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How Family Physicians in Saskatchewan Make Lung Cancer Screening Decisions

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A thesis submitted in partial fulfillment of the requirements for the Master of Clinical Science degree in Family Medicine

HOW FAMILY PHYSICIANS IN SASKATCHEWAN MAKE LUNG CANCER SCREENING DECISIONS

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By

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Abstract

Aims: This study explored family physicians' (FPs) stated practices and decision-making for lung cancer screening.

Methods: Cross-sectional survey of a stratified random sample of Saskatchewan FPs using single item questions and simulated clinical scenarios.

Findings: Wide variations in FPs' lung cancer screening practices exist in their decision to screen and choice of screening test. Certain physician, patient and non-medical factors influence FPs' decision-making contrary to their perception of guidelines.

Conclusions: The high self-reported prevalence and measured inclination to screen in clinical scenarios contrary to prevailing guidelines adds unnecessary health care costs and has potential to cause harm.

Significance: First and unique study regarding lung cancer screening in family practice in Canada. It contributes to the literature about existing FP practices and decision-making regarding lung cancer screening and highlights implications to health care cost, patient care and CME initiatives.

Keywords: Lung Cancer Screening, Decision-making, Clinical Practice Guidelines, Family Medicine.

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Finally, I wish to acknowledge the contribution of my husband Ken and my children Cameron, Sean and Joseph to this thesis and to my life.

Dedication

This thesis is dedicated to my father whose vision has always guided me and to my children Cameron, Sean and Joseph and to my niece Uzma Safia Jamil, whose quest for knowledge inspired me to complete this thesis.

Table of Contents

Abstract ii
Acknowledgements iii
Dedication iv
Table of Contents v
List of Figures vii
List of Tables viii
List of Acronyms, Abbreviations and Terminology ix
Chapter 1 Introduction 1
1.1 Chapter Overview 1
1.2 Literature Review 2
1.2.1 Significance of Lung Cancer 2
1.2.2 Lung Cancer Screening 2
1.2.3 Issues regarding Screening 6
1.2.4 Physicians' Attitudes about Screening In General 7
1.2.5 Physician attitude towards Cancer Screening 8
1.2.6 Physicians' attitudes and practices regarding Lung Cancer Screening 9
1.2.7 Physicians' attitudes towards use of Guidelines 10
1.2.8 Influence of Guidelines on Physician Behaviour 11
1.2.9 Current Evidence about Guidelines for Lung Cancer Screening 12
1.2.10 Post Survey – Recent Literature Summary 13
1.3 Identification of Research Opportunity 14
1.4 Research Questions 15
1.5 Objectives 16
Chapter 2 Methods 18
2.1 Introduction 18
2.2 Design 18
2.3 Sample 18
2.3.1 Inclusion Criteria 19
2.3.2 Exclusion Criteria 19
2.4 Survey Questionnaire Development 19
2.5 Variables 19
2.5.1 Outcomes 19
2.5.2 Predictor Variables 20
2.6 Data Collection 22
2.7 Data Entry 22
2.8 Data Analysis 23
2.9 Reliability and Validity 24
2.10 Ethics Approval 24
Chapter 3 Results 25
3.1 Introduction 25
3.2 Physician Factors and Screening Behaviour 27
3.3 Physician Attitudes & Practices by Screening Group 29
3.4 Physicians' Perceptions of Lung Cancer Screening Guidelines 32
3.5 Choice of Screening Test among *Screeners* by patient's smoking status 34
3.6 Influence of Non-medical Factors on Screening Behaviour 35

3.7 Influence of Lung Cancer in Self or Close Relative and Smoking on Screening Behaviour 36
3.8 Influence of Patient Factors in Clinical Vignettes 37
3.9 Influence of Patient Factors in Clinical Vignettes 38
3.10 Proportion of participants screening within each scenario by perception of screening recommendation 42
3.11 Conclusions 46
Chapter 4 Discussion 48
4.1 Introduction 48
4.2 Physician Factors and Screening Behaviour 48
4.3 Influence of Physician Attitudes on Screening Behaviour 49
4.4 Physicians' Perception of Lung Cancer Screening Guidelines 50
4.5 Choice of Screening Test among Screeners 51
4.6 Influence of Non-medical Factors on Screening Behaviour 52
4.7 Influence of Lung Cancer in Self or Anyone Close and Smoking Status on Screening Behaviour 52
4.8 Influence of Patient Factors in Clinical Scenarios 53
4.9 Implications 55
4.10 Strengths 56
4.11 Limitations 56
4.12 Direction for future research 57
References 58
Appendix A Lung Cancer Screening Survey Instrument 66
Appendix B Letter of Information 73
Appendix C Analysis of Tudiver Survey Instrument 76
C.1 Analysis 76
Appendix D Tudiver Survey Instrument 78
Appendix E Detailed Methods for Questionnaire Development 87
E.1 Questionnaire Design Methodology 87
E.2 Questionnaire Items 87
E.2.1 Section II Items to classify physicians as Screeners or Non-Screeners 88
E.2.2 Section III Clinical Case Vignettes 89
E.3 Reliability and Validity 90
Appendix F Ethics Approval 91
Appendix G Curriculum Vitae 93

