RETENTION OF SPECIALIST PHYSICIANS IN NEWFOUNDLAND AND LABRADOR

PATRICK J. FLEMING

Retention of Specialist Physicians in Newfoundland and Labrador

By

Patrick J. Fleming

A thesis submitted to the

School of Graduate Studies

in partial fulfillment of

the requirements for the degree of

Master of Science in Medicine

Division of Community Health and Humanities,

Faculty of Medicine,

Memorial University of Newfoundland

September, 2009

St. John's Newfoundland and Labrador

Abstract

Background: Specialist physicians make up nearly half of the physicians practicing in Newfoundland and Labrador (NL) but very little is known about them.

Methods: We examined registration data from NL to form cohorts of specialists initially licensed between 2000 and 2004 (cohort I) and between 1993 and 1997 (cohort II) and followed them up to 2007.

Results: By the end of follow-up, 50.6% of specialists in cohort I were still practicing in the province (median time 66 months) and 15.6% from cohort II were still practicing in the province (median time 35 months). Survival analysis indicated that Memorial University medical graduates (MMGs) were more likely than other groups to remain in NL. Large proportions of specialists in our samples were non-certified and provisionally-licensed.

Interpretation: Memorial University is a substantial contributor to specialist physician supply in NL. Increased recruitment of MMGs may improve long-term retention.

Acknowledgements

First and foremost I would like to sincerely thank my supervisor, Dr. Maria Mathews. Dr. Mathews has been a constant source of support and encouragement throughout my Master's. It has truly been a privilege to work with such a talented researcher. I would like to thank the members of my supervisory committee, Dr. Marshall Godwin and Dr. Veeresh Gadag, for their help and advice in preparing my thesis. In addition, I would like to recognize the wonderful faculty and staff of Division of Community Health and Humanities and the Office of Research and Graduate Studies for being so instrumental in my Master's education.

My Master's project would not be possible without the research funding I have received. During my first year of studies I received funding through a Canadian Institutes of Health Research (CIHR) grant (PHE-81965) entitled "Retention of Locally Trained Medical Graduates in Saskatchewan and Newfoundland and Labrador." In addition, the School of Graduate Studies provided a Merit Award. During my second year of studies I was a recipient the CIHR Frederick Banting and Charles Best Canada Graduate Scholarship - Master's Award. As well, I received a Master's Fellowship from the Newfoundland and Labrador Centre for Applied Health Research.

I would like to acknowledge the College of Physicians and Surgeons of Newfoundland and Labrador (CPSNL) and the Office of Post-Graduate Medical Education, Faculty of Medicine, for providing the data necessary to complete this project. However, note that the views expressed in this thesis do not necessarily reflect the views of either the CPSNL or Memorial University of Newfoundland.

Finally, I would like to thank my parents for always being there for me. They have been my source of strength through my entire life and an essential driving force behind my university education.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ABMS .....American Board of Medical Specialities
ACGME.....Accreditation Committee on Graduate Medical Education
AFMC.....Association of the Faculties of Medicine of Canada
AIT.....Agreement on Internal Trade
ANOVA.....Analysis of variance
CACMS.....Committee on the Accreditation of Canadian Medical Schools
CaRMS.....Canadian Residency Matching Service
CI.....Confidence interval
CIHI.....Canadian Institute for Health information
CMG.....Canadian medical graduate
CPSNL.....College of Physicians and Surgeons of Newfoundland and Labrador
GP.....General practitioner
FP.....Family physician
FRCPC.....Fellow of the Royal College of Physicians of Canada
FRCSC.....Fellow of the Royal College of Surgeons of Canada
IMG.....International medical graduate
IMG(Prov).....International medical graduate (provisional license)
IMG(Full).....International medical graduate (full license)
LCME.....Liaison Council on Medical Education
LMCC.....Licentiate of the Medical Council of Canada
MBBS.....Bachelor of Medicine and Bachelor of Surgery
MCCEE.....Medical Council of Canada Evaluating Exam
MCCQE.....Medical Council of Canada Qualifying Exam
MCCQE1.....Medical Council of Canada Qualifying Exam Part 1
MCCQE2.....Medical Council of Canada Qualifying Exam Part 2
MD.....Doctor of Medicine
MUN.....Memorial University of Newfoundland
MMG.....Memorial University medical graduate

NL.....Newfoundland and Labrador

RCPSC.....Royal College of Physicians and Surgeons of Canada

US.....United States

List of Appendices

Chapter 1 – Introduction

1.1 Problem Statement

Stories about shortages of physician specialists appear regularly in the Newfoundland and Labrador (NL) media. Recently, "Medical Exodus Looming," was the title of a media report in *The Telegram*, a major NL newspaper (Walsh, 2008). A team of specialist physicians met in 2008 to discuss the increasing shortages of specialists and the long wait-lists for patients wishing to see them. Presently, all three infectious disease specialist positions are unfilled in the province as are five out of ten rheumatology positions (Walsh, 2008). The article predicted that NL's only HIV/AIDS clinic may be forced to close soon because Eastern Health, which has been looking for over a year, has been unable to attract a replacement after the province's only remaining infectious disease specialist resigned (Walsh, 2008A). To further its woes, the only pathologist specialised in breast cancer recently resigned forcing health authorities to rely on pathology services out-of-province. A CBC News report also highlighted the province's difficulties in stating that Eastern Health, the largest regional integrated health authority in NL, will soon have a total of eight pathology positions unfilled (CBC News, 2008).

In 2007, specialist physicians accounted for roughly half of the 1048 practicing doctors in NL, but very little is known about how long they actually practise in the province (Canadian Institute for Health Information [CIHI], 2008). Several studies have looked at the retention of general practitioners (GPs) and family physicians (FPs) in NL (Mayo and Mathews, 2006; Mathews, Edwards, & Rourke, 2008). However, none has

examined how long specialists remained in the province before they migrate to other destinations within and outside of Canada.

Currently, 37% of all specialists in the province are foreign-trained which is substantially higher than the national average of 21% (CIHI, 2008). Within the current NL licensing regulations, some international medical graduates can receive a provisional license if they do not have the appropriate Canadian specialist credentials. It is unclear how this licensing system impacts specialist retention in the province.

1.2 Research Questions and Objectives

How long do specialist physicians practise in NL? Does retention vary among groups such as Memorial University medical graduates, other Canadian medical graduates, and internationally trained medical graduates? Has retention of specialists changed since the 1990s?

The goal of this study is to examine the retention of specialist physicians in NL. We examined two cohorts of specialists who received their first license to practise in NL between 2000 and 2004, and 1993 and 1997, and followed them for up to 8 and 15 years respectively. The research objectives are:

1) To examine the sociodemographic and professional characteristics of specialists in each cohort.

2) To compare the characteristics of four groups of specialists: a) Memorial University of Newfoundland medical graduates (MMGs) who began practice on a full license, b) other Canadian medical graduates (CMGs) who began practice on

a full license, c) international medical graduates (IMGs) who began practice on a provisional license (IMG(Prov)), d) international medical graduates who began practice on a full license (IMG(Full)).

3) To examine the retention of specialists in each cohort. Specifically, we identified the proportion of physicians who remained in NL at the end of the follow-up period and the average length of practice in NL in each cohort.

1.2.1 Hypothesis

Based on previous research on NL physicians (Mathews et al., 2008), we hypothesize that MMGs will practise longer in NL followed by CMG, IMG(Prov), and then IMG(Full).

1.3 Rationale

The recruitment and retention of specialist physicians represents a substantial investment of health system resources. Currently in NL, millions of dollars are spent on physician recruitment and retention (Government of Newfoundland and Labrador, 2001). An understanding of specialist physician retention will enhance and help inform these ongoing efforts.

This study contributes to a more complete understanding of physician workforce issues in the province. Previous studies have examined the contributions of Memorial University of Newfoundland's (MUN) Faculty of Medicine to the provincial physician supply and the average length of stay for GPs/FPs (Mathews, Rourke, and Park, 2006; Mathews et al., 2008). The few studies that have examined specialist physicians in

particular focused on clinical scientists, not practicing physicians (Moskowitz and Thompson, 2001; Kupfer, Hyman, Schatzberg, Pincus, and Reynolds, 2002; Weinert, Billings, Ryan, and Ingbar, 2006).

This study addresses a number of provincial and national research and health policy priorities. The NL Strategic Health Plan lists the recruitment and retention of physicians as an important human resources priority (Government of NL, 2002). The recruitment and retention of the health workforce is a priority theme in *Listening for Directions III*, a national consultation document on health services and policy research priorities for the Canadian Health Services Research Foundation and the Canadian Institutes of Health Research (Law, Flood, and Gagon, 2008). A senate report, *The Health of Canadians: the Federal Role,* described the national and worldwide shortage of health professionals as a "crisis" (Kirby, 2002). It lists the retention of health care professionals as being an important national priority. Similarly, another major national report, *Building on Values: the Future of Health Care in Canada*, lists the retention of doctors as being a critical national objective (Romanow, 2002)

Chapter Two – Background and Literature Review

2.1 Specialist Physician Credentialing

A specialist physician is an individual who has graduated with an approved medical degree and has completed four or more years of post-graduate training in a program recognized by the Royal College of Physicians and Surgeons of Canada (College of Physicians and Surgeons of Newfoundland and Labrador [CPSNL], 2006). A medical degree would include a Doctor of Medicine (MD) degree or the equivalent, such as a Bachelor of Medicine and Bachelor of Surgery (MBBS), obtained from other countries. To receive specialist credentials, physicians must write the appropriate certification exam administered by the Royal College of Physicians and Surgeons of Canada (RCPSC) after residency has been completed (RCPSC, 2008). Physicians who successfully complete their exams, and receive a certificate of qualification, are eligible to submit an application to become Fellows of the Royal College of Physicians of Canada or Fellows of the Royal College of Surgeons of Canada and use the designation FRCPC or FRCSC, respectively (RCPSC, 2005). Approximately 90% of specialists apply for fellowship after becoming certified (RCPSC, 2007). To maintain fellowship in the College, physicians must participate in the Maintenance of Certification program. Failure to complete this program satisfactorily will result in termination of a physician's membership in the RCPSC and therefore the loss of FRCPC/FRCSC designation (RCPSC, 2005).

2.1.1 International Medical Graduate Credentialing

IMGs are eligible to write RCPSC certification exams through four routes (RCPSC, 2008A): 1) Jurisdiction Approved Training; 2) Practice Ready Assessment; 3) Individual Competency Assessment; 4) complete a Canadian residency program.

Through Jurisdiction Approved Training, IMGs, who have completed training in one of 29 approved jurisdictions, may have their training assessed and may be deemed eligible to write RCPSC certification exams.

In order to receive certification through Practice Ready Assessment, IMGs must already have obtained speciality certification in their home country and have passed the Medical Council of Canada qualifying exams. They must hold a license to practise medicine and complete a three month clinical assessment program and pass RCPSC certification exams. IMGs must apply through provincial regulatory authorities to enter this program (e.g. CPSNL).

To receive certification through Individual Competency Assessment, IMGs must have graduated from an approved undergraduate medical program, successfully completed at least three years of post-graduate training in their home country, engaged in an intense screening evaluation through the provincial regulatory authority, completed two years of Canadian residency past the second year level, and passed either Canadian or American licensing examinations (Medical Council of Canada Evaluating Exam and Qualifying Exams 1 to 2 or United States Medical Licensing Exams Steps 1 to 3).

The fourth route is to complete a full Canadian residency program or a United States (US) residency program approved by the Accreditation Council for Graduate Medical Education. To complete a residency program in Canada, IMGs must apply through the Canadian Residency Matching Service (CaRMS). To be eligible to apply in the match, IMGs must fulfill both basic and province-specific criteria (CaRMS, 2008). They must have graduated from a medical program approved by the Liaison Committee on Medical Education (LCME)[1] or Committee on the Accreditation of Canadian Medical School (CACMS)[2] or an international medical school listed in the International Medical Education Directory. They also must have passed the Medical Council of Canada Evaluating Exams (MCCEE). Various province-specific criteria also exist, often includes acceptable scores on the Test of English as a Foreign Language, Canadian citizenship or permanent residency status, and the requirement to sign a return of service agreement (CaRMS, 2008A).

2.2 Specialist Physician Licensing

Licensing of specialist physicians is a provincial responsibility and carried out under the auspices of the provincial Colleges of Physicians and Surgeons. Under the Newfoundland and Labrador Medical Act (2005), and associated regulations, the CPSNL has the power to grant medical licenses to qualified physicians. The CPSNL has discretion under its own by-laws and regulations in determining what training is equivalent to RCPSC approved training.

---

[1] The LCME is an accrediting authority for MD programs in the US and Canada recognized by the US Department of Education (LMCE, 2009)

[2] The CACMS is an accrediting authority for medical programs in Canada (AFMC, 2009)

2.2.1 Full License for Specialist Practice

· Physicians may receive full licenses for specialist practice assuming they have graduated from an approved undergraduate medical program (Medical Board Regulations under the Medical Act, 2003). They must have completed two or more years of post-graduate training at CACMS or LMCE associated schools and be certified by the RCPSC. This training must be accredited by either the RCPSC or Accreditation Council for Graduate Medical Education (ACGME)[3] in the United States. Alternatively, they must have completed at least four years of post-graduate medical education which has fulfilled the RCPSC requirements in order to write the certification exams. In addition, a physician must have obtained Licentiate of the Medical Council of Canada (LMCC). Prior to 1992, to obtain LMCC status, physicians must have successfully completed the Medical Council of Canada Qualifying Exam (MCCQE) and one year of residency training (Medical Council of Canada, 2008). After 1992, to obtain LMCC status, physicians must have successfully completed the Medical Council of Canada Qualifying Exam Part 1 (MCCQE1) and Part 2 (MCCQE2) and one year of residency training. Physicians must also have completed various other requirements to obtain licenses (e.g., obtained professional liability insurance).

2.2.2 Provisional License for Specialist Practice

In NL, physicians who do not have full Canadian credentials can obtain a provisional license from the CPSNL (Medical Board Regulations under the Medical Act, 2003). IMGs may be eligible for a provisional licence if they have successfully completed

[3] The ACGME is an accrediting authority for post-graduate training in the US (ACGME, 2009)

a recognized undergraduate medical program and at least four years of post-graduate medical training. Training must have been completed in the United States, Ireland, The United Kingdom, Australia, New Zealand, South Africa, or in a program approved by the RCPSC. They must have also passed local board certification examinations and have specialist status in the country where they were trained. Certain three year post-graduate programs in the United States are acceptable as well. These include ACGME approved programs in general pediatrics, general internal medicine, and emergency medicine. In NL, IMGs are not initially certified and therefore do not have FRCPC or FRCSC designation, but may still practise their specialities in the interim. IMGs granted provisional licenses for speciality practice may have their right to practise medicine restricted to a particular location or region within the province. They must also have been accepted for employment by a sponsor approved by the CPSNL.

2.2.3 GP License for Specialist Practice

In NL, it is possible for a GP to obtain a provisional license to practise anaesthesiology (Medical Board Regulations under the Medical Act, 2003). Physicians must have an approved degree in medicine and have completed 12 months of post-graduate training in Canada, Australia, Ireland, the United States, South Africa, the United Kingdom, or New Zealand. GPs who are applying for a provisional license under this regulation must be accepted for employment within the province.

2.2.4 Implications of Provisional Licenses for Research

The granting of provisional licenses to specialists who have not yet been awarded certification by the RCPSC has had implications for research on specialist physicians. The Scott's Medical Database (formerly Southam) did not include non-certified specialists in their speciality counts (CIHI, 2004). Instead, non-certified specialists were grouped with GPs/FPs. Because CIHI reports utilized these data, their specialist counts underestimated the number of specialists in provinces with a high number of non-certified physicians. As a result, Southam reported 63.1% GPs/FPs and 36.9% specialists in NL in 2003. However, provincial licensing information indicates the ratio is closer to 49.1% for GPs/FPs and 50.9% for specialists (CIHI, 2004). This is because the NL physician workforce is composed of 13.7% non-certified specialists. This was corrected in the report *Supply, Distribution and Migration of Canadian Physicians Report, 2004* for NL and Saskatchewan and in the years since. This was not corrected retroactively in CIHI reports. In 2007, New Brunswick, Nova Scotia, and the Yukon data were also corrected (CIHI, 2008).

2.3 Supply of Specialists

2.3.1 Specialist Supply in Canada

In its annual report *Supply, Distribution, and Migration of Canadian Physicians, 2007*, CIHI identified 63 682 physicians in Canada consisting of 31 084 (48.8%) specialists and 32 598 (52.2%) GPs/FPs (CIHI, 2008). From 1993 to 2007 the total number of specialists has increased from 25 794 to 31 084 (CIHI, 1997, CIHI, 2001;

CIHI, 2005; CIHI, 2008). The proportion of specialists in the physician workforce has remained relatively stable from 1993 to 2007 with only a small increase from 46.2% to 48.8%. In 1993 the specialist physician-to-population ratio was 89 per 100 000 people. This peaked at 94 per 100 000 people in 2007 (CIHI, 1997, CIHI, 2001; CIHI, 2005; CIHI, 2008). See table 2.1 for a summary.

Table 2.1 – Summary Table of Specialist Supply in Canada from 1993 to 2007[4]

Year	Number of Specialist	Proportion of Workforce (%)	Specialist to Population Ratio (Per 100 000 people)
2007	31 084	48.8	94
2006	30 318	48.7	92
2005	29 989	48.7	92
2004*	29 518	48.7	92
2003	28 792	48.4	90
2002	29 154	49.1	93
2001	28 919	49.4	93
2000	28 690	49.6	93
1999	28 152	49.4	92
1998	27 661	49.2	91
1997	27 135	49.1	90
1996	26 737	48.6	90
1995	26 387	48.0	89
1994	26 321	47.8	89
1993	25 794	46.8	89

*During this year CIHI changed the way it counts non-certified specialists

[4] Data from CIHI (2008, 2005, 2001, 1997).

2.3.2 Specialist Supply in NL

In NL, there were 1048 physicians in 2007. Of these 505 (48.2%) were specialists. There were 334 clinical specialists, 30 laboratory specialists, 141 surgical specialists, and no medical scientists. Since 1993 the number of specialists has increased from 329 to 505. The specialist physician-to-population ratio has steadily increased during that period from 56 per 100 000 persons to 94 per 100 000 persons, slightly higher than the national ratio in 2005 (CIHI, 1997, CIHI, 2000; CIHI, 2005; CIHI, 2008). Most of the increase in the total number of specialists and in the increase in specialist-to-population ratio is the result of the way CIHI counts specialists. As discussed previously in section 2.2.1, before 2004, CIHI relied on the Scott's Medical Database which had grouped non-certified specialists with GPs/FPs and therefore may underrepresented the number of specialists in the province.

Table 2.2 - Summary Table of Specialist Supply in NL from 1993 to 2007[5]

Year	Number of Specialist	Proportion of Workforce (%)	Specialist to Population Ratio (Per 100 000 people)
2007	505	48.2	94
2006	492	48.3	97
2005	486	48.9	95
2004*	479	48.3	93
2003	360	36.9	69
2002	344	37.0	66
2001	346	36.6	65
2000	356	36.6	65
1999	369	39.8	68
1998	366	39.5	67
1997	363	38.9	66
1996	359	38.7	64
1995	334	35.5	58
1994	333	34.4	58
1993	329	33.9	56

*During this year CIHI changed the way it counts non-certified specialists

2.3.3 IMG Specialists

In 2007, IMGs accounted for 6 641 (21.36%) of the specialists in Canada (CIHI, 2008). In NL in 2007, the 175 IMG specialists made up 34.7% of the specialist workforce. Therefore, NL has a much higher proportion of foreign-trained specialists than the national average. Table 2.3 summarizes the proportion of IMG physicians in Canada and NL.

[5] Data from CIHI (2008, 2005, 2001, 1997).

Table 2.3 – Summary of the Total Number and Proportion of IMGs in the Canadian and NL Physician Supply from 1996 to 2007[6]

Year	Number of IMG Specialists in Canada	Proportion of IMGs in the Specialist Workforce in Canada (%)	Number of IMG Specialists in NL	Proportion of IMGs in the Specialist Workforce in NL (%)
2007	6 641	21.4	175	34.7
2006	6 451	21.0	183	37.2
2005	6 437	21.5	189	38.9
2004*	6 353	21.8	208	43.4
2003	6 652	22.1	113	31.4
2002	6 785	22.8	111	32.3
2001	6 785	23.5	114	32.9
2000	6 912	24.1	135	37.9
1999	6 924	24.6	143	38.8
1998	6 977	25.2	159	43.4
1997	6 994	25.8	163	44.9
1996**	6 995	26.2	170	47.4

* During this year CIHI changed the way it classified non-certified specialists.

