.4%
Unknown	18.9%
Average schedule of benefits change over last 3 yrs	
No significant change	62.2%
Decreased >10%	4%
Decreased >25%	4%
Increased >10%	8.1%
Increased >25%	1.4%
Unknown	20.3%
Appropriate malpractice premium for neurosurgeons (annually)	
<\$5000	13.5%
\$6000–\$10,000	21.6%
\$11,000–\$20,000	23%
\$21,000–\$30,000	16.2%
\$31,000–\$40,000	8.1%
\$41,000–\$50,000	2.7%
Unreported	14.9%

annually (Table 1). Most of the respondents were Caucasian males.

The majority of neurosurgeons in Canada feel that their malpractice coverage is adequate—in fact, 74.3% were “very” confident in their malpractice coverage. In comparison, around 70% of American neurosurgeons reported that they lack confidence in their current liability coverage, even though they pay as high as 15% of their annual income in insurance.¹⁴ The level of confidence is of great importance since Studdert et al.¹⁶ have demonstrated its

TABLE 5. Lawsuits, medical liability, and practice of DM

Characteristic	Percentage
Previous lawsuit	
Never sued	39.2%
<3 yrs ago	18.9%
>3 yrs ago	31.1%
Unreported	10.8%
Does medical liability affect where to practice?	
Neutral	10.8%
Disagree	25.7%
Strongly disagree	23%
Agree	27%
Strongly agree	5.4%
Unreported	8.1%
Orders to minimize the risk for a lawsuit	
Ordered laboratory tests	35.1%
Referred patients	43.2%
Prescribed medication	9.4%
Suggested a procedure	9.4%
Ordered imaging	50.1%
Discussion w/ patient	1.4%
Order additional imaging	
Very often	12.2%
Sometimes	31.1%
Rarely	37.8%
Never	13.5%
Unreported	5.4%
Conduct initial consultation	
Very often	2.7%
Sometimes	25.7%
Rarely	35.1%
Never	28.4%
Unreported	8.1%
High-risk procedures for lawsuits	
Shunts (pediatrics)	18.9%
Spine trauma	41.9%
Workers' compensation injury	33.8%
Head trauma	32.4%
Subdural evacuation	25.7%
Epidural evacuation	24.3%
Aneurysm coiling	8.1%
Aneurysm clipping	20.3%
Tumor resection	28.4%

significant role as a predictor of DM practice along with the physician's perception of premium burden, which was found to be a major issue only in 4.1% of our surveyed Canadian neurosurgeons. Accordingly, more than 30% of our respondents pay less than \$5000 USD in insurance annually. Many of these surgeons are likely the beneficiaries of the abovementioned reimbursement arrangement between physician organizations and provincial health au-

thorities. Only 1 in 5 respondent Canadian neurosurgeons (21.8%) reported viewing patients as potential plaintiffs. Our survey results clearly support Studdert et al.'s conclusions, and it is reasonable to say that DM is not practiced as frequently in Canada as it is in the US.

Regarding DM behaviors, the practice of ordering additional imaging is relatively low (37.8%) in Canada, though most of the doctors practicing DM agreed that laboratory tests and imaging are the most common practices of DM (Table 5). This finding corroborates previous reports. For example, a New York-based study found that up to 59% of those ordering imaging for head trauma are driven by the desire to minimize the possibility of malpractice litigation.⁷ In general, there was little reported fear regarding potential lawsuits. In total, 39.2% of the surveyed doctors reported that they have never been sued, and only 32.4% agreed that the medical liability system affects where they practice.

DM practices in the US tend to predominate in high-risk specialties such as obstetrics, neurosurgery, and orthopedic surgery.^{2,16} Rovit et al. explored neurosurgical experiences with malpractice litigation in the US in 2007 and found that neurosurgeons are at high risk of litigation.¹¹ They examined practice patterns and resultant litigation in a major physician-owned and -administered insurance company over a 5-year period (the largest physician-owned mutual insurance company in the US, which is based in the state of New York). In terms of total indemnity paid out by the insurance company over the 5-year period, neurosurgery ranked 10th out of 10 specialties with \$60,000,000. Obstetrics was the highest with \$450,000,000 paid out over 5 years.¹¹ However, when the indemnity figures were weighted by the actual numbers of insured specialists, neurosurgery was found to be the most vulnerable specialty, with more than \$600,000 paid out per neurosurgeon over the study period. This figure was twice as much as the next highest specialty, obstetrics.¹¹ In addition, about half of evaluated neurosurgeons had at least 1 suit filed against them over the past 5 years, and almost one-quarter had 2 suits filed against them. This type of data helps to demonstrate why neurosurgery as a specialty pays enormous insurance premiums in the US. The authors point out that not only are the awarded economic and noneconomic damages exceedingly high in some states in the US, but also the risk is spread out over a very small risk pool. Neurosurgeons in some states in the US pay up to \$400,000 annually for medical liability insurance. On the other hand, in Toronto, a neurosurgeon pays roughly \$29,200 for insurance coverage. These numbers are even smaller in other cities in other provinces, such as Montreal, where a neurosurgeon only pays \$20,600 for insurance, and Vancouver where the insurance premium is \$10,650.⁹