List of Figures

Figure 1-1 Conceptual FP Lung Cancer Screening Decision Making Model 17

List of Tables

Table 1-1 National Lung Cancer Screening Guidelines 5
Table 1-2 Guidelines from Canadian Sources 5
Table 3-1 Physician Characteristics 26
Table 3-2 Physician Factors and Screening Behaviour 28
Table 3-3 Physicians' agreement with statements on attitudes and practices by screening group 30
Table 3-4 Perceptions of Lung Cancer Screening Guidelines 33
Table 3-5 Choice of Screening Test by Smoking Status among *Screeners* (n=34) 34
Table 3-6 Physician agreement that non-medical factors would influence test ordering behaviour 35
Table 3-7 Close experience with lung cancer and smoking status 36
Table 3-8 Proportions of participants screening using CXR, CT, or sputum cytology in uncomplicated and complicated scenarios 37
Table 3-9 Comparison of the proportions of participants screening using CXR, CT, or sputum cytology in uncomplicated versus complicated patient-physician interactions 40
Table 3-10 Proportion of participants screening within each scenario by perception of screening recommendation 44

List of Acronyms, Abbreviations and Terminology

Attitude	a pattern of mental views established by cumulative prior experience
Behaviour	what physicians do in a simulated or actual clinical setting
Beliefs	what physician holds as true, a physician factor
CCFP	Certification in Family Medicine, College of Family Physicians of Canada
CFPC	College of Family Physicians of Canada
CME	continuing medical education
CPSS	College of Physicians and Surgeons of Saskatchewan
CRC	colorectal cancer
CT	computed tomography imaging
CTFPHC	Canadian Task Force on Preventative Health Care
CXR	chest X-ray
DRE	digital rectal exam
EMR	electronic medical record (computer program)
FP	family physician
GP	general practioner
LDCT	low dose spiral CT
Perception	what physician believes or perceives as true
Practices	actual behaviour in a clinical setting
PCP	primary care physician
USPSTF	United States Preventative Services Task Force
UWO	University of Western Ontario

Chapter 1
Introduction

1.1 Chapter Overview

This chapter describes the significance of lung cancer, guidelines, decision-making and practice variations in behaviour of family physicians (FPs) regarding lung cancer screening. The literature reports variation in medical practice that is not based on carefully constructed guidelines. This variation is seen in procedures where evidence is unclear or conflicting as well as where there is a clear consensus in guidelines.[1] Factors such as anxiety about cancer and expectation expressed by patients for a screening test influence FPs to order screening tests.[2]

The decision-making context in which screening decisions are made is explored. Issues about screening and guidelines are highlighted; physician's attitude towards screening in general, cancer screening, lung cancer screening, use of guidelines and variation in their practice behaviour are presented.

The variation in guidelines, risk of lung cancer and limited detection and treatment options raise questions about FPs decision-making on lung cancer screening for their patients. For example, do they screen for lung cancer? If they do, how often do they screen and which screening tests are ordered? Additionally the literature lacks evidence on how those decisions are made. Specifically, what factors influence a FP to order or not order a screening test for lung cancer? Do patient's preferences, fears and expectations, physician factors and the influence of colleagues, personal experience with cancer and availability, access and cost of the screening test influence their decision making for lung cancer screening?

This chapter concludes with a summary, which synthesizes the rationale for research based on gaps in knowledge and evidence presented in the literature review. Finally, the study research questions are formulated, corresponding research objectives defined and a conceptual FP lung cancer screening decision making model introduced.

1.2 Literature Review

1.2.1 Significance of Lung Cancer

Lung cancer accounts for the highest cancer mortality rate for both men and women according to American Cancer Society data.[3] The 2011 statistics show it is the leading cause of cancer death for men aged 40 and older, and for women aged 60 and older.[3] The five-year survival rate is only 16%[3] and 90% with the disease die from it.[4] Smoking is the most important risk factor causing 85% of U.S. lung cancer cases.[4] The primary reason for such a poor cure rate is that nearly all lung cancers are found at a very late stage, making curative treatment impossible.[5] Even with recent advances in detection, *"screening cannot prevent most lung-cancer deaths, and smoking cessation remains essential."*[4, p331]

1.2.2 Lung Cancer Screening

An editorial on the status of lung cancer screening[6] stressed the need for effective clinical strategies for aiding patients with lung cancer , which has the highest incidence and mortality among all cancers. Some groups, for example, the US Lung Cancer Alliance, advocate use of computed tomography (CT) scan for lung cancer screening. This position was clearly against the best available screening guidelines (at the time of the present study) which did not recommend (i.e. cited insufficient evidence for or against[7] or recommended against[8]) use of CT or chest X-ray (CXR) respectively. Only recently, the United States Preventative Services Task Force (USPSTF) 2014 Lung Cancer screening recommendation statement[4] updated their 2004 recommendation statement[7] to recommend annual CT Scan for high risk patients. Those at high risk were defined as asymptomatic current smokers or those who had quit within the last 15 years, and those between the ages of 55 years and 80 years having a 30 pack per year smoking history. This guideline was graded as category B meaning *"there is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial."*[4, Appendix, Table 1]

The literature reports physician ordering of CXR as a test for lung cancer screening despite the fact that guidelines were against its use.[9] It may be the case that certain patient factors, such as patient anxiety, diagnosis, or death in close friend or family member, and patient demands play a vital role in the final decision to order or not order a screening test for lung cancer.