** Data unavailable before 1996

2.4 Migration of Specialists

Physicians who leave NL may either move to another province in Canada, or move abroad to another country. CIHI data indicate that in 1999 Canada experienced a net loss of 173 specialists who migrated to international destinations. However, by 2007 Canada was recording a net gain of 34 (CIHI, 2008). For physicians overall, a net loss of 251 in 1999 tapered to a net gain of 61 in 2005. Interprovincial migration of specialists

[6] Data from CIHI (2008, 2005, and 2001)

has decreased substantially from 442 physicians in 1999 that moved from one province to another to 264 physicians in 2007 (CIHI, 2001; CIHI, 2008).

In NL there was a net loss of two specialists in 2007. In the overall physician supply, a net loss of 33 physicians was recorded in 2007. This is an increase over 1999 where there was a net loss of one specialist and an overall net loss of two physicians (CIHI, 2001; CIHI, 2008). See table 2.4 for a summary.

2.5 Retention of Specialists

2.5.1 Overview of Retention Study Methods and Challenges

Pathman, Konrad, and Agnew (1994) critiqued approaches often used to study physician retention. Although they focused on the retention of rural physicians, their critiques apply broadly to retention in general. They identified six main critiques of research methods used in retention studies: 1) reliance on self-reported data; 2) the use of satisfaction /dissatisfaction as proxy measure of intention to stay/leave; 3) failure to control for confounding variables; 4) limited use of qualitative methods; 5) use of different measures of retention; 6) the use of prevalence cohorts. Pathman et al. also commented on the difficulty of conducting retention studies because of the length of follow-up periods that may be required.

Many studies use physician self-reported data. This method is particularly vulnerable to bias. People have a tendency to blame others in negative situations and conversely attribute success to themselves in positive ones. As well, people tend to report obvious things while not noticing factors in the background. Therefore, physicians' self-

reported reasons for staying or leaving a particular location can be influenced by psychological factors of which they have little awareness. The effect of self-reported data could be mitigated by using other sources in quantitative analysis such as administrative data.

Second, Pathman et al. have noted that many studies often examine physician retention by surveying physicians about satisfying or dissatisfying elements of their practice. These studies make the assumption that dissatisfaction predicts turnover and satisfaction predicts retention. However, Pathman et al. indicate that the links between neither satisfaction and retention nor dissatisfaction and turnover have been established.

The third weakness in retention studies is the lack of adjustment for potential confounding variables. These include studies of epidemiological designs such as case-control and cohort studies. Confounding factors can be overcome, however, by using multivariate statistics.

The fourth critique is the limited use of "qualitative inquiry." While qualitative studies can be useful in physician retention studies, they are sometimes dismissed by more quantitatively inclined researchers. As well, formal qualitative research with embedded concepts of credibility and transferability has been underutilized in the study of physician retention.

One of the greatest challenges of conducting physician retention studies centers on how retention itself is defined (Pathman et al., 1994). Some studies assess whether a physician will remain in a particular area (intention to stay/intention to leave). Others utilize "turnover analysis" which examines a physician's location at two separate points

in time. "Duration of time", or length of practice looks at the how long a physician works in a given area. This definition of retention examines physician attrition over time. It is important that these studies account for right-censored data[7] (e.g. by using Cox proportional hazards). An added benefit of using Cox regression model is the ability to utilize likelihood ratios (e.g. hazard ratio) and control for confounders.

When studying physician retention, it is crucial to use an "inception cohort" – a group of physicians first entering practice in an area. Often time's prevalence cohorts are used which is a common mistake in the literature (Pathman et al., 1994). Prevalence cohorts include all physicians working in an area and therefore will over represent physicians less likely to leave thereby creating a selection bias.

A final consideration discussed by Pathman and associates in constructing a study of physician retention is directionality. While they acknowledge prospective studies are ideal methods of reducing bias, they are often resource-intensive. Retrospective studies may offer a more cost-effective and timely way to assess physician retention.

2.5.1 Retention of Specialists in Canada

Little is known about the retention of specialists. Particularly, while there were a substantial number of articles which examined the recruitment and retention of rural physicians, a majority of these physicians are GPs/FPs and generalizability to specialists is limited. Studies that included data on specialists tend to examine total physicians numbers as a whole and do not provide detailed information on specialists. Only a

[7] Right-censored data involves events which have not yet occurred by the end of the study period (Tabachnick and Fidell, 2001). Right-censoring may be under investigator-control (e.g. the researchers sets the length of follow-up) or there may be no control (e.g. cases lost to follow-up).

handful of studies have examined national, provincial, or state retention of physicians. Since this thesis examines the provincial retention of specialists in NL, our review draws on a limited pool of literature, often relying upon findings based on GPs/FPs where equivalent studies of specialists were not available.

Ryten, Thurber, and Buske (1998) conducted a pan-Canadian study on the 1989 graduating class of medical students and followed them over a seven year period. During the 1995-96 year, a higher proportion of Canadian medical graduates located outside of Canada were specialists (72.5%). As well, 82.0% of specialists remained in Canada. Retention was highest among laboratory medicine specialists (90.0% remaining), followed by medical and surgical specialists (82.0% and 81.1%, respectively). This study, however, groups practicing specialists with physicians still engaged in specialist residency training. Of the total sample, 15.7% were still in training (271 of the 1722 cases in this sample were still in training – 270 of whom were specialists). Training requirements for post-graduate trainees reduce the number of locations where they are able to complete their training. Therefore, this makes it difficult to draw conclusions regarding the retention of specialists in Canada.

A recent cross-sectional study on physician supply used administrative data from the American Medical Association to examine the characteristics of Canadian physicians practicing in the United States (Philips, Petterson, Fryer and Rosser, 2007). It found that during 2006, of the 8162 Canadian-trained physicians in the US, 69.9% in clinical practice were specialists and 30.5% were involved in primary care. However, Philips and associates used varying definitions of "primary care physician" in their study. In the US,

general internal medicine and general paediatrics are considered primary care whereas Canada only GPs/FPs are considered primary care. Under the Canadian definition, 78.0% of physicians in clinical practice in the US were specialists during 2006. While this study describes the total number of Canadian trained specialists working in the US, it is not able to analyze the factors related to the migration of Canadian specialists to the US. Moreover, the cross-sectional design does not determine how long specialists practised in the US and whether they returned to Canada.

2.5.2 Retention of Specialists in NL

Currently, there is limited knowledge about the retention of specialist physicians in NL. Only one study was identified which included any data about provincial retention of specialists (Mathews et al., 2006). This cross-sectional study examined national and provincial retention of MUN medical graduates based on the 2004 practice locations. It linked the Faculty of Medicine class lists, alumni database, post-graduate database, and the Southam database to permit a comprehensive analysis. The data revealed that 71.3% of MUN graduated specialists were currently working outside NL. Of those working outside NL, 20.0% were working outside Canada. However, this study is limited by its cross-sectional design which does not provide information about the length of time MUN trained specialists worked in the province.

2.6 Factors Related to Specialist Retention

Information on the factors affecting the retention of specialists is scarce. Currently, data from studies are limited either to exclusively GPs/FPs or GPs/FPs and

specialists. Several factors have been shown to affect retention: location of medical training, license type, gender, age, number of years since graduation, location of residency training, and type of speciality. Therefore, findings from these studies may not be generalizable to specialists.

2.6.1 Location of Undergraduate Medical Training

We were unable to find published studies which examined the effect of location of undergraduate medical training on specialist physician retention. There were, however, a number of studies which focused on GPs/FPs. A retrospective cohort study of GPs/FPs examined this factor (Mathews et al., 2008). They used administrative data and followed a cohort of 157 physicians for up to eight years. It found that location of undergraduate medical training was a significant predictor in a Cox regression model of retention in NL. Compared to MMGs, CMGs and IMGs were 2.15 and 2.03 times more likely to leave NL. When examining national retention, CMGs and IMGs were 2.75 and 1.63 times more likely to leave Canada than MMGs.

Another retrospective cohort study examined the retention of IMGs after the completion of residency training in NL (Mathews, Park, and Rourke, 2007). After conducting secondary analysis using multiple logistic regression, they found that the location of medical school was a significant predictor of practice location. After completing residency training, compared to MMGs, IMGs and CMGs were 0.16 and 0.29 times as likely to be working in Canada and 0.12 and 0.07 times as likely to be working in NL at the end of the follow-up period.

2.6.2 License Type

We could find no studies which examined the effect of license type on specialist retention. However, Mathews et al. (2008) found that IMGs in primary care who initially held a NL provisional license were more likely to leave both NL and Canada. They also found that compared to MMGs (42.9%), a higher proportion of IMGs (81.8%) left NL. Once IMGs receive a full license, they do not remain in the province for a long period of time. The majority move to urban areas in Ontario (Audas, Ross, and Vardy, 2005). It is likely that NL's provisional licensing system functions as an entry point for foreign-graduates to begin practice elsewhere in Canada. Once they attain full credentials they become highly mobile and relocate to areas where people hold more cultural similarities (Mathews et al., 2008).

Another study by Audas, Ryan, and Vardy (2009) tracked NL provisionally licensed IMGs in primary care over an 11 year period. It found that after five years, only one fifth of provisionally licensed IMGs were still practicing in NL. Like previous work by Audas, it found that most IMGs immigrate to Ontario. Of IMGs who emigrated 87.8% went to urban locations in Ontario.

2.6.3 Sex

Few studies have found that sex is significantly related to the retention of physicians. However, a cross-sectional study on the 2004 practice locations of MMGs found that sex was a significant predictor of practice location (Mathews et al., 2006). It found that compared to MMG males, MMG females were 1.63 times more likely to practise in Canada. In a case-control study, which surveyed Canadian trained physicians

practicing in the US and Canada, sex was also found to be a factor in retention (McKendry et al., 1996). Compared to physicians working in Canada, a large proportion of physicians who left to work in the US were male. An unpublished study on the 2007 practice locations of the University of Saskatchewan medical graduates found that a higher proportion of specialists, practicing outside of Canada, were male (Fleming, Mathews, Seguin and Card, no date).

2.6.4 Age

Age was only found to be significantly related to retention in one study. McKendry et al. (1996) found that Canadian trained physicians residing in the US were more likely to be older than their counterparts who remained in Canada.

2.6.5 Graduation Decade

The decade a physician graduated from undergraduate medical training has been shown to be a significant predictor of work location in a number of studies. Mathews et al. (2006) showed that MMGs who graduated in the 1980s and 1990s were 1.52 and 2.01 times more likely to be working in Canada compared to those who graduated in the 1970s. A paper on the retention of MUN and University of Saskatchewan trained specialists by Fleming et al. (no date) found that, among University of Saskatchewan medical graduates, those who graduated in the 1980s and 1990s were more likely to work in Canada compared to those who graduated in the 1970s. Mathews et al. (2007) found that physicians who started post-graduate training in the 1980s and 1990s were more

likely to practise in Canada in 2004 compared to those who graduated in the 1970s. Those who graduated before 1973[8] were less likely to practise in Canada.

2.6.7 Post-Graduate Training

The location of post-graduate training has been shown to be related to physician retention in a number of studies. In their cross-sectional study on the 2004 practice location of MMGs, Mathews et al. (2006) found that physicians who had completed some or all residency training at MUN were more likely to work in both NL and Canada. McKendry et al. (1996) found that migration of physicians to the United States was more much likely if the physician had completed residency training in the United States (OR=9.2). When they reanalyzed their data and included only specialists, residency training in the United States made it 7.0 times more likely that they would emigrate there compared to physicians who completed residency training in Canada. Another study found that, among specialists, both MUN and University of Saskatchewan graduates who completed some or all of their post-graduate education in their home province were more likely to work there as well as in other parts of Canada (Fleming et al., no date).

2.6.8 Speciality Type

Speciality type was shown in one study to be potentially related to physician migration. McKendry et al. (1996) found that there were twice as many cardiologists, cardiothoracic surgeons, neurosurgeons, orthopaedic surgeons, and respirologists among Canadian trained physicians working in the US compared to the Canadian sample.

[8] This study compared MMGs to IMGs and CMGs. 1973 was the year that MUN graduated its first medical class.

Among physicians working in Canada, in this study there were twice as many medical administrators, public health specialists, and medical microbiologists. These results are not statistically significant, however, because of the small numbers in some of these specialist types.

When examining the retention of specialists from MUN and University of Saskatchewan, Fleming et al. (no date) found that specialist group was a predictor of working in Canada. Compared to surgical specialists, MUN medical and diagnostic specialists[9] were more likely to practise in Canada. For University of Saskatchewan graduates, diagnostic specialists were more likely to remain in Canada compared with surgical specialists.

2.7 Summary of Current Literature

It is difficult to establish historical trends of specialist retention during the 1990s and early 2000s in Canada. National data compiled by the CIHI are based on changing methods of counting specialists. Before 2004, specialists without certification were counted as being primary care physicians, thereby distorting comparisons among provinces which rely on non-certified specialists.

Most of the published studies we identified focused mainly on physician supply in general or on primary care physicians. While there are similarities between specialist physicians and primary care physicians, there are a number of distinct differences. Specialists engage in a longer period of training (usually 5 years compared to 1-2 for

[9] Includes laboratory specialists and diagnostic radiology/nuclear medicine

primary care). Specialists may also require more specific health infrastructure compared with GPs/FPs and this may factor into their retention. These differences may affect their average length of practice and the comparisons between various physician groups. Some of the studies we found were conducted during the early to mid 1990s but licensing changes since then may play a role in the retention of physicians (Ryten et al., 1998, McKendry et al., 1996, Chan, 2002). The only provincial study to include any data on specialists examined locally trained medical graduates exclusively – not IMGs or CMGs (Mathews et al., 2006). As well, the study pooled specialist and FPs/GPs together and its cross-sectional design makes it impossible to determine the average length of practice of physicians in NL (Mathews et al., 2006). One unpublished study on specialist retention was identified. However, its data are limited only to MMGs and University of Saskatchewan graduates and do not include CMGs or IMGs.

Chapter 3 - Methods

Using administrative data, this study used a retrospective cohort design (also known as a reterolective design) to examine retention of specialist physicians in NL. It follows two cohorts of physicians to examine their length of practice in NL. It follows some physicians up to fifteen years after beginning their initial practice in the province.

3.1 Data Sources

We linked the registration database from the CPSNL with the MUN post-graduate database. As required by provincial law, the CPSNL must maintain an annually updated register of all specialist physicians practicing in this province (Medical Act, 2005). CPSNL by-laws stipulate that this register must contain the name(s), credentials, faculty or school of medicine attended, license status and other pertinent information (CPSNL, 2006A).

From the CPSNL database, we acquired the following data: name (first, last, middle, and previous), gender, year of birth, medical school, year of graduation, country where medical degree was issued, current mailing address (city, province, postal code), previous address(es) (city, province, country, postal code), practice address (city, province, postal code), registration status (e.g. fulltime, left, deceased, retired), registration type/date (e.g. certified/non-certified), FRCPC/FRCSC status, licensure type(s)/date(s), primary speciality/date registered, secondary specialities/date registered, and speciality registration type (e.g. specialist, special competence)

From the MUN post-graduate database we obtained the names, training program(s), and start/end date(s) of all MUN residents from 1969 to 2008 including those who graduated from medical schools other than MUN.

3.1.1 Data Management

The CPSNL database was imported from Microsoft Excel spreadsheet format into SPSS 16.0. The MUN post-graduate database was manually linked with the registration database using the first and last name as well as the year of graduation from undergraduate medical training. All analyses were conducted in SPSS 16.0.

3.2 Study Sample

We created and followed two cohorts:

1) Cohort I: specialist physicians who received their first license to practise in NL between January 1, 2000 and December 31, 2004. We followed these physicians up to a maximum of 8 years to December 31, 2007.

2) Cohort II: specialist physicians who received their first licensed to practise in NL between January 1, 1993 and December 31, 1997. We followed these physicians up to a maximum of 15 years to December 31, 2007.

We created two cohorts for a number of reasons. First, there were some data quality issues with records in the 1990s. Before 2000, the CPSNL database recorded only the most current status of physicians (i.e. if specialists left NL, only the date when they ceased practice was recorded – not the date they began practice). Therefore, by creating a cohort of physicians initially licensed between 2000 and 2004, we avoided this problem.

Second, there was also change in the licensing rules in 1993. Prior to this date, physicians completed a general rotating internship after finishing their undergraduate medical training (Chan, 2002). This internship was common to all residency programs and, upon completion, physicians were able to become fully licensed GPs. After practicing as GPs, physicians could return to residency to complete speciality training[10]. Almost all MMG and CMG physicians in the 2000-2004 cohort will have graduated after 1993 under the new licensing rules. Likewise, IMGs in the 2000-2004 cohort will have entered the Canadian system under new rules.

While the 2000-2004 cohort addresses data quality and changing licensing issues, it permits only a limited follow-up period (eight years for physicians licensed in 2000; but only four years for those licensed in 2004). Given the relatively small number of specialists who enter the physician workforce, a shorter inception period produces a sample that would be too small for meaningful analysis. Therefore, a cohort between 1993 and 1997 was also established to allow for a longer follow-up. Moreover, the second cohort allows us to capture the effect licensing changes in the 1990s may have had on retention and examine differences in retention in the 1990s and 2000s.

3.2.1 Inclusion and Exclusion Criteria

We included all specialist physicians who began practice for the first time between January 1, 2000 and December 31, 2004 for Cohort I or between January 1, 1993 and December 31, 1997 for Cohort II. We excluded:

[10] Family physicians can also enter a speciality program after completing the family medicine residency although this is generally rare.

1) *Physicians who held licenses prior to their respective cohort* (before 1993 and 2000).

2) *Students* who were engaged in residency training. If students did residency training in NL, they entered the cohort once their training was completed. The end-date in the post-graduate database was used to establish the end of residency.

3) *Non-practicing physicians* such as administrators, medical scientists, and retirees (based on their status in the CPSNL database).

4) *GPs/FPs* who did not have any speciality training or licenses to practise as specialists.

5) *Community medicine specialists* because it is impossible to determine if they practised in their capacity as a GPs/FPs or as a specialist. Community Medicine residency training programs offer the option of completing the requirements to become a Certificant of the College of Family Physicians (CCFP) (CaRMS, 2009). Prior to 1993 it was possible to obtain a GP license after successfully completing the rotating internship year (Chan, 2002).

6) *FPs with a special competence in Emergency Medicine*[11] because they are still considered family physicians and complete a program of less than four years in duration.

7) *Locums tenen physicians* were excluded in our main analysis. Locum physicians are defined as physicians who practised in NL for less than three months. This cut-off was used in a previous study in NL (Mathews et al., 2008). In the sensitivity

[11] Designated CCFP(EM)

analysis, repeated on both our cohorts, we included these locums providing they met all other inclusion criteria.

If a physician was identified as working before each cohort he/she was excluded from the study. In a small number of cases, physicians who were working prior to each cohort could be identified as solely being in residency training at that time and could therefore be included. By excluding anyone with a license or work history before 1993 in our samples, it is possible that we may have excluded physicians who practised as GPs, left the province for specialist training, then returned as specialists. This was unavoidable, however, because no mechanism exists within the available data to distinguish license types from GPs/FPs versus specialists.

3.3 Variables

Table A1 in Appendix A summarizes the variables, codes, and categories used in the analyses.

3.3.1 Dependent Variables

The dependent variables in the analysis were: whether or not a physician stayed in NL by the end of follow-up; and, the length of practice. Physicians who had left NL were coded as "yes" and those who did not leave were coded as "no", based on whether there was an "end date" to their first license recorded in the CPSNL database. Total time (in months) in NL was computed by subtracting the end dates and start dates of the first license. Start date was the date a physician first started practice as a physician in NL, outside of residency training. In many cases, this was determined using the "status" field

of the CPSNL database. The date a physician started as "current full-time" was used in many cases. In some situations, the start date needed to be estimated because the CPSNL database recorded only the physicians' most current status. In most cases it resulted in our knowing the date they left, but not their starting date in this datafield. In these cases, start-date was determined based on when a physician received his or her first license to practise. In cases where physicians were in residency training at MUN and may have had a full license prior to the completion of this training, the date their training ended was used as their start date. If the start date could not reasonably be determined, the physician was excluded from the study.

End date was the date a physician first ceased practice in NL. It was determined based on the "status" field in the CPSNL database. "Left", "left renew", "retired", and "deceased" codes in the status field were used to identify the end of the practice period. Physicians without a recorded end date were assumed to have remained in NL until the end of the study period.

3.3.2 Independent Variable

The independent variable was physician group. This was categorized into four groups based on the location of undergraduate medical training, and initial license type. It included: MMG for MUN medical graduates, CMG for other Canadian medical graduates, and IMG(Prov) international medical graduates with a provisional license, and IMG(Full) for IMGs with a full license. IMG status was based on school of graduation. All physicians who graduated from a medical school outside Canada were considered IMGs (including Canadian citizens). License status was based on the initial type of

license an IMG received when he/she first began practice. The initial license was coded as either full or provisional. Only the first license, after the completion of post-graduate training, was used. Under the Medical Board Regulations for the Medical Act 2003, it is possible for IMGs, who have graduated from an approved faculty or school and completed post-graduate training in a program approved by the RCPSC or located in certain countries, to receive a provisional licence. If an IMG has successfully completed RCPSC certification exams, he/she is able to receive a full license.