There are several leading hypotheses as to why DM is not practiced as frequently in Canada. In 1978, the Canadian Supreme Court limited the cap amount that can potentially be paid out for noneconomic financial compensation to \$300,000; the US, on the other hand, has no such federal restriction.⁶ Some patients might not find it worthwhile to go through the trouble of suing their physicians and challenging the CMPA for a relatively small sum, the majority of which will actually go toward paying off the

patient's legal teams and administrative costs instead of the patients themselves.

Unlike US law firms, Canadian law firms typically require the plaintiffs to pay for the initial investigation in order to determine whether a potential lawsuit even has merit—such costs also deter patients from making claims. Additionally, due to the single-payer system in Canada, the CMPA aggressively—and often successfully—defends its members in court, often spending significant amounts of money for their defense. Of all the cases tried in 2007, the patient won roughly 25 times and the physician won roughly 70 times. The median amount of damages awarded was \$91,000, a relatively small sum in comparison with the hundreds of millions of dollars that could potentially be awarded in a case in the US.⁹

Furthermore, in Canada, the burden of proof lies with the plaintiff, who must prove negligence and not simply an error in judgment on the part of the physician. The losing party must also pay approximately two-thirds of the winning party's costs, another disincentive for filing a lawsuit.⁶ In the Canadian system, these deterrents to filing lawsuits could mean that physicians do not fear being sued as greatly and, as a result, they are less likely to order unnecessary tests and procedures.

The medicolegal environments between the US and Canada are so different that in 2004 the CMPA declared it will no longer insure Canadian physicians who treat American patients using elective procedures due to the litigation risks.⁸

Lastly, and in contrast to the US, the majority of Canadian neurosurgeons practice in groups of 5 or more practitioners or in large academic settings. This study attempted to evaluate the differences in DM practice between neurosurgeons in large, academic groups and neurosurgeons in individual practices, but unfortunately only 6 neurosurgeons who responded to the survey reported practicing in a solo private practice. We were therefore unable to establish a statistically significant difference in DM behavior between these 2 groups.

It is clear that American physicians order more tests than their Canadian counterparts—this DM practice led to an increase in health care costs by 9% in 2005. The Canadian health care system works well, as evidenced by Canadians' longer life expectancies, and keeps health care costs down.¹ However, the Canadian system is not without faults—the wait times in Canada are significantly longer than they are in the US, and access to new medical technologies may lag behind.⁵ It remains to be seen whether the US will adopt a similar approach to the Canadian health care system or implement any changes in its litigation-centric system to combat DM practices and keep health care costs down.

Limitations

DM is a concept shaped by physician beliefs, and these are notoriously difficult to measure. In fact, the perfect measurement of DM would be counterfactual. The motivation to order an additional test is inherently related to the physician's confidence, experience, reimbursement, and perception of legal risk.

Moreover, this study is a cross-sectional survey of phy-

sician perceptions of DM and is susceptible to bias. Unfortunately, there was no opportunity to compare basic demographic features between respondents and nonrespondents in order to find out whether our study represents the actual DM practice in Canada. Also, this study provides information at a certain point in time; a series of surveys could demonstrate more clearly how practitioners view and report their DM practices. The survey was completed anonymously, and no incentives were provided upon survey completion. Selection bias occurred if the survey sample did not accurately represent the population. Nonresponse bias is also a concern. Voluntary response bias tends to overrepresent those who have strong opinions.

Conclusions

Canadian neurosurgeons perceive their medicolegal risk environment to be favorable, their patients as unlikely to sue, and overall engage infrequently in DM behaviors.

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: Smith, Babu, Das, Gormley, Rutka, Laws, Heary. Acquisition of data: Smith, Cote, Nahed, Babu,

Das, Gormley, Rutka, Heary. Analysis and interpretation of data: Smith, Hulou, Nahed, Rutka. Drafting the article: Smith, Hulou, Yan. Critically revising the article: Smith, Hulou, Yan, Cote, Rutka, Laws, Heary. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Smith. Statistical analysis: Smith, Hulou. Administrative/technical/material support: Hulou. Study supervision: Smith.

Supplemental Information

Online-Only Content

Supplemental material is available with the online version of the article.

Appendix. <http://thejns.org/doi/suppl/10.3171/2015.6.JNS15764>.

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