Research is required to study the behaviour of FPs regarding lung cancer screening and to explore what factors influence their decision- making. Factors influencing decision making for cancer screening indicate physician factors, patient factors, and patient-physician relationship are key to finding common ground and lead toward a mutual decision on whether or not to screen for several cancers.[10] However, this model emerged from studying cancer screening decision-making for cancers such as prostate, colorectal and breast cancer but did not study lung cancer decision making. The goal of that study was to understand the decision making process for cancers where National Guidelines from two or more sources are different.

One study[9] utilized a survey questionnaire to explore attitudes, beliefs and behaviours on lung cancer screening. The researchers concluded that a substantial number of physicians screen for lung cancer using CXR (25%) despite the fact that it was not recommended. They also discovered that pulmonologists screen more than family practitioners and those with more years in practice screen more frequently than those with fewer years in practice.[9] Further research is required to identify the factors that influence decision-making for lung cancer screening.

Screening by physicians contrary to the recommended evidence-based guidelines has potential risks such as increased incidence of false positives, unnecessary investigations, radiation exposure, psychological stress and increased cost without any benefit.[9]

It is important to see if the factors affecting decision making for other cancers where guidelines are conflicting or the evidence is unclear also apply to the case of lung cancer screening.

After many years of research, there is no evidence proving the efficacy of CXR as a screening test for lung cancer.[6] The Memorial-Sloan Kettering[11], the Johns Hopkins[12] and the Mayo Lung Project[13] trials evaluated CXR as a stand alone screening test or with sputum cytology to screen for lung cancer. Follow-up did not show a difference in lung cancer incidence or mortality.[11-15]

Prevailing national guidelines for lung cancer screening (at the time of the present study) differed in their advice about the use of CXR. The Canadian Task Force on Preventive Health Care (CTFPHC) guidelines[8] recommended against screening for lung cancer using CXR and concluded there was insufficient evidence to screen with low-dose computed tomography (LDCT). The USPSTF stated "*the evidence is insufficient to recommend for or against screening asymptomatic persons for lung cancer with either low-dose computerized tomography (LDCT), chest x-ray (CXR), sputum cytology, or a combination of these tests.*"[7, p738]

Nevertheless, in discussions with physician colleagues and departments of radiology, it is common to find CXR requisitions for asymptomatic patients for annual or periodic exams, which can be assumed to be for screening purposes. To date, there are no formal data collected to see whether these tests are being ordered for screening purposes in Canada. There is limited research regarding factors that may influence physician screening behaviour on lung cancer screening specifically.[9] There have been studies on physician behaviour on breast, prostate and colorectal cancer.[1]

Guidelines from various Canadian sources differ in their recommendations for lung cancer screening. The Saskatchewan Health Services Utilization and Research Commission[16] and British Columbia Council[17] recommended against use of CXR. However the Manitoba Consensus Group[18] recommended CXR for screening differing from the prevailing guidelines for lung cancer screening.

Lung cancer risk among heavy smokers may be as high as 30% [19] compared to non-smokers. Other risk factors include positive family history of lung cancer[20,21] and a history of chronic obstructive pulmonary disease (COPD).[22]

Studies reveal LDCT as a promising screening method for lung cancer detection as part of periodic health examinations. This could be offered to patients who are identified at high risk for lung cancer.[23] However, the radiation exposure may be harmful.[24]

The literature does not support lung cancer screening with CXR or with sputum cytological examination. Risk of inducing anxiety in false positive cases will cause unnecessary further testing and radiation. Further research is needed for identifying an appropriate approach to screening in clinic practice.[25]

Table 1 and 2 summarize the variation in national recommendations for lung cancer screening at the time of this study.

Table 1-1 National Lung Cancer Screening Guidelines

Screening Test	CTFPHE	USPSTF	Australia	NHS England
CXR	Recommend Against	Insufficient Evidence	Recommend Against	No Recommendation
CT Scan	Insufficient Evidence	Insufficient Evidence	Recommend Against	No Recommendation
Sputum Cytology	No Recommendation	Insufficient Evidence	Recommend Against	No Recommendation

Table 1-2 Guidelines from Canadian Sources

Screening Test	CTFPHE	British Columbia Council	Saskatchewan Health Services Utilization and Research Commission	The Manitoba Consensus
CXR	Recommend Against	Recommend Against	Recommend Against	Recommend
CT Scan	Insufficient Evidence	No Recommendation	Recommend Against	Recommend
Sputum Cytology	No Recommendation	Recommend Against	Recommend Against	Recommend Against

Despite the fact that, with one exception (Manitoba), current recommendations are against the use of CXR as a screening test for lung cancer, some FPs do screen their patients.[18] These significant variations in recommendations and practice behaviour identifies a gap and indicates that further research is needed to improve evidence based

guidelines that are implementable and will improve preventive care in family practice.[18,26]