3.3.3 Covariates

In our main analysis we examined a number of covariates that described the demographic, certification, specialist type, and practice profile of the physicians. They included:

1) *Sex*. This was coded as either male or female.

2) *FRCPC/FRCSC status*. This was coded into yes or no based on the most recent FRCPC/FRCSC status information available since previous entries were unavailable (e.g. if a specialist lost FRCPC/FRCSC designation). FRCPC/FRCSC is the designation awarded upon successful completion of RCPSC certification examinations.

3) *Certification status*. This variable was coded as "yes" or "no" based on whether physicians were fully certified specialist versus non-certified specialists (such as some IMGs). Certification was based on the most recent information available in the database. In this variable certification is based on

having specialist credentials in Canada. A small number of fully-certified specialists may choose not to apply for fellowship in the RCPSC despite attaining full certification (RCPSC, 2007).

4) *Specialist Group.* This included broad groupings based primarily on the use of surgical, clinical, or laboratory methods in their practice. The categories used by the CIHI (2008) were used. See table 3.1 for a breakdown of speciality types included in the speciality groups.

Table 3.1 – Broad Groups of Physician Specialties Based on CIHI Classifications

Speciality Group	**Speciality Types included**
Family Medicine	General Practitioners, Family Medicine, Emergency Family Medicine
Clinical Specialists	Anaesthesiology, Community Medicine, Dermatology, Diagnostic Radiology, Emergency Medicine, Internal Medicine (and Subspecialties), Medical Genetics, Neurology, Nuclear Medicine, Occupational Medicine, Paediatrics, Physical Medicine and Rehabilitation, Psychiatry, Radiation Oncology
Laboratory Specialists	Medical Biochemistry, Medical Microbiology, Pathology (Anatomical and General)
Surgical Specialist	Cardiac Surgery, Cardiothoracic Surgery, General Surgery, Neurosurgery, Obstetrics and Gynaecology, Ophthalmology, Otolaryngology, Orthopaedic Surgery, Plastic Surgery, Urology
Medical Scientists	Medical Scientists

5) *Decade of graduation.* This was coded according to the year each physician completed undergraduate medical training. Physicians who graduated before

1973 were combined into a single group. 1973 was used as a cut-off year because it was the first year that MUN graduated physicians. After that time, physicians were grouped as 1973-1979, 1980-1989, 1990-1999, and 2000-2007.

6) *Age*. Current age was calculated by subtracting 2008 from the year of birth.

7) *Age at graduation*. This was determined by subtracting the year of graduation from the year of birth. Graduation was considered the year a physician was awarded his/her medical degree.

8) *MUN Residency*. Specialists who completed some or all of their post-graduate training at MUN were coded as "yes" and those who had not were coded as "no".

In addition, in supplementary analyses we used the following variables to examine specific groups (sub-samples) of specialists:

1) *Speciality type*. This was grouped according to a physician's individual speciality or subspecialty (e.g. cardiology). In cases where there were small numbers of specialists in a group, they were combined with larger related groups. See Table 3.2 for further details. In cases where physicians practised two or more types of specialities simultaneously, they were assigned the more specialized speciality for classification purposes (e.g. if an individual practises both general surgery and thoracic surgery, he/she would be considered a thoracic surgeon and therefore grouped in specialized surgery).

Only specialists recognized by the RCPSC were included (RCPSC, 2008). Subspecialties that are accredited without certification were also included (e.g. Gynaecologic Oncology). See Table 3.2.

Table 3.2 – Specialities and Subspecialties Included in Each Speciality Type

Speciality Type	**Speciality types/subtypes included:**
Laboratory Medicine	Anatomical Pathology, General Pathology, Haematological Pathology, Medical Biochemistry, Medical Microbiology, Neuropathology
Anaesthesiology	Anaesthesiology
General Internal Medicine	General Internal Medicine
Internal Medicine Subspecialties & Related	Cardiology, Clinical Allergy & Immunology, Critical Care Medicine, Endocrinology & Metabolism, Gastroenterology, Geriatric Medicine, Haematology, Infectious Disease, Medical Genetics, Medical Oncology, Respiratory Medicine, Rheumatology
Radiology	Diagnostic Radiology, Nuclear Medicine
General Surgery	General Surgery
Specialized Surgery	Cardiac Surgery, Cardiovascular and Thoracic Surgery, Oral & Maxiofacial Surgery, Neurosurgery, Paediatric Surgery, Plastic Surgery, Ophthalmology, Urology, Thoracic Surgery, Vascular Surgery
Obstetrics and Gynaecology	Obstetrics and Gynaecology, Gynaecological Oncology
Orthopaedic Surgery	Orthopaedic Surgery
Paediatrics and Specialised Paediatrics	General Paediatrics, Cardiology, Clinical Allergy & Immunology, Critical Care Medicine, Endocrinology & Metabolism, Gastroenterology, Haematology, Infectious Disease, Medical Oncology, Neonatal-Perinatal Medicine, Respiratory Medicine, Rheumatology
Psychiatry	Psychiatry
Other	Dermatology, Emergency Medicine, Neurology, Otolaryngology (Ear, Nose, & Throat), Physical Medicine & Rehabilitation, Radiation Oncology

2) *Returned.* This was coded as either no, as a locum (less than three months), or as a permanent position (greater than three months).

3) *Time to get full license.* This was created for IMGs who initially held a provisional license. It was the time, in months, it took for an IMG to achieve a full license. It was calculated based on when an IMG started practice in NL until his/her license was converted into a full license.

4) *International region of graduation.* This was based on medical school and country if based outside of Canada. Physicians were grouped into large geographic regions for analysis using smaller cohorts. See table 3.3.

Table 3.3 – Groups of Countries in the International Region of Graduation Variable

Group	**Countries/Regions included:**
Canada	Canada
Other	United States of America, Australia, New Zealand, South America, Central America, Mexico, Caribbean
Europe	All western and eastern European countries, Russia
Southeast Asia/Asia	China, India, Myanmar, Pakistan, Philippines, & Sri Lanka
Africa	All African countries (excluding Egypt)
Middle-East	All Middle-Eastern countries including Egypt and Turkey.

5) *The Canadian region of graduation.* This was based on medical school. In cases where there were a small number of graduates from a province, they were grouped with other nearby provinces to prevent reporting small numbers and identifying individuals.

3.4 Data Analysis

We analyzed specialist physicians according to two cohorts: those first licensed from 2000 until 2004, and those first licensed from 1993 until 1997. In each cohort, physicians were tracked until the end of the study period, December 31, 2007, or until the termination of their initial licenses.

Various statistics were used to describe the socio-demographic characteristics of each cohort. Descriptive statistics (frequencies, means, medians, and standard deviation) were used to describe the sociodemographic and professional characteristics of each cohort.

Chi-square tests and one-way analysis of variance (ANOVA) were used to compare physicians who left or stayed. Where comparisons consisted of 2x2 tables and/or where cells contained less than five cases, Fisher's exact test was used to determine statistical significance instead of Pearson chi-square. Bonferroni tests were used in post-hoc tests following ANOVA. Kaplan-Meier survival analysis was used to obtain non-parametric statistics to determine median practice time and the Mantel-Cox test was used to compare medians. In Cohort I, because of the small number of IMGs(Full), these physicians were excluded from selected analyses (and their exclusion noted). However,

we elected to retain this physician subgroup for the remainder of the analysis because more substantial numbers existed in Cohort II.

Chi-square tests and one-way ANOVA were also used to describe the differences between physician groups. Where comparisons consisted of 2x2 tables and/or where cells contained less than five cases, Fisher's exact test was used to determine statistical significance instead of Pearson chi-square. Chi-square tests were first done to compare all four groups, and then, pair-wise tests were done to identify differences between specific groups. Bonferroni tests were used in post-hoc tests following ANOVA. Kaplan-Meier survival analysis was used to obtain non-parametric statistics to determine median practice time and the Mantel-Cox test was used to compare medians. In this set of analyses, because of multiple comparisons, statistical significance (alpha) was set at 0.001.

With each cohort, survival analysis using Cox regression was used to determine the retention patterns between MMGs, CMGs, IMGs(Prov), and IMGs(Full). Potential covariates were selected based on the results of chi-square tests and one-way ANOVAs; only significant variables were included in the regression model. Bivariate correlations/associations were used to determine whether variables were highly correlated. Pearson correlation was used for continuous variables and Kendall's tau-beta for categorical variables. In cases where a high correlation existed, only one covariate was selected for inclusion. For example, in both the 1993-1997 and 2000-2004 cohorts, FRCPC/FRCSC status and certification status were highly associated (Kendall's tau-beta = 0.935 and 0.989 respectively, $p<0.000$). Therefore, only certification status was

included as it includes all Canadian physicians with full RCPSC approved credentials. Only significant covariates were included in the final regression model. Coefficient β, Standard Error, Wald X^2, hazard ratios, p-values, and 95% confidence intervals (CI) were reported.

Sensitivity analysis was conducted on each cohort. Locum tenens, initially licensed in each cohort, were included in the sensitivity analysis. We repeated the analysis including locum tenens in each cohort.

In supplementary analyses for each cohort, we used frequencies to describe the region where CMGs graduated, additional characteristics of IMGs(Prov) and retention rate by speciality type. We also compared the characteristics of cohort I and cohort II using chi-square tests, ANOVA, and mantel-cox tests. Cox regression was used to compare the retention of specialists by cohort. Statistically significant variables from the bivariate tests were included as potential covariates in the Cox regression.

3.5 Ethical Considerations

This project was approved by the MUN Human Investigations Committee on March 6, 2008 (HIC # 08.46, Appendix B). All data were stored on a password protected computer, restricted to authorized persons, in a private room which remained locked at all times. Only aggregate data are reported. In instances where results contained less than five cases, they were reviewed to ensure that individuals could not be identified.

Chapter 4 - Results:

4.1 Cohort I (2000-2004):

The dataset included all specialists who held licenses to practise medicine in NL between 1993 and 2007. In cohort I, we excluded all physicians who were initially licensed prior to 2000 and after 2004. In cohort I there were 328 specialists who had "new" licenses in NL (Figure 4.1). We excluded: 109 locums tenens, 16 specialists with graduation dates between 2000 and 2004 which meant it was impossible for them to have completed post-graduate training before 2004, 11 residents, 8 cases with incomplete data (e.g. missing start dates), and 4 for various other reasons. The final sample consisted of 180 specialists.

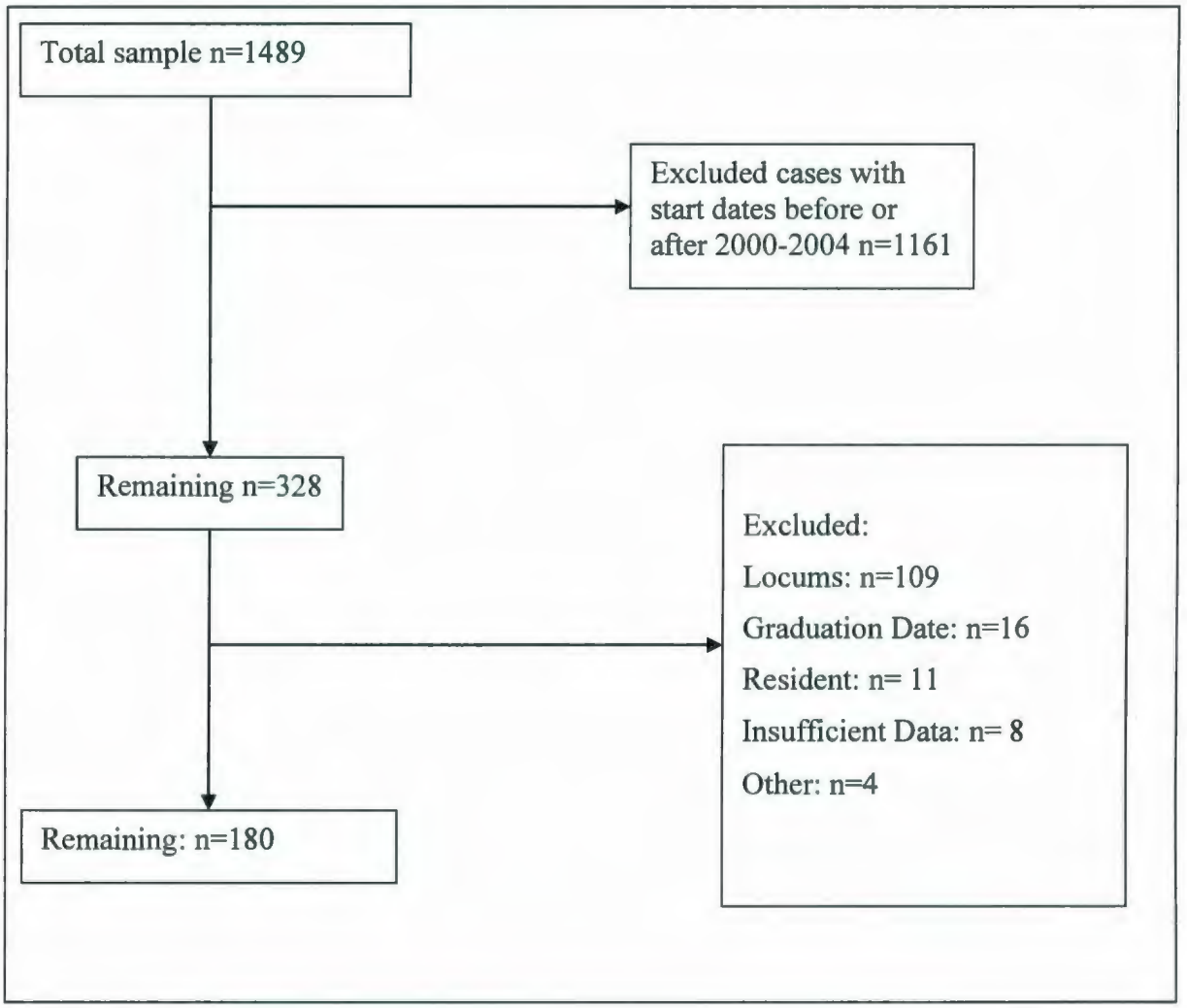

Figure 4.1 – Sample selection for Cohort I (2000-2004)

4.1.1 Sample Characteristics for Cohort I

IMGs formed the largest physician group in this cohort (Table 4.1) Most specialists were male (72.8%), almost half were not fully certified by the end of the study period (47.2%), almost half had not earned FRCPC/FRCSC designations (47.8%), most had graduated in the 1990s (58.6%), and most had not completed any residency training at MUN (70.7%). Clinical specialists formed the largest speciality group (63.3%). Over half had not left NL by the end of the follow-up period while 26.0% had left and never

returned. Of those who had come back, most had returned as locums rather than in permanent positions (greater than three months). The median age as of 2008 was 43.0 years old, and the median age at graduation from undergraduate medical training was 25.0 years old. The median time in NL was 66.0 months.

Table 4.1 – Characteristics of the Physicians who were First Licensed to Practise in NL, 2000-2004 (n=180)

Characteristic	n (%)*
Physician Group	
MMG	61 (33.9)
CMG	16 (8.9)
IMG(Prov)	94 (52.2)
IMG(Full)	9 (5.0)
Sex	
Male	131 (72.8)
Female	49 (27.2)
Have FRCPC/S	
No	86 (47.8)
Yes	94 (52.2)
Fully Certified	
No	85 (47.2)
Yes	95 (52.8)
Decade of Graduation	
<1973	5 (2.8)
1973-79	9 (5.0)
1980-89	60 (33.3)
1990-99	106 (58.9)
Did some or all of residency at MUN	
No	127 (70.6)
Yes	53 (29.4)
Speciality Type	
Clinical	114 (63.3)
Laboratory	13 (7.2)
Surgical	52 (28.9)
Retention	
Never Left	91 (50.6)
Left	47 (26.1)
Left and returned as locum	33 (18.3)
Left and returned as permanent	9 (5.0)
Age (at 2008)	
Mean (sd)	44.0 (7.1)
Median	43.0
Age at Graduation	
Mean (sd)	26.2 (3.7)
Median	25.0
Total time (months)	
Mean (sd)	45.8 (26.1)
Median	66.0

*Except for age, age at graduation, and total time

In a supplementary analysis, we examined the origins of CMGs: 25.0% graduated from the Nova Scotia medical school, 31.2% graduated from Quebec medical schools,

31.2% from Ontario medical schools, and 12.4% from Western Canadian medical schools (Appendix Table C1).

We also examined the origins of provisionally licensed IMGs. A majority of IMGs(Prov) completed undergraduate medical training in Southeast Asia (53.2%). More than three quarters of IMGs(Prov) did not have full-certification or FRCPC/FRCSC designations (77.7% for both) by the end of the follow-up period. The mean time to obtain a full license was 48.3 months (Appendix Table C2).

4.1.2 Comparisons of Specialist Physicians for Cohort I

Table 4.2 compares the characteristics of specialists who left and of those who stayed in NL. Compared to those who left, a larger proportion of specialists who stayed had FRCPC/FRCSC designation, were fully certified, were older at graduation, and worked in the province for a longer period of time. There were no differences in terms of sex, current age, decade of graduation, MUN residency training, or specialist group.

Table 4.2 – Characteristics of Physicians who Stayed and Left that were First Licensed from 2000-2004 (n=180)

Characteristic	Stayed n (%)*	Left n (%)*	p-value
Physician Group**			0.006
MMG	42 (46.7)	19 (23.1)	
CMG	6 (6.7)	10 (12.3)	
IMG(Prov)	42 (46.7)	52 (64.2)	
Sex			0.182
Male	62 (68.1)	69 (77.5)	
Female	29 (31.9)	20 (22.5)	
Have FRCPC/S			0.036
No	36 (41.9)	50 (56.2)	
Yes	55 (59.8)	39 (43.8)	
Fully Certified			0.025
No	35 (38.5)	50 (56.2)	
Yes	56 (61.5)	39 (43.8)	
Decade of Graduation			0.932
<1973	2 (2.2)	3 (3.4)	
1973-79	4 (4.4)	5 (5.6)	
1980-89	30 (33.0)	30 (33.7)	
1990-98	55 (60.4)	51 (57.3)	
Did some or all of residency at MUN			0.103
No	59 (64.8)	68 (76.4)	
Yes	32 (35.2)	21 (23.6)	
Speciality Group			0.933
Clinical	58 (63.7)	56 (63.6)	
Laboratory	6 (6.6)	7 (28.4)	
Surgical	27 (29.7)	25 (28.4)	
Age (at 2008)			0.423
Mean (sd)	44.2 (7.2)	43.5 (6.9)	
Age at Graduation			0.002
Mean (sd)	27.0 (4.4)	25.3 (2.6)	
Total time (months)			<0.000
Mean (sd)	63.7 (17.2)	27.5 (20.3)	

*Except for age, age at graduation, and total time
** IMG(Full) suppressed from analysis

Among specialists who remained in NL, anaesthesiologists formed the smallest speciality type staying (13.3%) followed by radiology (28.6%), general internal medicine (33.3%), and orthopaedic surgery (33.3%) (Appendix Table C3). "Other", which included dermatology and radiation oncology, had the highest proportion of specialists remaining

at 75.0%. Internal medicine subspecialties and specialized surgery rounded out the top three at 69.2% and 66.7% respectively.

Table 4.3 compares the characteristics of physician groups. Compared with MMGs, a smaller proportion of CMGs had FRCPC/FRCSC designation and full certification. CMGs practised in NL for a shorter period of time than MMGs.

Compared with MMGs, a larger proportion of IMGs(Prov) were male, had not earned FRCPC/FRCSC designation, were not fully certified, graduated before in the 1980s, did not complete any post-graduate training at MUN, and left NL. They were also older in 2008, but younger at graduation.

Compared with MMGs, a larger proportion IMGs(Full), graduated in the 1980s, and left NL.

Compared with CMGs, a smaller proportion of IMGs(Prov) had full certification, and graduated in the 1990s. CMGs were also older at 2008, but not at graduation.

Compared with CMGs, a larger proportion of IMGs(Full) had FRCPC/FRCSC designations and full certification, and graduated in the 1980s. A smaller proportion had MUN residency training.

Compared with IMGs(Full), a larger proportion of IMGs(Prov) were male, graduated in the 1980s, and did not have MUN post-graduate training.