1.2.3 Issues regarding Screening

The literature suggests that a number of factors are involved in decision-making around screening in general:[10,27-29]

Physician Perspective:

- Physicians are a resource to their patients. Physicians prefer to screen, as they like to prevent life-threatening illness for their patients.
- Physicians want to be rated as responsible physicians by their communities
- It is important to build patient-physician relationship
- Physicians may want to protect against litigation if it will come from not offering screening tests and by following available best practice guidelines that could prevent their patients from illness like cancer

Patient Perspective:

- Patients generally expect their physicians to diagnose illnesses
- Patients expect their physician to diagnose cancers early by ordering lab tests and radiological diagnostic tests for their periodic health exams
- Patients also appreciate and sometimes expect their physicians to educate them regarding preventative strategies for cancers

Issues regarding Guidelines

- Several guidelines are available as practice resources
- Some are conflicting and are unclear
- Some are clear, however may conflict with physicians practice experience and don't take into account the patient's perspectives.

Need for Screening

- Saves healthcare dollars by detecting disease early
- Savings in cost of treatment through earlier diagnosis

- Savings in lives saved
- Savings in ailments and disabilities in relatives and significant others

1.2.4 Physicians' Attitudes about Screening In General

The literature[27] indicates that physicians perform screening tests more often than recommended or sometimes do not follow current practice recommendations. The CTFPHC and USPSTF screening guidelines are considered the standard for prevention. Even when these screening guidelines are thought to be followed, deviation occurs. The following reasons were identified:[27]

- Lack of knowledge of current guidelines.
- Patient's expectation or demand as seen in the case of mammography.
- High volume of patients who are at risk for developing cancer.
- The physician has concerns regarding the sensitivity and effectiveness of screening methods.
- The guidelines that make recommendations also comment on the evidence being insufficient, which may decrease physician confidence in the recommendation.
- There is an economic benefit for the physician from ordering frequent tests for screening.

An American study used online surveys to determine attitudes of physicians regarding cholesterol and heart disease. It found that most of the physicians surveyed, (who were from pre-existing independent panels) felt they followed the National Cholesterol Education Program Adult Treatment Panel III guidelines, but felt that other physicians did not follow them. The attitudes of physician and consumers were similar in recognition of the significant health link between cholesterol and coronary artery disease, but differ in why patients do not take prescription medications.[30]

With a lack of knowledge about what actually influences physicians' attitudes toward screening, an American study examined the influence of actual or perceived state policy on pediatricians' attitudes toward screening. It found variations in support for the

screening guidelines considered in the study. It showed that pediatricians who believed the State had a policy of screening were more supportive of screening.[31]

In the absence of literature on the topic, an American study was undertaken to determine FPs' knowledge about sexually transmitted infections (STIs) management. The study demonstrated that physicians with good knowledge of STI guidelines were more likely to do routine screening of women at high risk for contracting Chlamydia infections. It was also identified that lack of knowledge was a barrier to following recommended screening for STIs. Educational and dissemination interventions were recommended.[32]

A U.S. study found there was substantial variation across medical offices in Chlamydia screening for at risk women. Further research was suggested to understand predictors of better office performance with the goal of more effective interventions promoting screening.[33]

FPs' screening practices vary depending on the medical condition being screened and FPs' beliefs and practices. A study on FPs' hepatitis C management found little use of a standardized history-taking form for disease-specific screening, something shown to be necessary, to screen for other medical conditions.[34]

In summary, the literature shows physicians' screening practices vary and differ from guideline recommendations. Physician attitudes about screening in general are influenced by knowledge (or lack thereof), differing recommendations, perceptions of state policy and sometimes personal preference.

1.2.5 Physician attitude towards Cancer Screening

An Alberta, Canada study explored the attitudes of specialists for colorectal cancer (CRC) screening practices, the year after a national CRC screening guideline was released. The results showed specialty-based variations in their practices and significant overall common practice and personal beliefs/attitudes for self-treatment which went against the CTFPHE guidelines, in which colonoscopy was not recommended.[35] This might be because specialists see a pre-screened population of patients and screening

guidelines that might be appropriate for primary care may not necessarily be appropriate for secondary care.

A U.S. survey study examined physician attitudes to prostate cancer screening at a health care facility for Veteran Affairs. The survey questionnaire asked what risk factors influence FP's' decision to screen patients for prostate cancer. The study concluded FPs recognized elevated risk for African-Americans and a family history of prostate cancer but frequently screened elderly or patients with a limited life expectancy, which was not within guidelines.[36]

An Italian survey study explored CRC screening knowledge, attitudes and practices of all general practitioners (GPs) in Lazio, Italy. The response rate was 59%. Ninety four percent believed CRC was preventable. Knowledge was higher in physicians using screening guidelines. Twenty-five percent recommended screening tests, 22% did not recommend and 47% over-recommended. The study investigators felt the low response rate was indicative of GP's lack of interest in screening.[37]

In summary, lack of interest in screening, logistical barriers and a lack of awareness of cancer information and research services were identified as factors relating to low cancer screening rates by FPs.

1.2.6 Physicians' attitudes and practices regarding Lung Cancer Screening

Physicians' attitudes and beliefs towards screening for lung cancer have been recently studied in a U.S. prospective descriptive survey[9], mailed to FPs, internists and pulmonologists. The response rate was 303/3000 (10%) with 71% FPs and 29% pulmonologists. Physicians were identified as high screeners, low screeners or no screeners. Physicians were also asked to describe factors that influence ordering of screening tests.

The study showed the relative importance of factors (highest to lowest) to physicians when assessing a screening program:

1. If there was proven clinical efficacy

2. If the test was recommended by USPSTF
3. If randomized control trials improved mortality rate
4. If the test was sensitive
5. If the test was cost effective

Despite the low response rate, the researchers concluded that a substantial number of physicians screen for lung cancer using CXR (25%) even though guidelines are against its use as a screening test. Pulmonologists screen more than family practitioners do and the number of years in clinical practice was directly related to screening behaviour. *"Screening outside accepted guidelines has potential risks including false-positive results, unnecessary invasive procedures, radiation exposure, psychological stress, and increased costs to the health care system."*[9, Clinical Implications]

A large scale U.S. national study[38,39] of FPs showed lung cancer screening tests such as CXR were commonly ordered even though unsupported by guidelines. Other research shows FPs screen for lung cancer,[26,40,41] including one study[42] which found 10-90 % of PCPs reporting they do so.

A U.S. qualitative study of physicians' lung cancer screening practices used telephone-conducted focus groups.[43] Participants consisted of 17 internists and 11 FPs. That study identified seven factors influencing physicians' decision to screen for lung cancer: five physician factors and two patient factors. Physician factors were perception of the effectiveness of screening; guideline recommendations; practice experience; perception of patient's risk factors for lung cancer and fear of litigation. Patient factors were patient request for screening and ability to pay for the screening procedure.

1.2.7 Physicians' attitudes towards use of Guidelines

Family physicians play a vital role in cancer screening. The attitudes of family physicians towards guidelines have been explored. A study by the Ottawa Health Research Institute[44] explored the family physician's views on cancer screening guidelines. It was found that guidelines sometimes add controversy and barriers to the decision-making process. FPs expect guideline developers to provide them with the resources to help in

their decision-making process by providing clear guidelines in an easy-to-use format on topics identified by them as relevant to their practice.

Since FPs involve their patients in care, including patient involvement in decision-making, FPs expect guidelines/decision-making tools be made available to them in an interactive format which they can use with their patients in the office setting.[44]

A German study of general practitioners and internists studied knowledge of secondary prevention of coronary heart disease. It also studied their perception of guidelines and how that perception influenced their treatment practices. Results showed that increased knowledge of guidelines was directly related to improved management of risk factors for heart disease. However, many physicians who were aware of guidelines chose to treat in a way that differed from guidelines.[45]

In a study that assessed knowledge and beliefs of American physicians and how they influenced their practices in managing colorectal cancer screening, it was found that most providers recommended screening-guidelines, but patient refusal was common. Usual practice often did not follow evidence-based guidelines.[46]

A systematic review of studies on clinician's attitudes to clinical practice guidelines was conducted covering years 1990-2000.[47] Clinicians agreed guidelines were helpful and useful as educational tools and believed they tend to improve quality of care. However, they also found guidelines to be impractical; some felt they were very rigid and inapplicable to individual patient situations. They also felt guidelines reduced physician autonomy and were oversimplified. Most expressed the view that guidelines are intended to cut costs in healthcare. Some also feared that use of guidelines may increase litigation.[47]

1.2.8 Influence of Guidelines on Physician Behaviour

Studies have been conducted to understand the influence of guidelines on physician behaviours and practices. For example, a US survey study was conducted to explore FPs' attitudes and practices regarding Periodic Health Exam. The study revealed that FPs do

not follow recommendations to use more selective health care approaches for prevention.[48]

Physician factors may affect screening guideline compliance. Compliance with American Cancer Society CRC screening guidelines was associated with physician's perception of risk for CRC in one study.[49]

A U.S. study assessed the knowledge, perception, and behaviour of family physicians regarding management of dyslipidemia. The study found variability in all three among family physicians and also an overall variability in adherence to guidelines.[50]

All FPs in Newfoundland and Labrador, Canada were surveyed on their prostrate cancer screening practices, attitudes and continuing medical education (CME) preferences. The study found physicians were supportive of screening, but their beliefs and practice varied - one half questioned the reliability and evidence to support digital rectal exam (DRE) for screening, and one third questioned both DRE and PSA testing, motivating a need for CME to address identified issues with prostate screening.[51]

In summary, physicians' practices vary from one another and may differ from guidelines. Physicians have a wide variation in knowledge, beliefs and practice patterns. In general, physicians were supportive of screening, however, their beliefs and practices varied from guideline recommendations. They also questioned the evidence supporting the guidelines.