PAGE 48 MISSING

Table 4.3 – Characteristics of Physicians Differentiated by Physician Group Who were First Licensed from 2000-2004 (n=180)*

Characteristic	MMG n (%)**	CMG n (%)**	IMG (Prov) n (%)**	IMG (Full) n (%)**	p-value (Omnibus)	p-value α	p-value β	p-value γ	p-value δ	p-value ε	p-value ζ
Sex					<0.000	0.243	<0.000	0.623	0.653	0.025	<0.000
Male	32 (52.5)	11 (68.8)	84 (89.4)	4 (44.4)							
Female	29 (47.5)	5 (31.2)	10 (10.6)	5 (55.6)							
Age (at 2008)					<0.000	0.662	<0.000	0.002	0.008	0.073	0.647
Mean (sd)	40.6 (5.0)	41.3 (6.0)	46.2 (7.0)	47.4 (7.0)							
Age at Graduation					<0.000	0.722	<0.000	0.051	0.001	0.065	0.967
Mean (sd)	27.9 (4.20)	27.5 (3.10)	25.0 (2.85)	25.0 (3.1)							
Have FRCPC/S					<0.000	0.001	<0.000	0.012	0.012	0.001	0.004
No	4 (6.6)	6 (37.5)	73 (77.7)	3 (33.3)							
Yes	57 (93.4)	10 (62.5)	21 (22.3)	6 (66.7)							
Fully Certified					<0.000	<0.000	<0.000	0.004	0.004	0.001	0.004
No	3 (4.9)	6 (37.5)	73 (77.7)	3 (33.3)							
Yes	58 (95.1)	10 (62.5)	21 (22.3)	6 (66.6)							
Decade of Graduation					<0.000	0.100	<0.000	<0.000	<0.000	<0.000	<0.000
<1973	0 (0.0)	0 (0.0)	4 (4.3)	1 (11.1)							
1973-79	0 (0.0)	1 (11.1)	7 (7.4)	1 (11.1)							
1980-89	3 (4.9)	0 (0.0)	54 (57.4)	3 (33.3)							
1990-98	58 (95.1)	15 (93.8)	29 (30.9)	4 (44.4)							
Did some or all of residency at MUN					<0.000	0.021	<0.000	0.038	0.038	<0.000	<0.000
No	19 (31.4)	10 (62.5)	92 (97.9)	6 (66.7)							
Yes	42 (68.9)	6 (37.5)	2 (2.1)	3 (33.3)							
Speciality Group					0.104	0.579	0.169	0.083	0.083	0.081	0.267
Clinical	35 (58.3)	7 (43.8)	64 (68.1)	8 (88.9)							
Laboratory	3 (5.0)	1 (6.2)	8 (8.5)	1 (11.1)							
Surgical	22 (36.7)	8 (50.0)	22 (23.4)	0 (0.0)							

Did MD leave?					0.001	0.021	0.004	0.001	0.001	0.563	0.047
No	42 (68.9)	6 (37.5)	42 (44.7)	1 (11.1)							
Yes	19 (31.1)	10 (62.5)	52 (54.7)	8 (88.9)							
Came Back after leaving?					0.270	0.911	0.106	0.826	0.826	0.383	0.138
No	7 (36.8)	4 (40.0)	33 (63.5)	3 (37.5)							
As locum	9 (47.4)	5 (50.0)	16 (30.8)	3 (37.5)							
As permanent	3 (15.8)	1 (10.0)	3 (5.8)	2 (25.0)							
Time in NL (months)					<0.000						
Median	N/A^	24.0	57.0	26.0		0.010	0.016	0.001	0.095	0.493	0.011

α – MMG vs. CMG

β – MMG vs. IMG(Prov)

γ – MMG vs. IMG(Full)

δ – CMG vs. IMG(Prov)

ε – CMG vs. IMG(Full)

ζ – IMG(Prov) vs. IMG(Full)

*Except for age, age at graduation, and total time

** Significance was defined as $p<0.01$

^Because more than 50% remained in NL by the end of the follow-up period

4.1.3 Survival Analysis for Cohort I

Figure 4.2 shows the survival curve for the cohort. The graph line represents the proportion of the physicians who remain in the province (y-axis) as time passes (x-axis). At 70 months roughly half of the cohort remained. Cox regression was also used to compare the retention of groups. Only physician group remained as a significant covariate in the final Cox regression model (Table 4.4). Compared to MMGs, all other physician groups were more likely to leave NL: CMGs, IMGs(Prov), and IMGs(Full) were 3.19, 1.85, and 4.39 times more likely to leave.

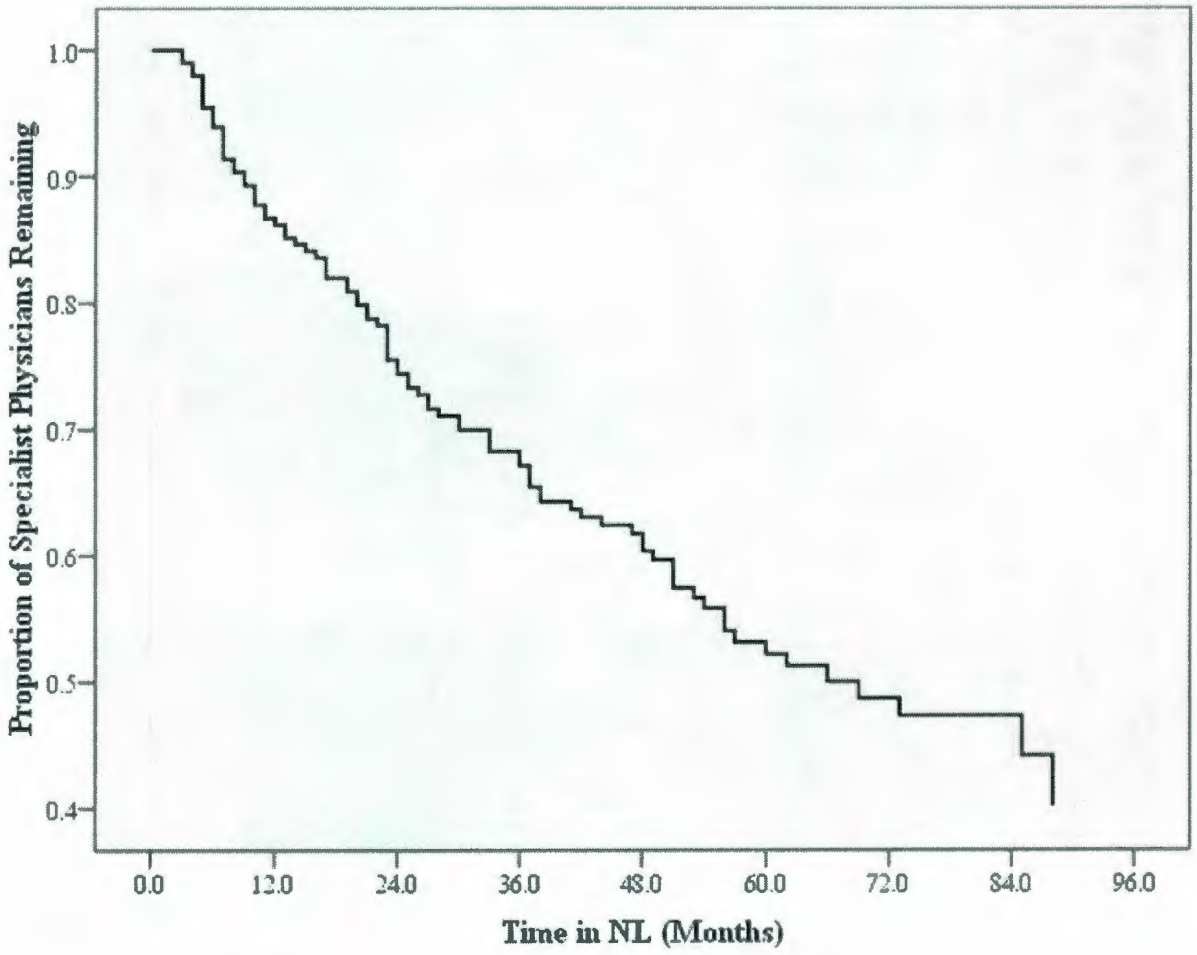

Figure 4.2 - Survival Curve Obtained from Cox Regression for Specialist Physicians Leaving NL for Those Initially Licensed between 2000-2004

Table 4.4 – Predictors of Physicians Leaving NL Based on Survival Analysis (Cox Regression) who were First Licensed from 2000-2004 (n=180)

Characteristic	Coefficient β	Standard Error	Wald X^2	Hazard Ratio	p-value	95% CI
Physician Group			15.79		0.001	
MMG	--	--	--	1.00*	--	--
CMG	1.159	0.393	8.68	3.19	0.003	1.47-6.89
IMG(Prov)	0.614	0.269	5.24	1.85	0.019	1.09-3.17
IMG(Full)	1.48	0.425	12.14	4.39	<0.000	1.91-10.10

* Reference category

Figure 4.3 shows the survival curve for each physician group. Roughly half of IMGs(Full), CMGs, and IMGs(Prov) remained in NL after 24 months, 34 months, and 60 months respectively. Almost 60% of the MMG group remained at the end of the follow-up period (96 months).

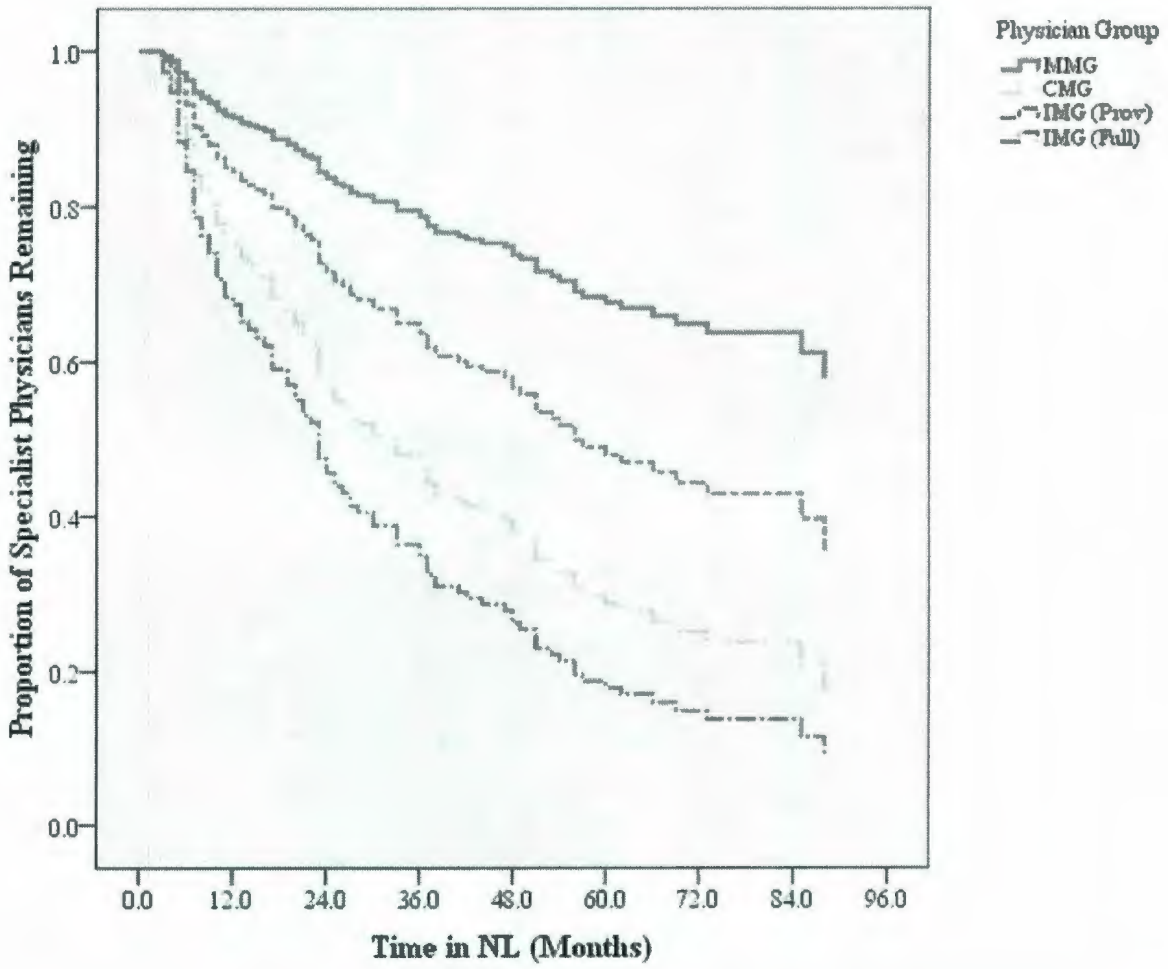

Figure 4.3 - Survival Curve Obtained from Cox Regression for Specialist Physicians Leaving NL for Those Initially Licensed between 2000-2004, by Physician Group

4.2. Cohort I Including Locums Tenens

In the sensitivity analysis, we repeated the analysis including locum tenens in the 2000 to 2004 cohort. This analysis excluded the same physicians as the 2000-2004 cohort except it included all 109 locums initially licensed during that period. In this cohort IMGs(Prov) still made up the largest physician group at 44.6%,. However, CMGs more

than doubled in size from 8.9% to 20.8% (Table 4.1 and Appendix Table D1). More specialists in this group had FRCPC/FRCSC status and certification. There were also more graduates prior to 1973 (6.9% versus 2.8%). Median retention time decreased to 19.5 months.

Compared to those who left, a greater proportion of specialists completed all or some residency training at MUN and were older at graduation (Appendix table D3).

The results of the survival analysis differed from the 2000-2004 main cohort. Graduation age was a significant covariate in the Cox regression model (Table 4.5). For every additional year of age, physicians were less likely to leave. Compared to MMGs, CMGs and IMGs(Full) were more likely to leave NL. There was no difference between IMGs(Prov) and MMGs (Table 4.5). Figure 4.4 shows the survival curve for the cohort as a whole. After 23 months only half of the cohorts remained in NL.

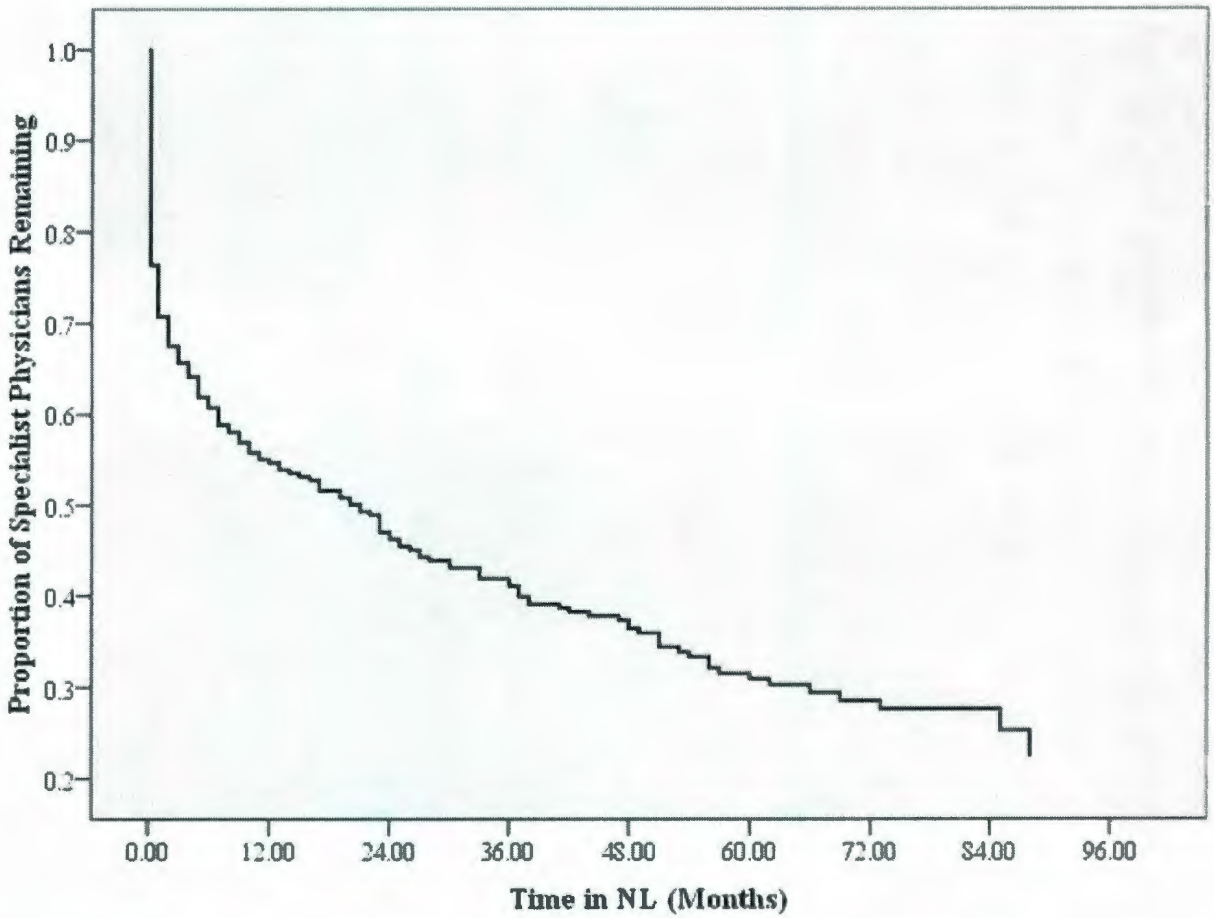

Figure 4.4 - Survival Curve, Obtained from Cox Regression, for Specialist Physicians Leaving NL for Those Initially Licensed from 2000-2004, Including Locums

Table 4.5 – Predictors of Physicians Leaving NL Based on Survival Analysis (Cox Regression) who were First Licensed from 2000-2004, Including Locums (n=195)

Characteristic	Coefficient β	Standard Error	Wald X^2	Hazard Ratio	p-value	95% CI
Graduation Age	-0.095	0.031	9.42	0.909	0.002	0.855-0966
Physician Group			47.65		<0.000	
MMG	--	--	--	1.00*	--	--
CMG	1.24	0.217	32.71	3.47	<0.000	2.26-5.31
IMG(Provisional)	0.136	0.206	0.435	1.15	0.509	0.765-1.72
IMG(Full)	0.906	0.301	9.09	2.48	0.003	1.37-4.46

* Reference category

Figure 4.5 shows the survival curve for each physician group. Roughly half of CMGs, IMGs(Full), and IMGs(Prov) remained in NL after 3 months, 6 months, and 36 months. About half of MMGs remained in NL after 48 months.

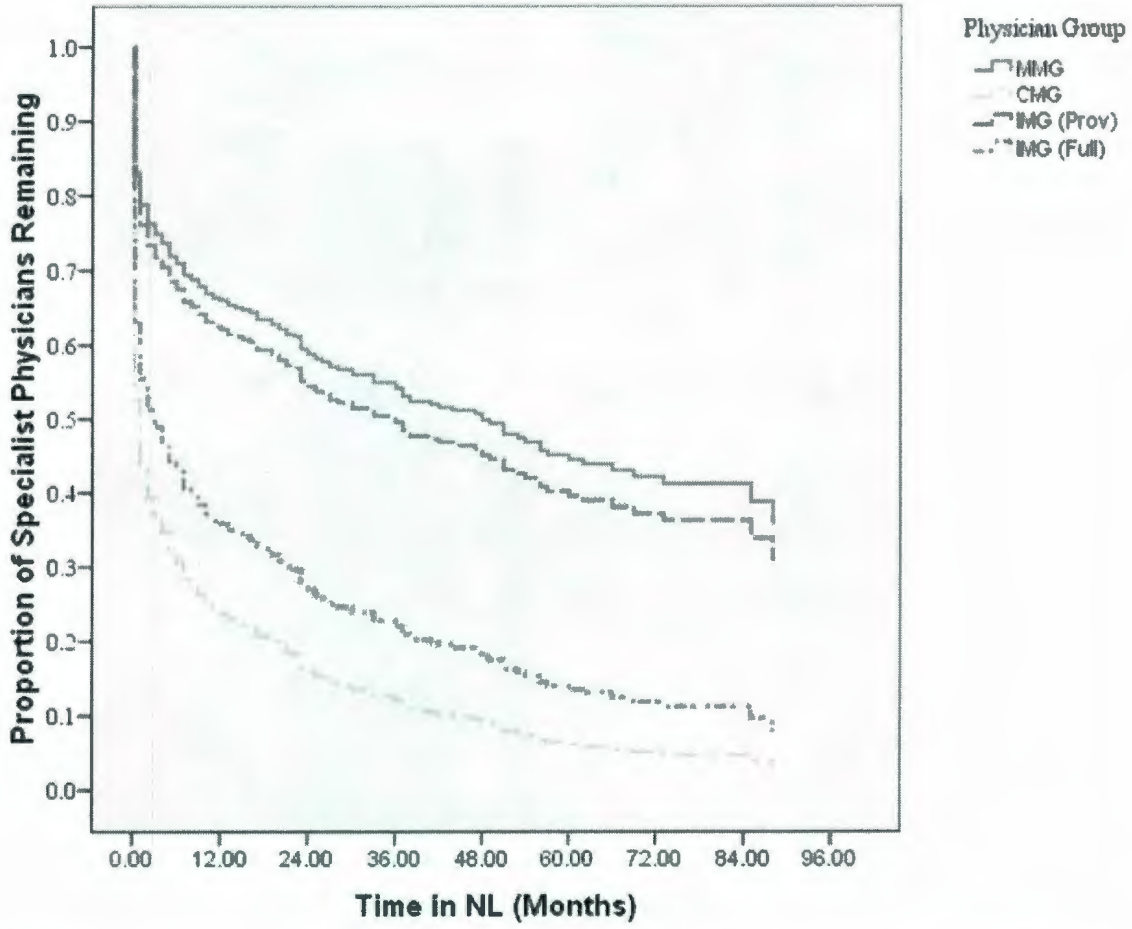

Figure 4.5 - Survival Curve, Obtained from Cox Regression, for Specialist Physicians Leaving NL for Those Initially Licensed from 2000-2004, Including Locums

4.3 Cohort II (1993-1997)

Between 1993 and 1997 there were 347 specialists who received licenses to practise in NL. Of these, we excluded: 69 locums, 33 who had previously held a license, 18 with graduation dates within the cohort, 15 due to insufficient data, and 1 for other reasons (Figure 4.6).Cohort II consisted of 211 specialist physicians.