1.2.9 Current Evidence about Guidelines for Lung Cancer Screening

At the time the survey was completed (2012), the prevailing guideline from the Canadian Task Force on Preventive Health Care (CTFPHC)[8] concluded that "*there is **fair** evidence to recommend* against *screening asymptomatic people for lung cancer using chest radiographic examination **(D recommendation)**.*"[8, p1]

The CTFPHC concluded "*there is **insufficient** evidence (in quantity and/or quality) to make a recommendation as to whether spiral CT scanning should be used for screening*

asymptomatic people for lung cancer. However, other factors may influence decision-making. ***(I recommendation)"***[8, p1]

At the time the survey was completed, the prevailing guideline from the U.S. Preventative Services Task Force (USPSTF) was the 2004 recommendation for lung cancer screening, stating that "*the evidence is insufficient to recommend for or against screening asymptomatic persons for lung cancer with either low-dose computerized tomography (LDCT), chest x-ray (CXR), sputum cytology, or a combination of these tests.This is a grade I recommendation."*[7, p738]

The current Cancer Council of Australia health guideline states "*No forms of population screening for lung cancer, including regular chest radiography, with or without sputum cytology even in high-risk groups, have been shown to improve outcomes and screening is not recommended. In view of the limited information available on outcome, helical CT screening for lung cancer is not recommended except in the context of a well- designed clinical trial.***"**[52, pxiv]

In the 2014 update of their 2004 recommendation, the USPSTF[4] recommended certain people at high risk for lung cancer be screened with low dose CT scan annually. The high-risk people were defined as current smokers or smokers who have quit within the last 15 years, in adults aged 55-80 who have a 30 pack-year smoking history. A pack year was defined as smoking an average of one pack of cigarettes per day for one year. Screening should be discontinued once a person has not smoked for 15 years or developed a health problem that substantially limits life expectancy or the ability or willingness to have curative treatment for lung cancer. This guideline was graded as category B meaning "*there is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantia*.**"**[4, Appendix, Table 1]

1.2.10 Post Survey – Recent Literature Summary

Subsequent to survey instrument development and data collection, recent related research was published. A Scopus search was conducted to bring the literature review up to date. It found 25 articles that cited Haggerty[2], the most recent publication in the series of

research that this thesis extends[2,10,28,53]. Three have relevance to physician decision making. One[54] investigated which factors influenced physician decision to order PSA screening tests. Although factors included some of those studied in this thesis research, others were dissimilar, and the survey methods and analysis were dissimilar and unsuited for adaptation or comparison. Another study[55] explored which patient and physician factors influenced cervical cancer screening over and under use. This was not a survey study, but instead collected actual ordering data. The third study[56] involved a survey instrument completed by both physician and patient regarding attitudes to shared care and influence on specialist referrals. The instrument and methods were dissimilar to that used in the current study.

Updates to guidelines for lung cancer screening were also made, with modified recommendations. The changes have already been discussed in section 1.2.9 above.

1.3 Identification of Research Opportunity

Lung cancer is a prevalent cancer and accounts for significant mortality. There are not many helpful strategies available for dealing with lung cancer prevention other than counselling smoking cessation and detection at an earlier stage. There are not many treatments that are very useful for treating lung cancer. FPs have regular contact with the patient population at risk for disease and the physician group most likely to screen for diseases. As their patient population includes smokers, FPs are concerned about them and face the challenge of what can they do which would be helpful in detecting lung cancer at early stages.

In summary, lung cancer is a prevalent disease and those at higher risk, such as those who smoke are frequently attended in family physicians' offices where screening may be taking place.

The literature has been reviewed in terms of the effectiveness of lung cancer screening tests. Recommendations are conflicting regarding use of screening tests. At best, there is insufficient evidence to recommend routine screening with CXRs. Some guideline panels

have stated there is enough evidence to say that CXR is not effective and have recommended against routine screening while others do recommend it.

Regardless, the literature confirms that some FPs do screen with CXRs. There appears to be a dissonance between what people reviewing the evidence suggest and how certain FPs are behaving. The literature shows a gap between recommendations and behaviour in practice and that there is a need to examine some of the various reasons for this gap. There is also literature that has looked at cancer screening generally and in the context of uncertainty.[38,39,43,57]

Therefore, to try to understand this gap, it is important to understand how often FPs report they are screening for lung cancer, what screening tests they order and the factors that influence them to behave in a way that is different than some experts have suggested the evidence would indicate or direct.

Understanding this is important for several reasons. In economic terms, if resources are being used that are not effective, then they are not available for other purposes. It will provide insights in terms of helping FPs understand guidelines better and aid in adherence. It will help guideline developers to understand how they might improve adherence to recommendations by understanding how intended users make decisions around screening and the many factors that influence their decision-making.

1.4 Research Questions

The following research questions were explored:

1. What do family physicians practicing in urban and rural Saskatchewan report they do regarding their lung cancer screening practices?
2. Which lung cancer screening test(s) do family physicians practicing in urban and rural Saskatchewan report they use?
3. Which factors influence the decision-making of family physicians practicing in urban and rural Saskatchewan when presented with hypothetical clinical scenarios?

1.5 Objectives

The study objectives were:

1. To estimate the frequency with which FPs order lung cancer screening tests. Data were used to identify two groups of FPs:
   a) *Screeners*, defined as those who report they order lung cancer screening tests for asymptomatic ever smokers;
   b) *Non-Screeners*, defined as those who report they do not order lung cancer screening tests for patients who are asymptomatic ever-smokers.
2. To determine how frequently CXR was ordered as a screening test. Since the CTFPHE recommendations are clearly against the use of CXR as a screening test, the survey specifically questioned about the use of CXR.
3. To determine the factors that influence lung cancer screening decision-making.

This research explored FPs' reported lung cancer screening behavior based on factors identified in the literature that influenced screening decision-making for other cancers such as breast, colon and prostate. The literature revealed no research to-date that studied the influence of any of these factors on lung cancer screening decision-making in Canada. This study incorporates these factors into a proposed model shown in Figure 1-1.

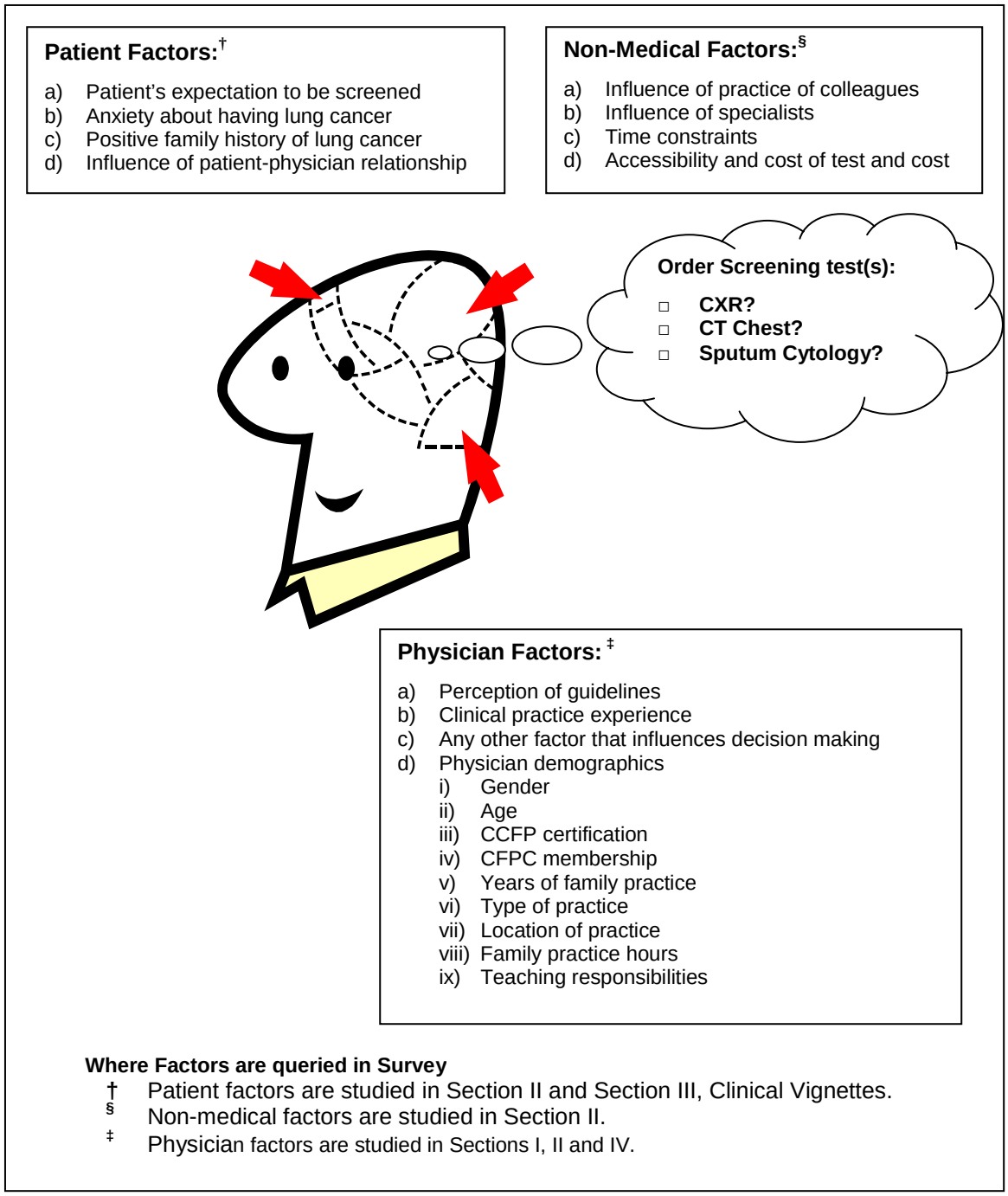

Figure 1-1 Conceptual FP Lung Cancer Screening Decision Making Model

This illustrates the author's initial concept of the factors involved in a physician's lung cancer screening decision-making based on the literature. It illustrates patient, physician and non-medical factors that are identified in the literature as factors influencing cancer-screening decision-making for breast, colon and prostate cancers.[2,10] This study used clinic scenarios in the survey to explore whether these factors also influenced lung cancer decision-making behaviour.