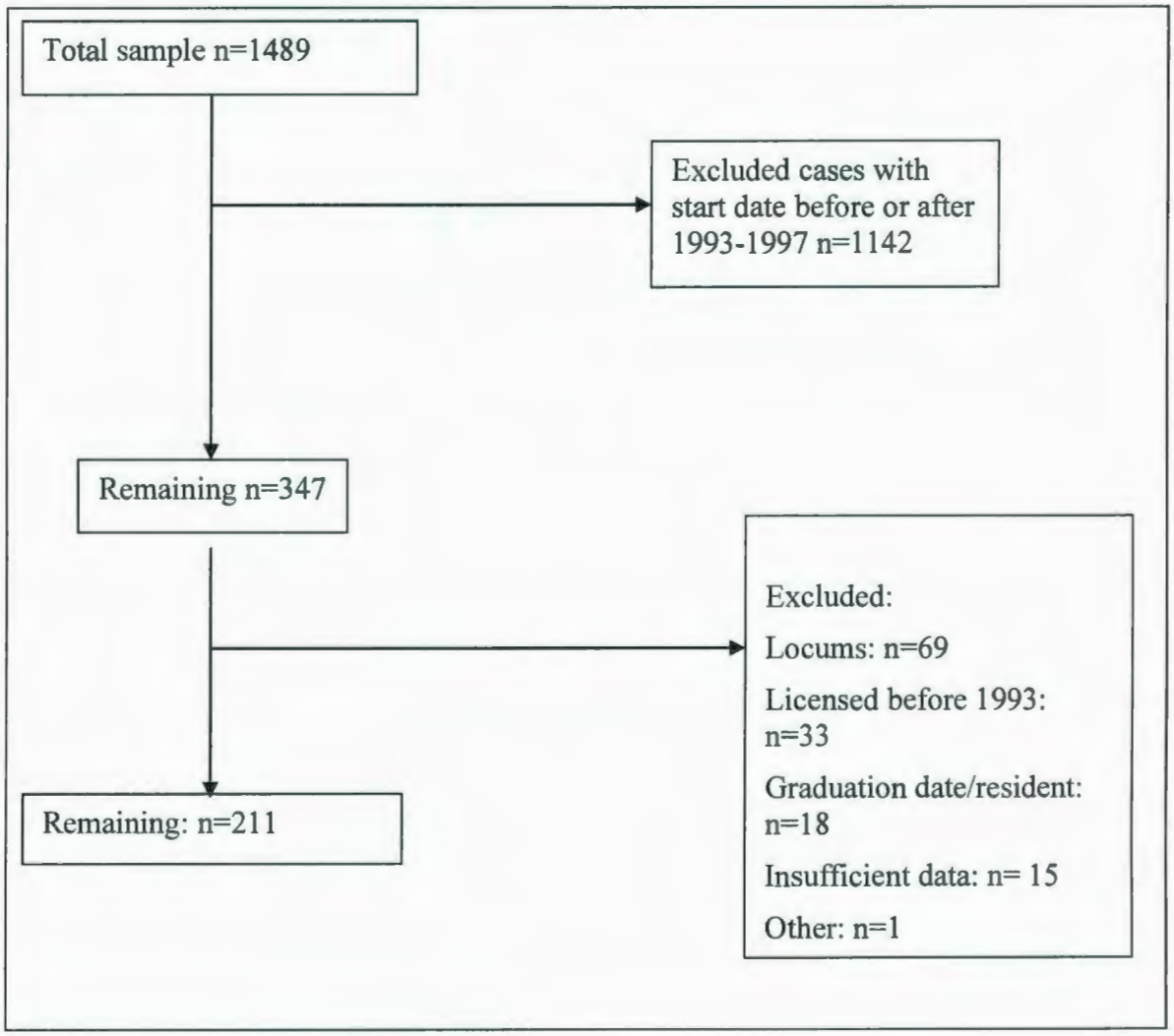

Figure 4.6 – Sample selection for cohort II (1993 to 1997)

4.3.1 Characteristics of Cohort II

As seen in Table 4.6, in cohort II, IMGs(Prov) made up the largest physician group (48.3%). Most specialists were male (76.3%), had obtained FRCPC/FRCSC designation by the end of follow-up (67.8%), were certified by the end of follow-up (68.7%), had graduated in the 1980s (50.7%) and had not completed residency training at MUN (72.5%). Most were clinical specialists (57.8%). Only 15.6% of specialists had not left by the end of the follow-up period. Two-thirds had left while 9.0% had left and returned as locums, and 9.0% had returned in permanent positions. The mean graduation age was 25.1 years. The median practice time in NL was 35.0 months.

Table 4.6 – Characteristics of Physicians who were Licensed to Practise in NL, 1993-1997 (n=211)

Characteristic	n (%)*
Physician Group	
MMG	38 (18.0)
CMG	34 (16.1)
IMG(Prov)	102 (48.3)
IMG(Full)	37 (17.5)
Sex	
Male	161 (76.3)
Female	50 (23.7)
Have FRCPC/S	
No	68 (32.3)
Yes	143 (67.8)
Fully Certified	
No	66 (31.3)
Yes	145 (68.7)
Decade of Graduation	
<1973	28 (13.3)
1973-79	45 (21.3)
1980-89	107 (50.7)
1990-99	30 (14.2)
Did some or all of residency at MUN	
No	153 (72.5)
Yes	58 (27.5)
Speciality Group	
Clinical	122 (57.8)
Laboratory	18 (8.5)
Surgical	70 (33.2)
Retention	
Never Left	33 (15.6)
Left	140 (66.3)
Left and returned as locum	19 (9.0)
Left and returned as permanent	19 (9.0)
Age (at 2008)	
Mean (sd)	52.2 (8.2)
Median	51.0
Age at Graduation	
Mean (sd)	25.1 (2.1)
Median	25.0
Total time (months)	
Mean (sd)	54.2 (49.8)
Median	35.0

*Except for age, age at graduation, and total time

Supplementary analysis of CMGs indicated that 32.4% had graduated from the Nova Scotia medical school, 11.8% from Quebec medical schools, 35.3% from Ontario medical schools, and 20.6% from Western medical schools (Appendix Table E1).

As seen in Appendix Table E2, most IMGs(Prov) specialists graduated from medical schools in Southeast Asia (43.1%). A majority lacked full certification (59.8%) or FRCPC/FRCSC designation (58.8%) by the end of the follow-up period. The mean time to obtain a full license after beginning practice in NL was 49.2 months.

4.1.2 Comparisons of Specialist Physicians for Cohort II:

Table 4.7 compares those who stayed in NL and those who left. Compared to specialists who left, a larger proportion of those who stayed in NL were MMGs, graduated in the 1990s, and completed all or some residency training at MUN. Specialists who stayed were younger in 2008 and practised in NL for a longer period of time.

Table 4.7 – Characteristics of Physicians who Stayed and Left that were First licensed from 1993-1997 (n=211)

Characteristic	Stayed n (%)*	Left n (%)*	p-value
Physician Group			<0.000
MMG	15 (45.5)	23 (12.9)	
CMG	6 (18.2)	28 (15.7)	
IMG(Prov)	5 (15.2)	97 (54.5)	
IMG(Full)	7 (21.2)	30 (16.9)	
Sex			0.182
Male	22 (66.7)	139 (78.1)	
Female	11 (33.3)	39 (21.9)	
Have FRCPC/S			0.025
No	5 (15.2)	63 (35.4)	
Yes	28 (84.8)	115 (64.6)	
Fully Certified			0.040
No	5 (15.2)	61 (34.3)	
Yes	28 (84.8)	117 (65.7)	
Decade of Graduation			0.008
<1973	3 (9.1)	25 (14.1)	
1973-79	5 (15.2)	40 (22.6)	
1980-89	14 (42.4)	93 (52.5)	
1990-98	11 (33.3)	19 (10.7)	
Did some or all of residency at MUN			<0.000
No	14 (42.4)	139 (78.1)	
Yes	19 (57.6)	39 (21.6)	
Speciality Group			0.266
Clinical	23 (69.7)	99 (55.9)	
Laboratory	3 (9.1)	15 (8.5)	
Surgical	7 (21.2)	63 (35.6)	
Age (at 2008)			0.343
Mean (sd)	24.8 (1.3)	25.2 (2.2)	
Age at Graduation			0.005
Mean (sd)	48.6 (7.8)	52.9 (8.1)	
Total time (months)			<0.000
Mean (sd)	151.1 (21.8)	37.0 (28.0)	

*Except for age, age at graduation, and total time

Supplementary analysis indicated that the two groups with the poorest retention rates were radiologists and obstetrics/gynecology with none (0%) of these specialists remaining (Appendix Table E3). Only 7.7% of both specialized surgery and 10.0% other remained. Internal medicine subspecialties (33.3%), psychiatry (27.3%) and pediatrics (25.0%) had the highest retention rates.

Table 4.8 compares the characteristics of various physician groups. Compared to MMGs, higher proportions of CMG were male, graduated before 1973, and did not do residency training at MUN. CMGs were older than MMGs in 2008.

Compared to MMGs, a higher proportion of IMGs(Prov) were male, did not have FRCPC/FRCSC status, were not fully certified, graduated in the 1980s, did not complete residency training at MUN, and left NL. IMGs(Prov) were older in 2008 and remained in NL for a shorter period of time than MMGs.

Compared to MMGs, a higher proportion of IMGs(Full) graduated before 1990, and did not do any residency training at MUN. IMG(Full) were older in 2008.

Compared with CMGs, a higher proportion of IMGs(Prov) did not have FRCPC/FRCSC status, were not fully certified, and graduated in the 1980s.

Compared with CMGs, IMGs(Full) were younger at graduation. There were no other significant differences between these two groups of physicians.

Compared with IMGs(Full), a lower proportion of IMGs(Prov) had FRCPC/FRCSC status, and were certified.

Table 4.8 – Characteristics of Physicians Differentiated by Physician Group who were First Licensed from 1993-1997 (n=211)*

Characteristic	MMG n (%)**	CMG n (%)**	IMG (Prov) n (%)**	IMG (Full) n (%)**	p-value (Omnibus)	p-value α	p-value β	p-value γ	p-value δ	p-value ε	p-value ζ
Sex					0.001	0.006	<0.000	0.007	1.000	1.000	1.000
Male	19 (50.0)	28 (82.4)	84 (82.4)	30 (81.1)							
Female	19 (50.0)	6 (17.6)	18 (17.6)	7 (18.9)							
Age (at 2008)					0.004	<0.000	<0.000	<0.000	0.006	0.726	0.004
Mean (sd)	44.6 (3.2)	56.7 (12.6)	52.3 (5.5)	55.8 (7.7)							
Age at Graduation					<0.000	0.985	0.038	0.005	0.034	0.003	0.082
Mean (sd)	25.8 (2.6)	25.9 (2.3)	25.0 (1.9)	24.4 (1.7)							
Have FRCPC/S					<0.000	0.599	<0.000	0.108	<0.000	0.432	<0.000
No	1 (2.6)	2 (5.9)	60 (58.8)	5 (13.5)							
Yes	37 (97.4)	32 (94.1)	42 (41.2)	32 (86.5)							
Fully Certified					<0.000	0.219	<0.000	0.115	<0.000	1.000	<0.000
No	0 (0.0)	2 (5.9)	60 (58.8)	3 (8.1)							
Yes	38 (100.0)	32 (94.1)	42 (41.2)	34 (91.9)							
Decade of Graduation					<0.000	<0.000	<0.000	<0.000	<0.000	0.032	0.013
<1973	0 (0.0)	13 (38.2)	6 (5.9)	9 (24.3)							
1973-79	1 (2.6)	3 (8.8)	29 (28.6)	12 (32.4)							
1980-89	15 (39.5)	13 (38.2)	64 (63.4)	15 (40.5)							
1990-98	22 (57.9)	5 (14.7)	2 (2.0)	1 (2.7)							
Did some or all of residency at MUN					<0.000	<0.000	<0.000	<0.000	0.058	0.781	0.017
No	5 (13.3)	27 (79.4)	93 (92.2)	28 (75.7)							
Yes	33 (86.8)	7 (20.6)	9 (8.8)	9 (24.3)							
Speciality Group					0.079	0.124	0.087	0.010	0.901	0.438	0.162
Clinical	28 (73.7)	30 (58.8)	56 (54.9)	18 (50.0)							
Laboratory	0 (0.0)	3 (8.8)	8 (7.8)	7 (19.4)							
Surgical	10 (26.3)	11 (32.4)	38 (37.3)	36 (17.2)							

Did MD leave?					<0.000	0.068	<0.000	0.075	0.029	1.000	0.016
No	15 (39.5)	6 (17.6)	5 (4.9)	7 (18.9)							
Yes	23 (60.5)	28 (82.4)	97 (95.1)	30 (81.1)							
Came Back after leaving?					0.036	0.028	0.015	0.166	0.271	0.587	0.671
No	14 (60.9)	22 (78.6)	81 (83.5)	23 (76.7)							
As locum	2 (8.7)	5 (17.9)	8 (8.2)	4 (13.3)							
As permanent	7 (30.4)	1 (5.3)	8 (8.2)	3 (10.7)							
Time in NL (months)					0.006	0.143	0.001	0.168	0.171	0.087	0.042
Median	37.0	33.0	33.0	41.0							

α – MMG vs. CMG

β – MMG vs. IMG(Prov)

γ – MMG vs. IMG(Full)

δ – CMG vs. IMG(Prov)

ε – CMG vs. IMG(Full)

ζ – IMG(Prov) vs. IMG(Full)

* Significance was defined as $p<0.01$

**Except for age, age at graduation, and total time

4.3.3 Survival Analysis for Cohort II

Figure 4.7 shows the survival curve for this cohort. After about 38 months, half of specialists remained in NL. The only significant covariate was physician group. Compared with MMGs, IMG(Prov) were 2.16 times more likely to leave. There was no significant difference between MMG and CMGs or IMGs(Full) (Table 4.9).

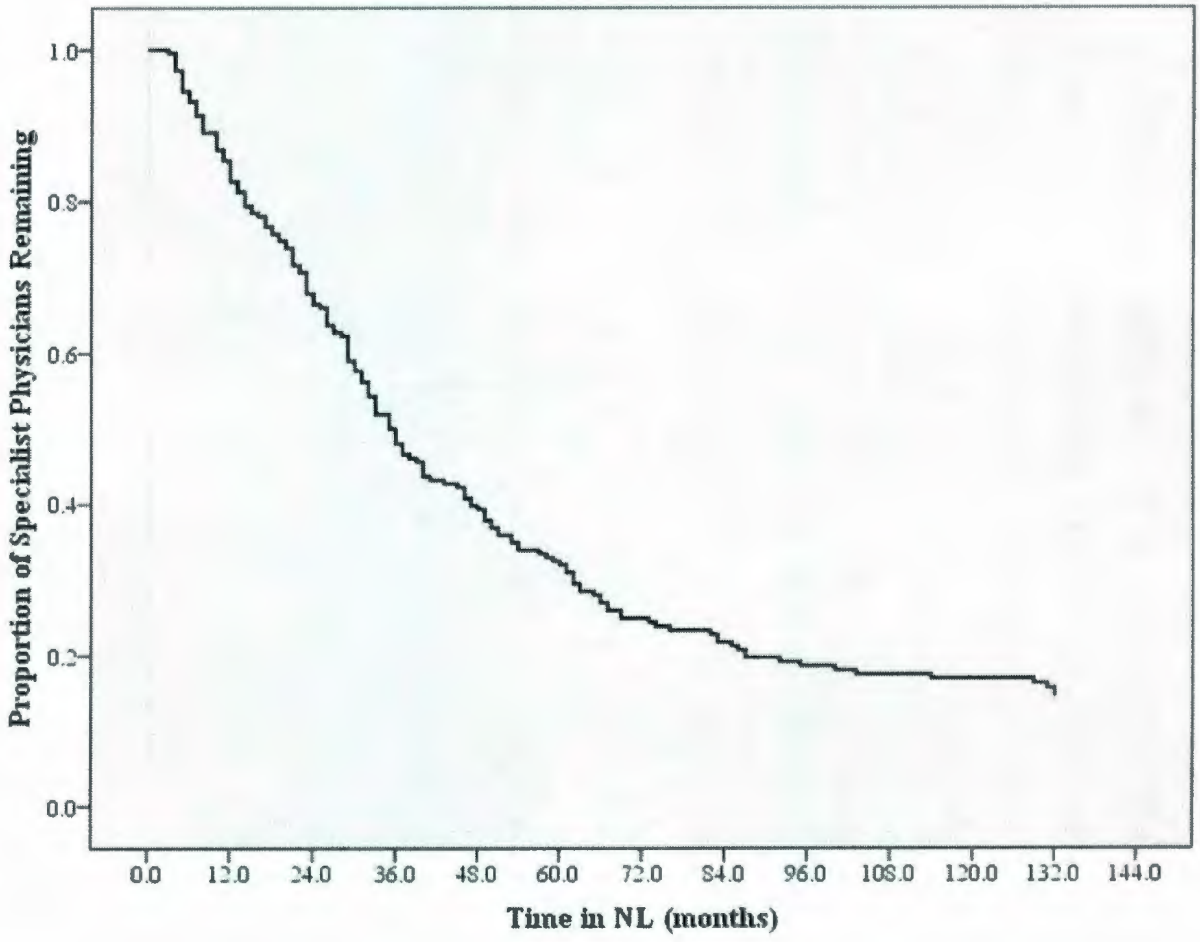

Figure 4.7 - Survival Curve Obtained from Cox Regression for Specialist Physicians Leaving NL who were initially Licensed from 1993-1997

Table 4.9 – Predictors of Physicians Leaving NL Based on Survival Analysis (Cox Regression) who were First Licensed from 1993-1997 (n=211)

Characteristic	Coefficient β	Standard Error	Wald X^2	Hazard Ratio	p-value	95% CI
Physician Group			11.96		0.008	
MMG	--	--	--	1.00*	--	--
CMG	0.505	0.282	3.19	1.66	0.074	0.952-2.88
IMG(Prov)	0.772	0.235	10.79	2.16	0.001	1.37-3.42
IMG(Full)	0.404	0.278	2.12	1.50	0.146	0.869-2.58

* Reference category

Figure 4.8 shows the survival curve by physician group. Roughly half of IMGs(Prov), CMGs, and IMGs(Full) remained in NL after roughly 32 months, 36 months, and 40 months, respectively. About half of MMGs remained roughly 60 months.

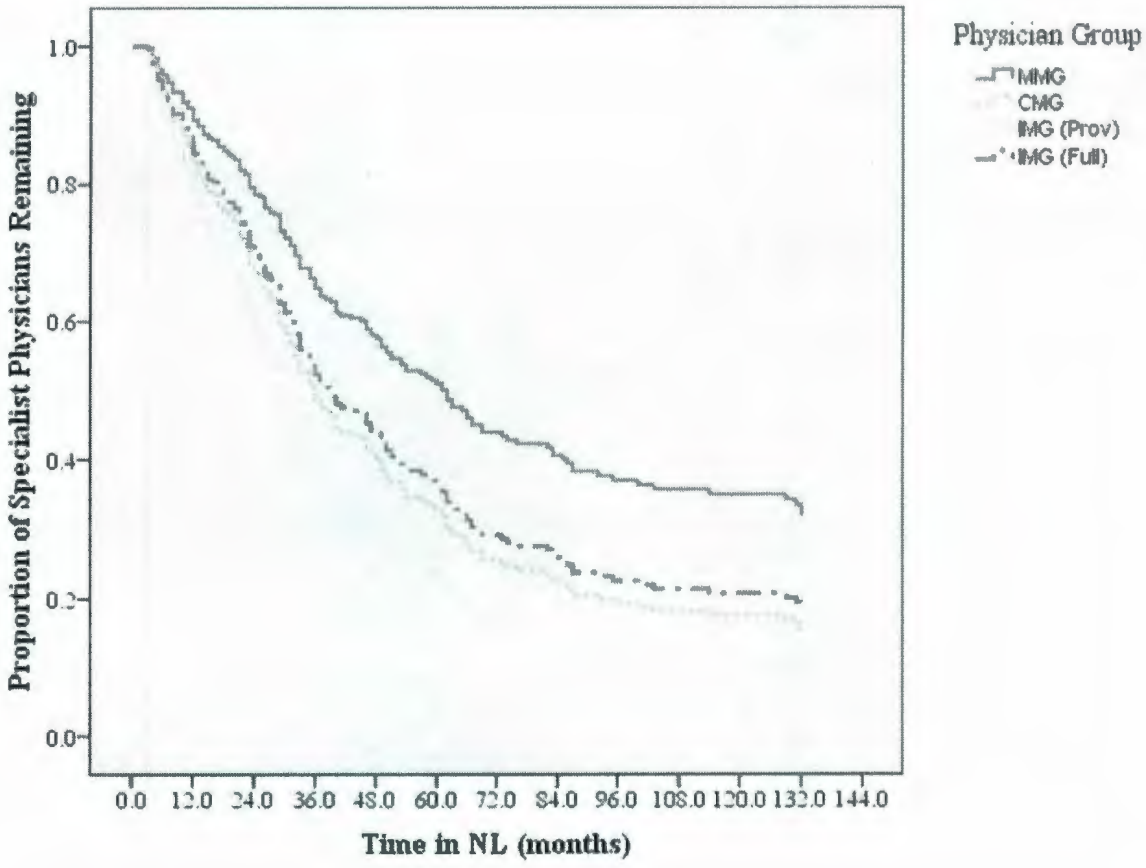

Figure 4.8 - Survival Curve Obtained from Cox Regression for Specialist Physicians Leaving NL who were initially Licensed from 1993-1997

4.4 Cohort II with Locum Tenens

In the sensitivity analysis we included locums and repeated the analysis. The median retention time was 24.0 months by the end of the follow-up period (Appendix Table F1). The largest proportion of specialists who stayed were MMGs, graduated in the 1980s and did some or all residency training at MUN (Appendix Table F3).

Figure 4.9 shows that by the end of the follow-up period roughly 15% of specialists remained. Half had left by 24 months. In Cox regression, the only significant predictor was physician group. Compared to MMGs, CMGs, IMGs(Prov), and IMGs(Full) 2.72, 2.20, and 1.88 times more likely to leave NL, respectively.

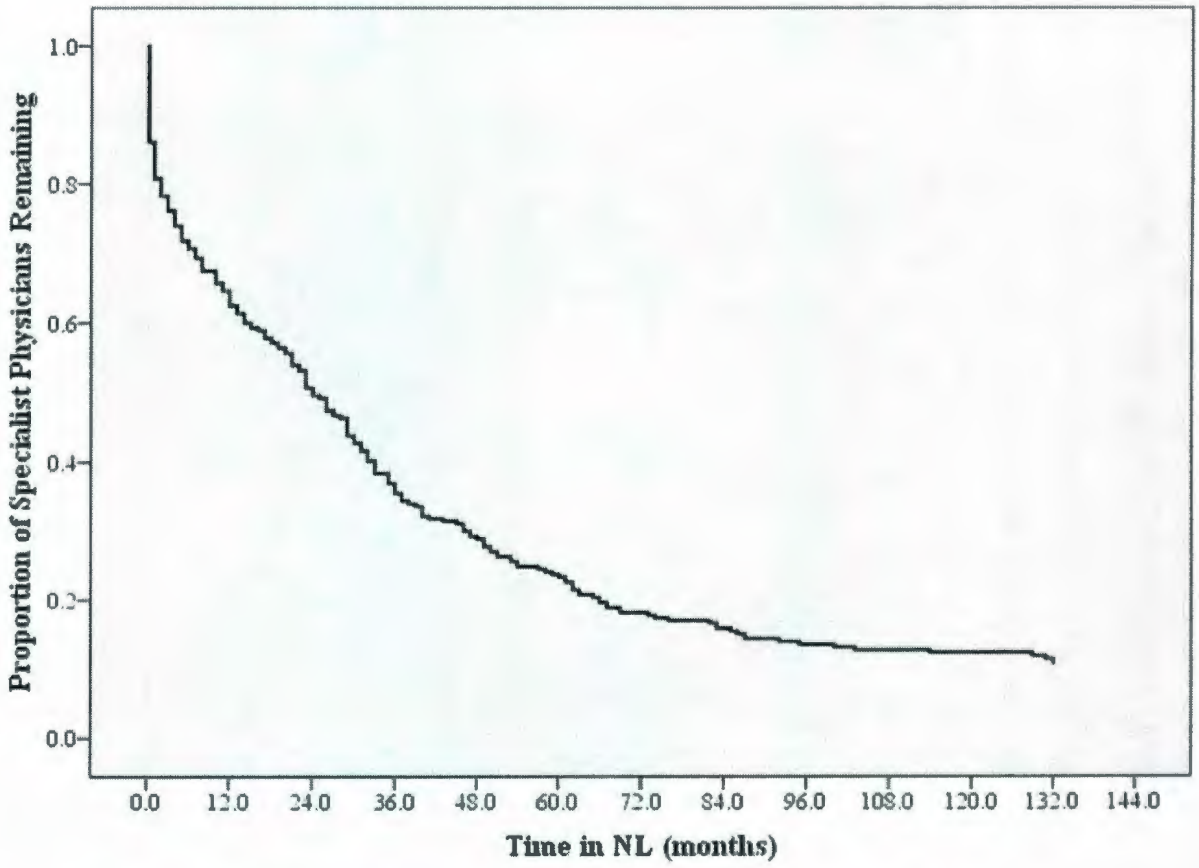

Figure 4.9 - Survival Curve Obtained from Cox Regression for Specialist Physicians Initially Licensed from 1993-1997, Including Locums

Table 4.10 – Predictors of Physicians Leaving NL Based on Survival Analysis (Cox Regression) who were First Licensed from 1993-1997, including Locums (n=195)

Characteristic	Coefficient β	Standard Error	Wald X^2	Hazard Ratio	p-value	95% CI
Physician Group			18.04		<0.000	
MMG	--	--	--	1.00	--	--
CMG	1.00	0.241	17.27	2.72	<0.000	1.70-4.36
IMG(Provisional)	0.784	0.222	12.46	2.20	<0.000	1.42-3.39
IMG(Full)	0.633	0.250	6.42	1.88	0.011	1.15-3.08

* Reference category

Figure 4.10 shows the survival curve by physician group. Roughly half of CMGs, IMGs(Prov), and IMGs(Full) remained in NL after 20 months, 24 months, and 30 months. About half of MMGs remained after 72 months.

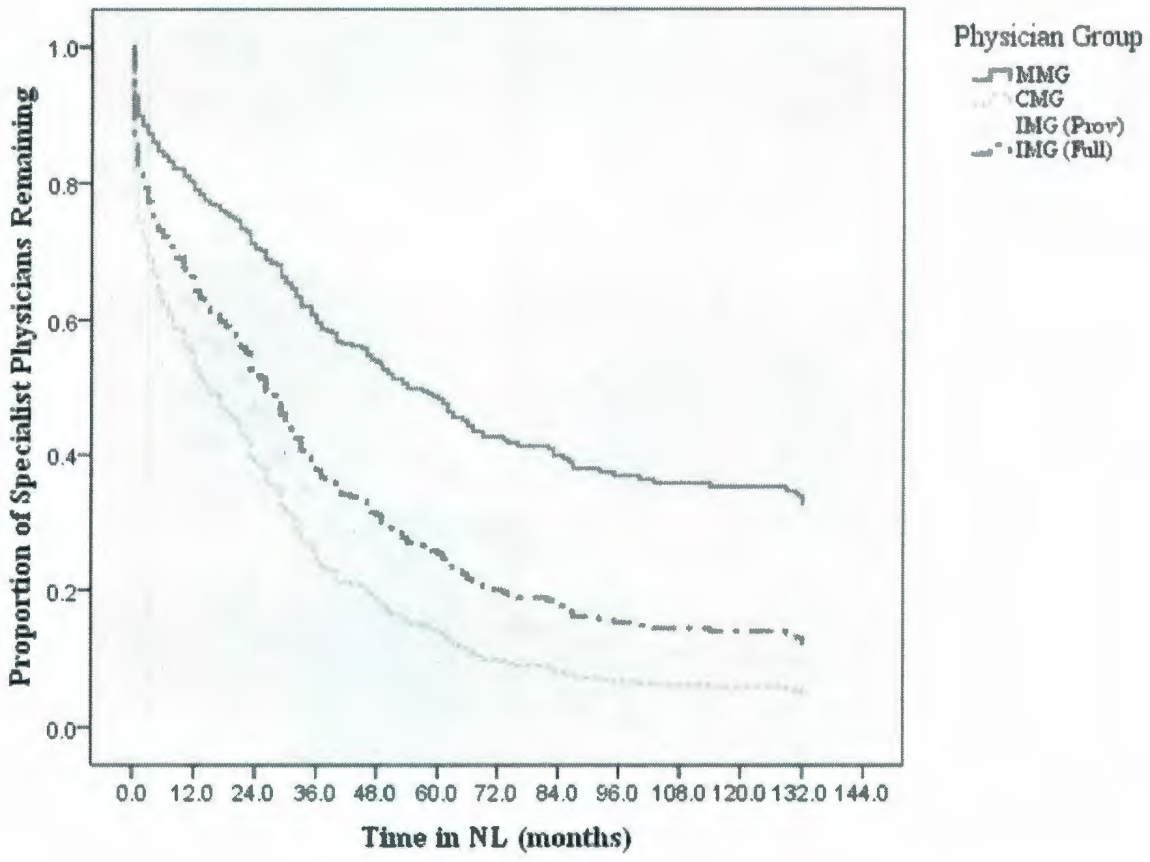

Figure 4.10 - Survival Curve Obtained from Cox Regression for Specialist Physicians, by Physician Group, for Those Initially Licensed from 1993-1997, Including Locums

4.5 Comparison of Cohort I and Cohort II

We carried out supplementary analyses to determine the differences between cohort I and cohort II. Compared to cohort II, a smaller proportion of physicians in cohort I were IMG(Full), were fully certified specialists, had FRCPC/FRCSC status, graduated

before 1990, more left NL by the end of follow-up, and fewer came back after leaving (Table G1). Cohort I physicians were older at graduation and practised longer in NL.

Using Cox regression, we compared the survival curves of the two cohorts (Appendix Figure G1). After 48 months, roughly 60% of cohort I physicians and 45% of cohort II physicians remained in NL. Compared to cohort II, cohort I specialists were 0.62 times more likely to stay, suggesting that the retention of specialists has improved over time (Appendix Table G2).

Chapter 5 – Discussion

This study tracked two cohorts of specialist physicians for up to either 8 years or 15 years after they received their initial NL license. It described the characteristics of the physicians in each cohort, the differences between physician groups, and the average length of practice for each group. Factors affecting retention were analysed to determine predictors of practicing in NL. As the results show, our hypothesis was correct. MMGs remained in NL for a longer period of time than either CMG, IMG(Full), or IMG(Prov).

5.1 Characteristics of Each Cohort

Roughly half of the specialists in cohort I and cohort II were IMGs(Prov). In the total physician workforce in NL, IMGs (Prov) compose nearly 30% of the physician supply (Audas et al., 2005). This is far higher than the national average of 5%. By the end of our study period, half of the IMGs(Prov) remained from Cohort I and only 5.0% remained from Cohort II. It does not appear that the use of IMGs(Prov) leads to long-term retention in NL.

Some research has indicated that male physicians may have a lower national retention rate than female physicians. McKendry et al. (1996) found significantly more males in their U.S. sample compared with their Canadian sample which may indicate a propensity for international migration. As well, Mathews et al. (2006) found that female MMGs were 1.63 times more likely than male MMGs to work in Canada. They did not find that sex was associated with provincial retention. Likewise, our main and supplementary analysis did not indicate sex was a significant factor in retention. The

proportion of males in our sample did not significantly change between cohort I and cohort II. The increasing proportion of female physicians in the workforce does not appear to influence specialist retention in NL.

The fact that over 70% of specialists in each cohort had not done any post-graduate training at MUN was not surprising. At present, the University's residency training program is mainly limited to core areas such as general surgery and general internal medicine (CaRMS, 2009). Only one subspecialty program exists (nephrology). There are few options for various specialized surgery programs like cardiac surgery or urology. Many graduates would need to leave the province to pursue training in these specialities. It is not clear if these graduates return to work in NL or if IMGs or CMGs are recruited to provide these services. Other studies show that residency training is a strong predictor of future work location (Fleming et al., no date; Mathews et al., 2006). While these findings may suggest increasing the availability of specialist residency training in the province, given the relatively small provincial population of roughly 510, 000, there may be limited opportunities to expand existing programs.

5.1.1 Non-Certified Specialists

Nearly half of cohort I and roughly one-third of cohort II were not fully certified by the end of the follow-up period. Similar numbers of physicians had also not obtained FRCPC/FRCSC designation. While it appears that there was a high proportion of certified specialists in cohort II this may be because data on certification status is cross-sectional and this cohort had a much longer follow-up time compared with cohort I. It is possible that specialists practised in NL under a provisional license until eligible to write the

RCPSC certification exams; then exited the province shortly thereafter, much like provisionally-licensed GPs/FPs (Mathews et al., 2008).

The number of non-certified specialists in our sample is much higher than the 26.9% non-certified specialists reported by CIHI (CIHI, 2004). NL appears to be highly reliant on non-certified physicians to bolster its specialist workforce. By comparison, only 0.78% of Ontario's specialists are non-certified (CIHI, 2004). The only other provinces to utilize high numbers of non-certified specialists were Prince Edward Island and Saskatchewan – both rural provinces with similar retention challenges as NL.

Non-certified specialists are physicians who have not earned the appropriate Canadian specialist credentials and therefore have not written or are not eligible to write the RCPSC board exams (CIHI, 2004). They do, however, possess a license to practise medicine on a provisional basis while in the process of obtaining full credentials. While these specialists do not possess RCPSC credentials, they are often required to have obtained equivalent certification from their home jurisdiction. In this context, the term non-certified may be misleading because these specialists may indeed be certified in their home country (e.g. a board-certified American specialists would still be considered non-certified by Canadian standards).

There is a substantial body of evidence from U.S. medical literature indicating that board certification is associated with improved clinical outcomes and higher levels of satisfaction. To become board certified in the U.S., physicians must pass a thorough examination process by an American Board Medical Specialities' (ABMS) member after completion of an ACGME accredited training program. A systematic review of speciality

board certification examined 237 relevant publications (Sharp, Bashook, Lisky, Horowitz, and Miller, 2002). This systematic review extensively searched multiple databases including Medline, PsychLit, and ERIC from 1966 to 1999. Studies must have conformed to a number of criteria such as verification of speciality board certification and measurement on a clinical outcome based on "nationally recognized standards." The authors identified 13 studies with 33 separate outcome measurements. Board specialist certification was linked with a number of improved clinical outcomes such as fewer patient complications and lower mortality. For example, one study found that when abdominal aortic aneurysm treatment was performed by board-certified surgeons, there were 24% fewer deaths or complications than when the procedure was performed by a non-certified surgeon. Another found that fewer deaths were reported for peptic ulcer surgeries by board-certified surgeons. Internists who were board-certified had 3.1% fewer deaths due to myocardial infractions in hospital than non-certified internists.

However, while there is evidence within this systematic review to suggest improved outcomes with speciality board certification, Sharp et al. (2002) indicated there were methodological weaknesses in the data. Most of the studies included in the review used pooled physicians and patient data. Therefore, it is impossible to link a specific outcome with a specific physician. This makes it more difficult to undertake more in-depth analysis. As well, some studies tended to pool all specialists into one large group during comparisons. For example, cardiologists and general surgeons may be grouped under "specialist". In the US, like Canada, the vast majority of specialists are fully certified making this type of study difficult to conduct. An alternative measure of board

certification may be found by analyzing outcomes with physicians who made multiple attempts to pass certification exams or the exam scores (Sharp et al., 2002).

In the 1990s, the NL Medical Act was amended to stipulate that primary care physicians who are provisionally licensed generally have a maximum of three years to obtain their LMCCs (Mathews et al., 2008). While they are not required to obtain the CCFP designation, it does necessitate that they receive a full license within a specified time period. No such changes were made to the relevant sections on specialist licensure. Research on certification status and quality of care would help us answer if changes to the legislation are necessary in NL.

5.1.2 Agreement on Internal Trade

There has been concern expressed by provincial regulatory bodies and the RCPSC that an amendment to the Agreement on Internal Trade (AIT) may worsen problems with physician supply in some parts of Canada (RCPSC, 2009; Sullivan, 2009). The AIT is an agreement between the provincial and territorial premiers which enhances the level of mobility among certified or registered professions like medicine. A recent amendment[12] to this agreement will allow professionals certified in one province to move to another province without restriction, if they are in good standing, as of April 1, 2009 (Government of Canada, 2009; AIT Chapter 7, 2008). The receiving province may not require any additional assessment, training, or certifications on such processionals.

[12] Ninth protocol of amendment to chapter seven

Given NL's high reliance on provisionally-licensed IMGs, the AIT may put NL at potential risk of further out-migration of these physicians. Current evidence suggests that the majority of IMGs practise in NL only until they receive full licensure at which point many leave the province (Audas et al., 2009; Mathews et al., 2008). With these new amendments to the AIT, physicians may practise in NL for an even shorter period of time before leaving which may create a potential crisis in physician staffing – especially in rural areas. Further research will be needed to assess the impact of the amended AIT on the physician workforce in provinces like NL and Saskatchewan which rely heavily on IMGs(Prov).

5.2 Comparisons between Physician Groups

There were several significant differences between the physician groups in both cohort I and cohort II. Compared with MMGs, IMG(Prov) and IMG(Full) tended to be an average of about 6 years older. This may be due to the lengthy Canadian immigration process. It is also possible that IMGs practised in their home countries for some time before securing employment in Canada.

The vast majority of IMGs(Prov) were still non-certified by the end of our follow-up period (77.7% in cohort I and 59.8% in cohort II). IMGs(Prov) are the main source of non-certified specialists in the provincial workforce. However, a small number of MMGs, CMGs, and fully licensed IMGs were also not certified for unknown reasons.

Both CMGs and IMGs(Full) had similar median practice times in NL at 24 and 26 months in cohort I. By comparison, IMGs(Prov) remained for 57 months. The longer length of practice for IMGs(Prov) is likely related to the lengthy process of obtaining a

full license in NL. Our supplementary analysis showed that it took a median time of 51 months (cohort I) and 37 months (cohort II) for provisionally licensed IMGs to obtain a full license.

5.3 Retention

Retention was significantly better in cohort I than in cohort II (50.6% vs. 15.6% retention, median time 66 months vs. 35 months) by the end of the follow-up periods. The longer follow-up time of cohort II may have allowed for greater attrition of specialists. However, cohort I had a higher retention rate than cohort II after both cohorts were followed for the same follow-up period. As well, turmoil in the Canadian health care system during the 1990s such as hospital closures, physician expenditure caps and practice restrictions may have encouraged more physicians to move to countries with greater resources and more lucrative remuneration packages (Chan, 2002; McKendry et al., 1996; Philips et al., 2007). In addition, improved remuneration and recruitment and retention initiatives may have contributed to the higher retention rates in cohort I. Among GPs/FPs only 13.5% remained in NL after a seven year follow-up period (Mathews et al., 2008). Their median retention time was 25 months, with MMGs, CMGs, and IMGs remaining 39 months, 22 months, and 25 months, respectively. Specialist retention in NL is better than GP/FP retention.

Within Cohort II, the highest proportion of those who left had graduated in the 1980s. Since a high number of IMGs graduated in the 1980s and since they are likely to leave NL, it is possible that this finding is related to that factor. This is consistent with other research which has indicated that graduation decade may be related to the retention

of MMGs and family physicians (Mathews et al., 2006; Mathews et al., 2008). Since most specialists are recently graduated it highlights the importance of recruiting new graduates because once they leave it is unlikely they will return.

Specialists who remained in NL had a much higher median practice time than those who left. In cohort I (8 year follow-up) specialists who remained practised a mean time of 63.7 months[13], while those who left practised a mean time of 27.5 months. In cohort II (15 year follow-up) specialists who remained practised a mean of 151.1 months while those who left practised for only 37.0 months. In other words, specialists who stay tend to stay for a long period of time. Determining what factors contribute to departure among exiting specialists may be helpful to provincial health human resources planning. Cohort II specialists remained in NL for a significantly shorter period with a median time of 35 months compared to cohort I which remained 66 months.

Almost two fifths of physicians from cohort I left but returned as locums whereas only one-tenth of physicians from cohort II came back as locums. Nearly half of all MMGs and CMGs in cohort I who left returned as locum tenens. As well, a large proportion of IMGs who left returned as a locum tenens. This may indicate greater practice mobility of specialists entering the provincial workforce in the 2000s compared with the 1990s.

In cohort II, a significantly higher proportion of specialists who stayed in NL were fully-certified and had obtained FRCPC/FRCSC. This was not the case in cohort I. It is possible that the longer follow-up time allowed a greater number of specialists, especially

[13] Means are reported because medians were not available for cohort I.

IMGs, to obtain certification resulting in the greater number of certified specialists in cohort II.

Our survival analysis indicated that, compared to all other physician groups in each cohort, MMGs were most likely to remain in NL. This indicates the contribution MUN's Faculty of Medicine has made to the provincial specialist retention. This provides support to the Faculty's ongoing expansion plans to increase the number of seats for the undergraduate medical training program from 64 at present to 78-80 in the 2011 entering class (Strategic Resource Planning Committee, 2008). However, analysts have pointed out the potential drawbacks of an overreliance on locally trained physicians (Katz, DeWals, and West, 2008). Katz et al. indicate that an over-reliance on home-grown physicians may result in homogeny of training and thought which could affect academic, clinical, and organizational functioning.

5.4 Study Strengths

This study was the first to offer a focused analysis on the retention of specialist physicians in NL. It therefore expands our knowledge on a poorly understood area of the physician workforce. The study sample is drawn from the entire available population of specialists in NL from 1993 to 2007. The sample size is comparable to previous research in this area.

We also avoided many of the limitations identified in other retention studies (Pathman et al., 1994). The retrospective cohort design allowed us to track specialists over a long period of time. By examining both the proportion that remained at the end of the follow-up period and the length of time physicians practised in NL, we are able to

contribute a more complete understanding of specialist retention in the province. The use of Cox regression was suitable for analyzing right-censored data and allowed us to control for potential confounders. We also used an inception cohort instead of a prevalence cohort thereby reducing bias in the study from "long-term stayers" (Pathman et al., 1994).

5.5 Study Limitations

This study has a number of limitations. There was difficulty in accurately determining the start and end dates of a physician's practice in NL which may have affected our analysis of the length of practice variable. This was due to CPSNL record keeping during part of the 1990s when only the most recent status of a physician's practice was recorded. For example, if a physician entered practice and then left, only the date he or she left would be recorded. Therefore it is possible that a specialist may have begun as a locum, left, then returned to NL in a permanent position. Our analysis would not capture this. However, this appears to be a problem limited to Cohort II. As well, we were able to use an alternative algorithm to determine the start and end dates for these cases based on other data available.

The CPSNL database also did not differentiate between full GP licenses versus full specialist licenses. As a result, physicians practicing in NL prior to 1993 as GPs, who eventually completed speciality training out-of-province and subsequently returned as specialists, would be excluded from the analysis. Although we may have excluded these physicians, we do not believe this subgroup to be large enough to affect our analysis. Likewise, practice location data were not reliable for physicians. Only the current practice

locations and addresses of residences were recorded. It is therefore impossible to examine intra-provincial migration of specialists. As well, it was not possible to exclude "fly-in super-specialists" who maintain an active medical license but primarily live and work outside the province. However, we believe the number of "fly-in specialists" to be very low in our sample and therefore not a substantial issue in our analysis.

The use of administrative data limited the number of variables we could examine. We were not able to examine the effect of variables like marital status, number of children, etc., which may impact retention.

The Cox regression analysis also has limitations. It assumes that there is a constant probability of the event (i.e. physicians leaving) occurring. As well, highly correlated covariates may result in multi-colinearity which is a concern when using Cox regression (Tabachnick and Fiddell, 2001). However, we did not detect large standard error values indicative of multi-colinearity during our final analysis.

The somewhat low number of physicians in each cohort resulted in wide confidence intervals for some variables. However, using two shorter cohorts allowed us to compare retention between 1990s and 2000s. This also shielded cohort I from the various limitations in the CPSNL database, thereby strengthening the validity of this analysis. As well, there were a small number of fully-licensed IMGs in cohort I. Because we had sufficient numbers for analysis of this variable in cohort II, we elected to include fully-licensed IMGs in cohort I to maintain consistency in our analysis.

Chapter 6 – Conclusion

6.1 Summary of Findings

This study used administrative data on specialist physicians licensed in NL from 1993 to 2007. We formed two inception cohorts (cohort I: 2000-2004, n=180, cohort II: 1993-1997, n=211) and followed them retrospectively for up to 8 and 15 years, respectively. This allowed us to track specialists as they entered and exited practice in the province.

The retention of specialist physicians has improved in NL since the 1990s. By the end of follow-up, the retention rate for cohort I was 50.6% (median time: 66 months) and the retention rate for cohort II was 15.6% (median time: 35 months). In both cohorts, a larger proportion of MMGs than other physicians were likely to remain working in NL at the end of the follow-up period. MMGs also worked longer in the province than their IMG and CMG counterparts..

We found that IMGs, particularly IMG(Prov), made up a substantial proportion of physicians in each cohort. NL is dependent on provisionally licensed physicians to sustain its specialist workforce. We also found that roughly a third or more of physicians in each cohort were not certified by the RCPSC at the end of the follow-up period.

The recruitment and retention of specialist physicians is a substantial investment of the health care system's resources in NL. This study indicates that, while retention rates have improved, over time a high proportion of specialists leave the province. It also highlights the need to continue research on the physician workforce. MUN has made

substantial contributions to the specialist supply in NL and efforts should continue to improve the recruitment of locally-trained physicians.

6.2 Recommendations

Based on the results of this study we make the following recommendations:

1) *NL should continue the provisional licensing program.* The results of this study indicate that provisionally-licensed physicians make up a substantial proportion of the specialist workforce in the province. With NL's current human resources challenges there is insufficient domestic supply to maintain current staffing levels without provisionally licensed physicians.
2) *NL should improve its recruitment of MMGs.* MMGs specialists are more likely to remain in NL and practise for a longer period of time in the province than other physician groups. Therefore, physician workforce planners should consider initiatives to recruit locally trained specialists.
3) *Explore means of increasing specialist training in NL.* Completing some or all residency training in NL is a strong predictor of working in NL. Where possible, expanding opportunities for specialist post-graduate training should be considered.
4) *Improved data are required for more extensive research on specialist retention.* Available administrative data is limited in the number of variables which can be extracted. For example, because of limitations in the CPSNL registration database we were unable to track intraprovincial movement of specialist physicians over time. Improved datasets, with more variables, would allow for an expanded analysis of factors related to retention in NL.

5) *Continue research on specialist physicians in NL.* This study raises a number of additional topics for further study. For example, some US studies have linked board-certification with improved clinical outcomes (Sharp et al., 2002). This study indicated that NL is highly reliant on non-certified specialists to bolster its specialist supply. There is a need to determine if non-certified physicians in NL provide the same quality of care as their certified counterparts. In addition, studies using qualitative methods may provide information that cannot be addressed through administrative data or quantitative analyses.

References

Accreditation Council for Graduate Medical Education. (2009). About ACGME. Retrieved April 10, 2009 from http://www.acgme.org/acWebsite/home/home.asp

AIT Chapter 7. (2008). Chapter seven: Labor mobility: Attachment 1 to ninth protocol of amendment. Retrieved May 27 from: http://www.aved.gov.bc.ca/labourmobility/docs/AITchapter7.pdf

Association of Faculties of Medicine of Canada. (2009). Committee on the Accreditation of Canadian Medical Schools. Retrieved May 10, 2009 from: http://www.afmc.ca/education-cacms-e.php

Audas, R., Ross, A., & Vardy, D. (2005). The use of provisionally licensed international medical graduates in Canada. *CMAJ, 173*(11), 1315-1316

Audas, R., Ryan, A., Vardy, D. (2009). Where did the doctors go? A study of the retention and migration of provisionally licensed international medical graduate practicing in Newfoundland and Labrador between 1995 to 2006. CJRM, 14(1), 21-24

Canadian Institute for Health Information. (2004). Analytical bulletin: certified and non-certified specialists: understanding the numbers. Retrieved January 10, 2009 from http://secure.cihi.ca/cihiweb/en/downloads/PDAB2_final_en.pdf

Canadian Institute for Health Information. (1997). *Supply and distribution of Canadian physicians: selected years 1965-1995*. Ottawa: Canadian Institute for Health Information

Canadian Institute for Health Information. (2001). *Supply, distribution, and migration of Canadian physicians*, 2000. Ottawa: Canadian Institute for Health Information

Canadian Institute for Health Information. (2005). *Supply, distribution, and migration of Canadian physicians, 2004*. Ottawa: Canadian Institute for Health Information.

Canadian Institute for Health Information. (2008). *Supply, distribution, and migration of Canadian physicians, 2007*. Ottawa: Canadian Institute for Health Information.

Canadian Residency Matching Service. (2008). R-1 Eligibility Basic Criteria. Canadian Residency Matching Service. Retrieved March 2, 2009 from: http://www.carms.ca/eng/r1_eligibility_e.shtml

Canadian Residency Matching Service. (2008A). R-1 Eligibility – Provincial Restrictions. Retrieved March 2, 2009 from http://www.carms.ca/eng/r1_eligibility_prov_e.shtml

Canadian Residency Matching Service. (2009). Program Descriptions. Retrieved March 15, 2009 from http://www.carms.ca

CBC News. (2008, May 4). Get chequebook out, doctors tell N.L. over pathologists shortage. Retrieved from http://www.cbc.ca/canada/newfoundland-labrador/story/2008/05/03/pathology-shortage.html

Chan, B.T.B. (2002). *From perceived surplus to perceived shortage: What happened to Canada's physician workforce in the 1990s*. Ottawa: Canadian Institute for Health Information.

College of Physicians and Surgeons of Newfoundland and Labrador. (2006). Registration and Licensure. Retrieved October 25, 2007 from http://www.cpsnl.ca/Registration.asp

College of Physicians and Surgeons of Newfoundland and Labrador. (2006A). By-Law No.4. Retrieved April 11, 2009 from: http://www.nmb.ca/ByLawDocument.asp?ID=4

Fleming, P., Mathews, M., Seguin, M., Card, R. (no date). Specialists Retention in Canada: Factors Related to Provincial and National Retention. Manuscript in preparation.

Government of Canada. (2009). Backgrounder – Agreement on Internal Trade. Retrieved May 27, 2009 from http://pm.gc.ca/eng/media.asp?id=2385

Government of Newfoundland and Labrador, Department of Health and Community Services. (2002). *Healthier together: A strategic health plan for Newfoundland and Labrador* . St. John's, NL.

Government of Newfoundland and Labrador. (2001). Recruitment and retention of physicians a priority. Retrieved December 14, 2007 from http://www.releases.gov.nl.ca/releases/2001/health/0322n37.htm

Katz, A.N., DeWals, P., West, L.J.. (2008). Report of the inquiry of employer misconduct at Memorial University of Newfoundland and Eastern Health Corporation. Retrieved June 2, 2009 from: http://www.popadiukinquiry.ca/Popadiuk%20Inquiry%20Report%20March%2008.pdf

Kirby, M.J.L. (2002) The health of Canadians: The federal role. Retrieved October 5, 2007 from: http://www.parl.g c.ca/37/2/parlbus/commbus/senate/Com-e/soci-e/rep -e/repoct02vol6-e.pdf

Kupfer, D.J., Hyman, S.E., Schatzberg A.F., Pincus, H.A., Reynolds CF. (2002). Recruiting and Retaining Future Generations of Physician Scientists in Mental Health. *Arch Gen Psychiatry*, 59, 657-66

Law, S., Flood, C., & Gagnon D.. (2008). Listening for directions III: National consultation on health services and policy issues, 2007-2010. Canadian Health Services Research Foundation. Retrieved from: http://www.chsrf.ca/other_documents/listening/documents/LfDIII-FINAL_ENG.pdf

Liaison Committee on Medical Education. (2009). Overview: Accreditation and the LCME. Retrieved May 15, 2009 from: http://www.lcme.org/overview.htm

Mayo, E., & Mathews, M. (2006). Spousal perspectives on factors influencing recruitment and retention of rural family physicians. *CJRM, 11*(4), 271-276.

Mathews, M., Edwards, A.C., Rourke, J.T.B. (2008). Retention of provisionally licensed international medical graduates: A historical cohort study of general and family physicians in Newfoundland and Labrador. Open Medicine, 2(2), e37-44.

Mathews, M., Park, A., Rourke, J.T.B. (2007). Retention of international medical graduates following postgraduate medical training in Newfoundland and Labrador. Healthcare Policy, 3(2), 50-57.

Mathews, M., Rourke, J. T., & Park, A. (2006). National and provincial retention of medical graduates of Memorial University of Newfoundland. *CMAJ, 175*(4), 357-360.

McKendry, R.J.R., Wells, G.A., Dale, P., Adams, O., Burske, L., Strachan, J., Flor, L. (1996). Factors influencing the emigration of physicians from Canada to the United States. CMAJ, 154(2), 171-181.

Medical Act 2005, SNL2005. S 17, 12, 22-23. Retrieved Janurary15, 2009 from: http://www.assembly.nl.ca/legislation/sr/statutes/m04-01.htm

Medical Board Regulations under the Medical Act. CNLR 1113/96. S 3-7, 10.3, 12-13. Retrieved May 15, 2009 from http://www.assembly.nl.ca/Legislation/sr/Regulations/rc961113.htm

Medical Council of Canada. (2008). Licentiate of the medical council of Canada. Retrieved April 15, 2009 from: http://www.mcc.ca/en/mcc_docs/licentiate.shtml

Moskowitz, J. & Thompson, J.N. (2001). Enhancing the clinical research pipeline: Training approaches for a new century. *Academic Medicine*, 76, 307-315.

Mullan, F. (2005). The metrics of the physician brain drain. *NEJM, 353*(17), 1810-1818

Pathman, D.E., Konrad, T.R., & Agnew, C.R. (1994). Studying the retention of rural physicians. The Journal of Rural Health, 10(3) 183-192

Phillips, R.L., Petterson, S., Fryer, G.E., Rosser, E. (2007). The Canadian contribution to the US physician workforce. CMAJ, 176(8), 1083-1087.

Romanow, R. (2002) Commission on the future of healthcare in Canada. *Building on values: the future of health care.* Retrieved October 9, 2007 from http://www.hc-sc.gc.ca/english/pdf/romanow/pdfs/HCC_Final_Report.pdf

Royal College of Physicians and Surgeons of Canada. (2005). By-Law Number 15. Retrieved De cember 11, 2008 from: http://rcpsc.medical.or g/publications/bylaw15_e.html#art4

Royal College of Physicians and Surgeons of Canada. (2007). Membership in the Royal College. Retrieved June 1, 2009 from: http://rcpsc.medical.org/membership/index.php

Royal College of Physicians and Surgeons of Canada. (2008). Policies and Procedures for Certification and F ellowship. Retrieved March 1, 2009 from http://www.rcpsc.medica l.org/residency/certification/policy-procedures_e.pdf

Royal College of Physicians and Surgeons of Canada. (2008A). International Medical Graduates. Retrieved March 1, 2009 from http://www.rcpsc.medica l.org/residency/certification/img_e.php

Royal College of Physicians and Surgeons of Canada. (2009). One step forward – two steps back? A discussion paper on physician mobility in Canada. Retrieved June 1, 2009 from: http://rcpsc.medical.org/publicpolicy/Physician%20Mobility%20Paper_e_fe.pdf

Ryten, E., Thurber, A. D., & Buske, L. (1998). The class of 1989 and physician supply in Canada. *CMAJ, 158*(6), 723-728.

Sharp, L. K., Bashook, P. G., Lipsky, M. S., Horowitz, S. D., & Miller, S. H. (2002). Specialty board certification and clinical outcomes: The missing link. *Academic Medicine: Journal of the Association of American Medical Colleges, 77*(6), 534-542.

Strategic Resource Management Committee. (2008). Medical Education Expansion Planning. Retrieved September 10, 2008 from http://www.med.mun.ca/getdoc/dc4a176f-71b4-4f33-bf9b-014a9e52a57f/MEDICINE-EXPANSION-PLANNING.aspx

Sullivan, P. (2009, February 5). New rules may strip rural, remote areas of their physicians, colleges warn. *Canadian Medical Association*. Retrieved from http://www.cma.ca/index.cfm?ci_id=10043185&la_id=1

Tabachnick, B.G., & Fiddell, L.S. (2001). Using multivariate statistics: fourth edition. Needham Heights, MA: Allyn & Bacon.

Walsh, P. (2008, December 20). Medical exodus looming. *The Telegram*. Retrieved from http://www.thetelegram.com/index.cfm?sid=203112&sc=79

Walsh, P. (2008A, April 17). Doctor's resignation a shock. *The Telegram*. Retrieved from http://www.thetelegram.com/index.cfm?sid=126916&sc=79

Weinert, C.R., Billings, J., Ryan, R., Ingbar, D.H. (2006). Academic and Career Development of Pulmonary and Critical Care Physician-Scientists. *Am J Respir Crit Care Med,* 173, 23-31.

Appendix A – Summary of Variables used in Data Analysis

Table A1 – Summary of Variables used in Data Analysis

Variable Type/Name	Variable Description	Coding
DEPENDENT		
Stayed in NL	In NL at end of study period	0= No 1= Yes
Total Time in NL	Total time in months a physician practised in NL after initial license	N/A
INDEPENDENT		
Physician Group	Type of Physician	0 = MMG 1 = CMG 2 = IMG(Prov) 3 = IMG(Full)
COVARIATES		
Sex	Gender	0 = Male 1 = Female
Practice Location	Urban or Rural population (<10 000)	0 = Rural 1 = Urban
FRCPC/FRCSC Status	Held FRCPC/FRCSC designation	0 = No 1 = Yes
Certification Status	Certified by the RCPSC	0 = No 1 = Yes
Specialist Group	Nature of speciality practice/training	0 = Clinical 1 = Laboratory 2 = Surgical
Decade of Graduation	Decade physician graduated from medical school	0 = <1973 1 = 1973-1979 2 = 1980-1989 3 = 1990-1999
Age	Current age as of 2008 in years	N/A
Age at graduation	Age during year of graduation from medical school	N/A

MUN Residency	Completed all or some residency training at MUN	0 = No 1 = Yes
SUPPLEMENTARY VARIABLES		
Speciality Type	Highest accredited level of training achieved	0 = Laboratory Medicine 1 = Anaesthesiology 2 = General internal medicine 3 = Internal Medicine Subspecialties & Related 4 = Radiology 5 = General Surgery 6 = Specialized Surgery 7 = Obstetrics & Gynaecology 8 = Orthopaedic Surgery 9 = Pediatrics 10 – Psychiatry 11 Other
Returned to NL	Returned to NL after leaving	0 = No 1 = As locum tenens 2 = As a permanent position
Time to get full license	Total time for an IMG(Prov) receive a full license	N/A
Country/Region of Graduation	Geographic region in which a physician graduated from medical school	0 = Canada 1 = Other 2 = Europe 3 = Southeast Asia 4 = Africa 5 = Middle-East

Canadian region of graduation	Country or region in which a Canadian physician graduated from medical school	0 = NL 1 = Nova Scotia 2 = Quebec 3 = Ontario 4 = Western

Appendix B – Letter of Approval from the MUN Human Investigations Committee

MEMORIAL UNIVERSITY

Faculty of Medicine

www.mun.ca

March 7, 2008

Reference #08.46

Mr. Patrick Fleming

Dear Mr. Fleming:

Your application entitled "Retention of Specialist Physicians in Newfoundland and Labrador" was reviewed by a Sub-Committee of the Human Investigation Committee and **full approval** was granted.

This will be reported to the full Human Investigation Committee, for their information, at the meeting scheduled for March 13, 2008.

Full approval has been granted for one year. You will be contacted to complete the annual form update approximately 8 weeks before the approval will lapse on March 6, 2009. It is your responsibility to ensure that the renewal form is forwarded to the HIC office not less than 30 days prior to the renewal date for review and approval to continue the study. The annual renewal form can be downloaded from the HIC website http://www.med.mun.ca/hic/downloads/Annual%20Update%20Form.doc.

For a hospital-based study, it is **your responsibility to seek the necessary approval from Eastern Health and/or other hospital boards as appropriate**.

The Human Investigation Committee advises THAT IF YOU DO NOT return the completed annual update form prior to or on the aforementioned date of renewal:

* ***Your ethics approval will lapse***
* ***You will be required to stop research activity immediately***
* ***You will not be permitted to restart the study until you reapply for and receive approval to undertake the study again***

In addition, the Human Investigation Committee will inform the appropriate authorities. To ensure proper action is taken; the appropriate officials will be notified to terminate funding.

This Research Ethics Board (the HIC) has reviewed and approved the application for the study which is to be conducted by you as the qualified investigator named above at the specified study site. This approval and the views of this Research Ethics Board have been documented in writing. In addition, please be advised that the Human Investigation Committee currently operates according to the Tri-Council Policy Statement and applicable laws and regulations.

Notwithstanding the approval of the HIC, the primary responsibility for the ethical conduct of the investigation remains with you.

We wish you success with your study.

Sincerely,

John D. Harnett, MD, FRCPC
Co-Chair
Human Investigation Committee

Richard S. Neuman, PhD
Co-Chair
Human Investigation Committee

JDH;RSN\jd

C Dr. C. Loomis, Vice-President (Research), MUN
Mr. W. Miller, Senior Director, Corporate Strategy & Research, Eastern Health

Appendix C – Supplementary Analysis Data Tables for Cohort I

Table C1 – Location of Undergraduate Medical Training for CMGs first licensed from 2000-2004 (n=16)

Characteristic	n (%)
Region of Medical School	
Nova Scotia	4 (25.0)
Quebec	5 (31.2)
Ontario	5 (31.2)
Western Canada	2 (12.4)

Table C2 – Characteristics of Provisionally Licensed IMGs who were First Licensed from 2000-2004 (n=95)

Characteristic	n (%)
Region of Medical School	
Europe	8 (8.5)
Southeast Asia	50 (53.2)
Africa	19 (20.2)
Middle-East	14 (14.9)
Other	3 (3.2)
Fully Certified	
No	73 (77.7)
Yes	21 (22.3)
FRCPC/S	
No	73 (77.7)
Yes	21 (22.3)
Time to get full license* (months)	
Mean (sd)	48.3 (17.3)
Median	51.0

*Of those who received a full license

Table C3 – Proportions of Physicians Initially Licensed between 2000-2004 Based on Speciality Type (n=180)

Characteristic	Stayed n (%)	Left n (%)	Total Number
Specialist Type			
Laboratory Medicine	6 (46.2)	7 (53.8)	13
Anaesthesia	2 (13.3)	13 (86.7)	15
General Internal Medicine	7 (33.3)	14 (66.7)	21
Internal Medicine Subspecialties	18 (69.2)	8 (30.8)	26
Radiology*	2 (28.6)	5 (71.4)	7
General Surgery	9 (45.0)	11 (55.0)	20
Specialized Surgery	8 (66.7)	4 (33.3)	12
Obstetrics & Gynaecology	7 (63.6)	4 (36.4)	11
Orthopaedic Surgery	3 (33.3)	6 (66.7)	9
Paediatrics**	7 (53.8)	6 (46.2)	13
Psychiatry	13 (65.0)	7 (35.0)	20
Other***	9 (75.0)	3 (25.0)	12

*Includes Diagnostic Radiology and Nuclear Medicine
** Includes specialized paediatrics
*** Includes Dermatology, Emergency Medicine, Neurology, Physical Medicine & Rehabilitation (Physiatry), and Radiation Oncology.

Appendix D – Data Tables for Sensitively Analysis Cohort I

Table D1 – Comparison of the Characteristics of the Physicians who were Licensed to Practise in NL, Including Locums (n=289) versus Excluding Locums (n=180), 2000-2004

Characteristic	Including Locums n (%)*	Excluding Locums n (%)*
Physician Group		
MMG	82 (28.4)	61 (33.9)
CMG	60 (20.8)	16 (8.9)
IMG(Prov)	129 (44.6)	94 (52.2)
IMG(Full)	18 (6.2)	9 (5.0)
Sex		
Male	213 (73.7)	131 (72.8)
Female	76 (26.3)	49 (27.2)
Have FRCPC/S		
No	117 (40.5)	86 (47.8)
Yes	172 (59.5)	94 (52.2)
Fully Certified		
No	119 (41.2)	85 (47.2)
Yes	170 (58.8)	95 (52.8)
Decade of Graduation		
<1973	20 (6.9)	5 (2.8)
1973-79	21 (7.3)	9 (5.0)
1980-89	93 (32.2)	60 (33.3)
1990-99	155 (53.6)	106 (58.9)
Did some or all of residency at MUN		
No	215(74.4)	127 (70.6)
Yes	74(25.6)	53 (29.4)
Speciality Group		
Clinical	186 (64.4)	114 (63.3)
Laboratory	13 (4.5)	13 (7.2)
Surgical	89 (30.8)	52 (28.9)
Locum		
No	180 (62.3)	N/A
Yes	109 (37.7)	N/A
Retention		
Never Left	93 (32.2)	91 (50.6)
Left	95 (32.9)	47 (26.1)
Left and returned as locum	84 (29.1)	33 (18.3)
Left and returned as permanent	17 (5.9)	9 (5.0)
Age (at 2008)		
Mean (sd)	45.6 (9.2)	44.0 (7.1)
Median	43.0	43.0
Age at Graduation		
Mean(sd)	25.9 (3.2)	26.2 (3.7)
Median	25.0	25.0

Total time (months)		
Mean(sd)	29.4 (30.1)	44.0 (7.1)
Median	19.5	43.0

*Except for age, age at graduation, and total time

Table D2 – Proportions of Physicians Initially Licensed between 2000-2004 Based on Speciality type, Including Locums (n=289)

Characteristic	Stayed n (%)	Left n (%)	Total number
Specialist Type			
Laboratory Medicine	6 (46.2)	7 (53.8)	13
Anaesthesia	2 (8.3)	22 (91.7)	24
General Internal Medicine	7 (23.3)	23 (76.7)	30
Internal Medicine Subspecialties	18 (64.3)	10 (35.7)	28
Radiology*	3 (11.1)	24 (88.9)	27
General Surgery	10 (30.3)	23 (69.7)	33
Specialized Surgery	8 (38.1)	13 (61.9)	21
Obstetrics & Gynaecology	7 (38.9)	11 (61.1)	18
Orthopaedic Surgery	3 (18.8)	13 (81.2)	16
Paediatrics**	7 (22.6)	24 (81.2)	31
Psychiatry	13 (41.9)	18 (58.1)	31
Other***	9 (56.2)	7 (43.8)	16

*Includes Diagnostic Radiology and Nuclear Medicine

** Includes specialized paediatrics

*** Includes Dermatology, Emergency Medicine, Neurology, Physical Medicine & Rehabilitation (Physiatrist), and Radiation Oncology.

Table D3 – Characteristics of Physicians who Stayed and Left that were First Licensed from 2000-2004, Including Locums (n=289)

Characteristic	Stayed n (%)*	Left n (%)*	p-value
Physician Group**			<0.000
MMG	43 (46.7)	39 (21.8)	
CMG	7 (7.6)	53 (29.6)	
IMG(Prov)	42 (45.7)	87 (48.6)	
Sex			0.065
Male	62 (66.7)	151 (77.0)	
Female	31 (33.3)	45 (23.0)	
Age (at 2008)			0.083
Mean (sd)	44.3 (7.2)	46.3 (10.0)	
Age at Graduation			<0.000
Mean(sd)	27.0 (4.3)	25.4 (2.4)	
Have FRCPC/S			0.702
No	36 (38.7)	81 (41.3)	
Yes	57 (61.3)	115 (58.7)	
Fully Certified			0.444
No	35 (37.6)	84 (42.9)	
Yes	58 (62.4)	112 (57.1)	
Decade of Graduation			0.053
<1973	2 (2.2)	18 (9.2)	
1973-79	4 (4.3)	17 (8.7)	
1980-89	30 (32.3)	63 (32.1)	
1990-98	57 (61.3)	98 (50.0)	
Did some or all of residency at MUN			0.004
No	59 (63.4)	156 (79.6)	
Yes	34 (36.6)	40 (20.4)	
Speciality Group			0.549
Clinical	59 (63.4)	127 (65.1)	
Laboratory	6 (6.5)	7 (3.6)	
Surgical	28 (30.1)	61 (31.3)	
Total time (months)			<0.000
Mean(sd)	63.8 (17.1)	13.0 (19.1)	

*Except for age, age at graduation, and total time
** IMGs(Full) suppressed from analysis

Appendix E – Supplementary Data Tables for Cohort II

Table E1 – Location of Undergraduate Medical Training for CMGs First Licensed from 1993-1997 (n=34)

Characteristic	n (%)
Region of Medical School	
Nova Scotia	11 (32.4)
Quebec	4 (11.8)
Ontario	12 (35.3)
Western Canada	7 (20.6)

Table E2 – Characteristics of provisionally IMGs who were First Licensed from 1993-1997 (n=102)

Characteristic	n (%)
Region of Medical School	
Europe	11 (10.8)
Southeast Asia	44 (43.1)
Africa	38 (37.1)
Middle-East	7 (6.9)
Other	2 (2.0)
Fully Certified	
No	61 (59.8)
Yes	41 (40.2)
FRCPC/S	
No	60 (58.8)
Yes	42 (41.2)
Time to get full license* (months)	
Mean(sd)	49.2 (36.5)
Median	37.0

*Of those who received a full license

Table E3 – Proportions of Physicians Initially Licensed between 1993-1997 Based on Speciality Type (n=210)

Characteristic	Stayed n (%)	Left n (%)	Total
Specialist Type			
Laboratory Medicine	3 (16.7)	15 (83.3)	18
Anaesthesia	4 (14.8)	23 (85.2)	27
General Internal Medicine	4 (18.2)	18 (81.8)	22
Internal Medicine Subspecialties	3 (33.3)	6 (66.7)	9
Radiology*	0 (0.0)	12 (100.0)	12
General Surgery	4 (20.0)	16 (80.0)	20
Specialized Surgery	1 (7.7)	12 (92.3)	13
Obstetrics & Gynaecology	0 (0.0)	25 (100.0)	25
Orthopaedic Surgery	2 (16.7)	10 (83.3)	12
Paediatrics**	5 (25.0)	15 (75.0)	20
Psychiatry	6 (27.3)	16 (72.7)	22
Other***	1 (10.0)	9 (90.0)	10

*Includes Diagnostic Radiology and Nuclear Medicine

** Includes specialized paediatrics

*** Includes Dermatology, Emergency Medicine, Neurology, Physical Medicine & Rehabilitation (Physiatrist), and Radiation Oncology.

Appendix F – Data Tables for Sensitively Analysis for Cohort II

Table F1 – Comparison of Characteristics of the Physicians who were Licensed to Practise in NL, Including Locums (n=280) and Excluding Locums (n=211), 1993-1997

Characteristic	Including Locums n (%)*	Excluding Locums n (%)*
Physician Group		
MMG	40 (14.3)	38 (18.0)
CMG	64 (22.9)	34 (16.1)
IMG(Prov)	124 (44.3)	102 (48.3)
IMG(Full)	52 (18.6)	37 (17.5)
Sex		
Male	220 (78.6)	161 (76.3)
Female	60 (21.4)	50 (23.7)
Have FRCPC/S		
No	90 (32.1)	68 (32.3)
Yes	190 (67.9)	143 (67.8)
Fully Certified		
No	87 (31.1)	66 (31.3)
Yes	193 (68.9)	145 (68.7)
Decade of Graduation		
<1973	43 (15.4)	28 (13.3)
1973-79	63 (22.5)	45 (21.3)
1980-89	139 (49.6)	107 (50.7)
1990-99	34 (21.1)	30 (14.2)
Did some or all of residency at MUN		
No	210 (75.0)	153 (72.5)
Yes	70 (25.0)	58 (27.5)
Speciality Group		
Clinical	166 (59.3)	122 (57.8)
Laboratory	24 (8.6)	18 (8.5)
Surgical	89 (31.8)	70 (33.2)
Locum		
No	211 (75.4)	211 (100.0)
Yes	69 (24.6)	0 (0.0)
Retention		
Never Left	33 (11.8)	33 (15.6)
Left	206 (73.6)	140 (66.3)
Left and returned as locum	20 (7.1).	19 (9.0)
Left and returned as permanent	21 (7.5)	19 (9.0)
Age (at 2008)		
Mean (sd)	56.4 (57.1)	52.2 (8.2)
Median	52.0	51.0
Age at Graduation		
Mean(sd)	25.2 (2.2)	25.1 (2.1)
Median	25.0	25.0

Total time (months)		
Mean(sd)	41.2 (48.9)	54.2 (49.8)
Median	24.0	35.0

*Except for age, age at graduation, and total time

Table F2 – Proportions of Physicians who Stayed or Left that were First Licensed between 1993-1997 Based on Speciality Type, Including Locums(n=280)

Characteristic	Stayed n(%)	Left n(%)	Total
Specialist Type			
Laboratory Medicine	3 (12.5)	21 (87.5)	24
Anaesthesia	4 (10.5)	34 (89.5)	38
General Internal Medicine	4 (14.3)	24 (85.7)	28
Internal Medicine Subspecialties	3 (33.3)	6 (66.7)	9
Radiology*	0 (0.0)	16 (100.0)	16
General Surgery	4 (18.2)	18 (81.8)	22
Specialized Surgery	1 (5.3)	18 (94.7)	19
Obstetrics & Gynaecology	0 (0.0)	34 (100.0)	34
Orthopaedic Surgery	2 (14.3)	12 (85.7)	14
Paediatrics**	5 (14.3)	30 (85.7)	35
Psychiatry	6 (25.0)	18 (75.0)	24
Other***	1 (6.2)	15 (93.8)	16

*Includes Diagnostic Radiology and Nuclear Medicine

** Includes specialized paediatrics

*** Includes Dermatology, Emergency Medicine, Neurology, Physical Medicine & Rehabilitation (Physiatrist), and Radiation Oncology.

Table F3 – Characteristics of Physicians who Stayed and Left that were First Licensed from 1993-1997, Including Locums (n=229)

Characteristic	Stayed n (%)*	Left n (%)*	p-value
Physician Group			<0.000
MMG	15 (45.5)	25 (10.1)	
CMG	6 (18.2)	58 (23.5)	
IMG(Prov)	5 (15.2)	119 (48.2)	
IMG(Full)	7 (21.2)	45 (18.2)	
Sex			0.111
Male	22 (66.7)	198 (80.2)	
Female	11 (33.3)	49 (19.8)	
Age (at 2008)			0.405
Mean (sd)	48.6 (7.7)	57.4 (60.7)	
Age at Graduation			0.269
Mean(sd)	24.8 (1.33	25.3 (2.3)	
Have FRCPC/S			0.029
No	5 (15.2)	85 (34.4)	
Yes	28 (84.8)	162 (65.6)	
Fully Certified			0.044
No	5 (15.2)	82 (33.2)	
Yes	28 (84.8)	165 (66.8)	
Decade of Graduation			0.001
<1973	3 (9.1)	40 (16.3)	
1973-79	5 (15.2)	58 (23.6)	
1980-89	14 (42.4)	125 (50.8)	
1990-98	11 (33.3)	23 (9.3)	
Did some or all of residency at MUN			<0.000
No	14 (42.4)	196 (79.4)	
Yes	19 (57.6)	51 (20.6)	
Speciality Type			0.367
Clinical	23 (69.7)	143 (58.1)	
Laboratory	3 (9.1)	21 (8.5)	
Surgical	7 (21.2)	82 (33.3)	
Total time (months)			<0.000
Mean (sd)	151 (21.8)	26.5 (28.5)	

*Except for age, age at graduation, and total time

Appendix G – Comparison of Cohort I and Cohort II

Table G1 – Comparison of Cohort I (2000-2004) and Cohort II (1993-1997) n=391

Characteristic	Cohort I n (%)*	Cohort II n (%)*	p-value
Physician Group			<0.000
MMG	61 (33.9)	38 (18.0)	
CMG	16 (8.9)	34 (16.1)	
IMG(Prov)	94 (52.2)	102 (48.3)	
IMG(Full)	9 (5.0)	37 (17.5)	
Sex			0.561
Male	131 (72.8)	161 (76.3)	
Female	49 (27.2)	50 (23.7)	
Have FRCPC/S			0.001
No	86 (47.8)	68 (32.3)	
Yes	94 (52.2)	143 (67.8)	
Fully Certified			0.001
No	85 (47.2)	66 (31.3)	
Yes	95 (52.8)	145 (68.7)	
Decade of Graduation			<0.000
<1973	5 (2.8)	28 (13.3)	
1973-79	9 (5.0)	45 (21.3)	
1980-89	60 (33.3)	107 (50.7)	
1990-98	106 (58.9)	30 (14.2)	
Did some or all of residency at MUN			0.572
No	127 (70.6)	153 (72.5)	
Yes	53 (29.4)	58 (27.5)	
Left			<0.000
No	91 (50.6)	33 (15.6)	
Yes	89 (49.4)	178 (84.3)	
Came back after leaving?			<0.000
No	47 (52.8)	140 (66.3)	
As a locum	33 (37.1)	19 (9.0)	
As a permanent	9 (10.1)	19 (9.0)	
Speciality Type			0.530
Clinical	114 (63.7)	122 (57.8)	
Laboratory	13 (7.3)	18 (8.5)	
Surgical	52 (29.1)	70 (33.2)	
Age (at 2008)			<0.000
Mean (sd)	44.0 (7.1)	52.2 (8.2)	
Age at Graduation			0.001
Mean(sd)	26.2 (3.7)	25.1 (2.1)	
Total time (months)			<0.000
Median	66.0	35.0	

*Except for age, age graduation, and total time

Table G2 – Predictors of Physicians Leaving NL Based on Survival Analysis (Cox Regression) Comparing Cohort I with Cohort II (n=391)

Characteristic	Coefficient β	Standard Error	Wald X^2	Hazard Ratio	p-value	95% CI
Cohort			12.00		0.001	0.475-0.814
Cohort II* (93-97)	--	--	--	1.00	--	--
Cohort I (00-04)	-0.475	0.137		0.622	0.001	0.475-0.814
Physician Group			18.55		<0.000	
MMG*	--	--	--	--	--	--
CMG	0.688	0.227	9.23	1.99	0.002	1.28-3.10
IMG(Prov)	0.746	0.175	18.19	2.11	<0.000	1.50-3.00
IMG(Full)	0.618	0.228	7.33	1.86	0.007	1.19-2.90

* Reference category

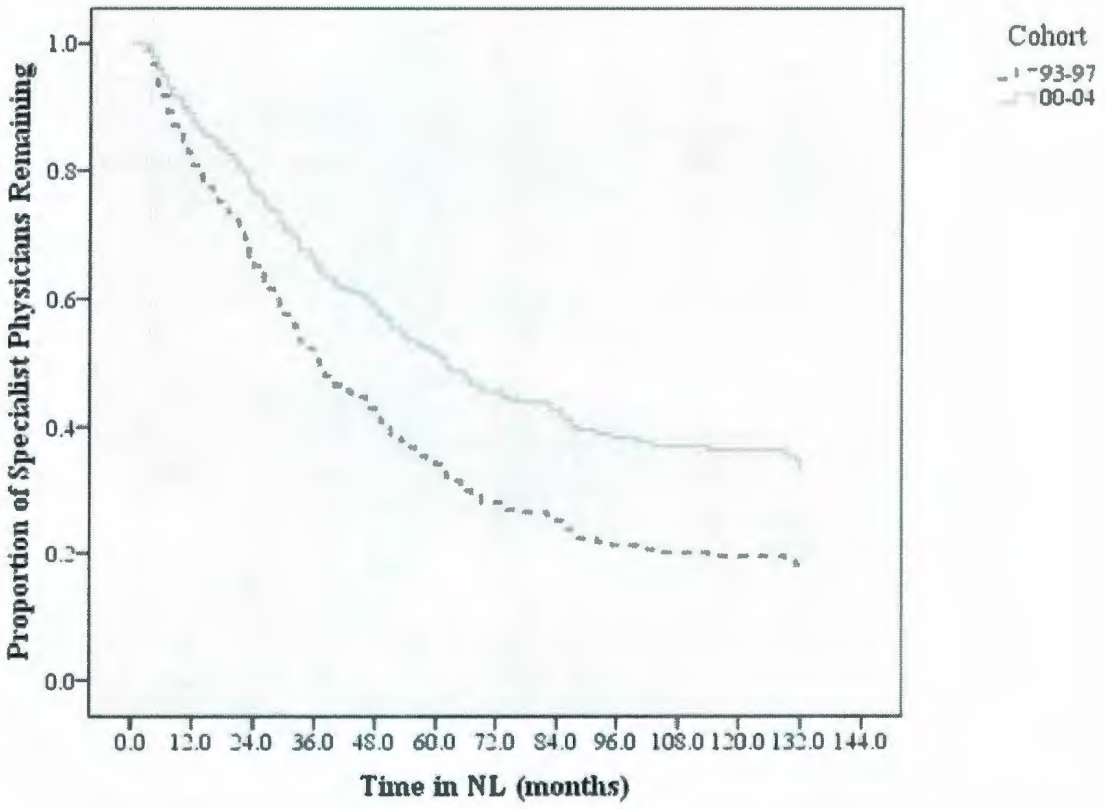

Figure G1 – Survival Curve Obtained from Cox Regression Comparing Cohort I and Cohort II