Chapter 2
Methods

2.1 Introduction

The CTFPHC and USPSTF guidelines for lung cancer screening at the time of the study differed slightly but none recommended screening with CXR. However, there is uncertainty about family physicians' (FPs) lung cancer screening practices in clinical encounters - whether FPs screen for lung cancer, what screening test do they order and how often do they screen despite guideline recommendations.

This study identified whether Saskatchewan FPs screen for lung cancer and what factors influenced them to do so. It consisted of a cross-sectional survey and measured FPs' responses to self-reported screening behaviour questions and to hypothetical clinical screening scenarios. These two outcomes were analyzed separately.

2.2 Design

This study consisted of a cross-sectional survey with two components:

1. Questions designed to measure physicians' self-reported behaviour and
2. Hypothetical clinical scenarios designed to determine physician's intended behaviour in different situations. The data collected from these two components were analyzed separately.

2.3 Sample

The study respondents were FPs practicing in rural, regional and urban areas of Saskatchewan.

2.3.1 Inclusion Criteria

Only physicians who worked more than fifteen hours per week in family practice (i.e. deemed to be full-time) were included. This maintains consistency with the classification used in comparable research by Tudiver et al.[2]

2.3.2 Exclusion Criteria

Specialist physicians practicing internal medicine, surgery, pulmonology, neurology, pathology, radiology and any other specialities were excluded from the study.

2.4 Survey Questionnaire Development

The method of data collection used was survey via a self-administered paper questionnaire. A mail survey package was developed for distribution, including a letter of information, a survey questionnaire and a stamped return envelope (Appendices A & B).

This study's objectives were consistent with Tudiver et al. except that they studied breast, colon and prostate screening behaviours of FPs whereas this study specifically explored lung cancer screening behaviour of FPs.

Tudiver's survey instrument (Appendix C) was adapted because of the benefit of employing a previously validated methodology. The survey was modified to study lung cancer screening behaviour. Appendix D describes the systematic and rigorous adaptations made to the Tudiver survey.

2.5 Variables

2.5.1 Outcomes

Two outcomes were measured:

1. Based on their self-reported screening behaviours, physicians were dichotomized into *Screeners* and *Non-Screeners*. We defined *Screeners* as physicians who

ordered screening tests for lung cancer if they reported they routinely ordered screening tests for asymptomatic patients who are ever-smokers (Section II, question 2a). Similarly, physicians who reported they did not order lung cancer screening tests for asymptomatic ever-smokers were defined as *Non-Screeners* (Section II, question 2a).

2. Based on their responses to clinical scenarios (Section III), FPs' intended decision to order a lung cancer screening test with dichotomous variables (yes or no). This was based on six hypothetical scenarios:
    a) Scenario 1 was considered uncomplicated.
    b) Scenarios 2 to 5 each contained a complicating dynamic: expectation, anxiety, family history, poor patient-physician relationship respectively.
    c) Scenario 6 contained all four complicating dynamics.
    d) For each scenario, respondents indicated whether they would order any of three possible screening tests: CXR, CT chest and sputum cytology

2.5.2 Predictor Variables

Several characteristics of the physician and non-medical factors have been shown to influence physicians' screening behaviour.[10] Therefore the self-reported *Screeners* and *Non Screeners* were compared by the following independent variables:

1. Physician Factors:
    a) Physician characteristics (as outlined below) (Section IV):
        i. Gender (question 1)
        ii. Age group (question 2)
        iii. Certification by The College of Family Physicians of Canada (CCFP) (question 3)
        iv. Professional membership in the College of Family Physicians of Canada (question 4)
        v. Number of years of family practice (question 5)

vi. Type of practice: solo, group (question 6)

vii. Location of practice: urban vs. non-urban-(regional were coded as non-urban (question 7)

viii. Number of practice hours per week (question 8)

ix. Teaching responsibilities (question 9)

b) Attitudes toward screening (Section II, question 3-13)

c) Perception of guidelines (Section I, questions 1-3)

d) Screening behaviour (Section II, questions 1-2)

2. Non-Medical Factors (Section II, questions 14c-h):

a) Influence of practice colleagues

b) Influence of specialist colleagues

c) Cost of the test

d) Accessibility of test

e) Ease of administration

f) Time constraints

Several patient factors have been identified as the most important determinants of cancer screening decision-making for breast cancer, colorectal cancer and prostate cancer.[10] This study measured if they also influenced the physicians' decision to screen for lung cancer in hypothetical clinical scenarios. These factors were:

1. Patient Factors, self-reported behaviour (Section II, questions 14a-b):

a) Patient's expectations to undergo screening

b) Anxiety about having lung cancer

2. Patient Factors, measured behaviour (Section III):

a) Patient's expectations to undergo screening (Scenario 2)

b) Anxiety about having lung cancer (Scenario 3)

c) Positive family history of lung cancer (Scenario 4)

d) Quality of the patient-physician relationship (Scenario 5)

2.6 Data Collection

A distribution list was generated from the College of Physicians and Surgeons of Saskatchewan registry and the Regional Health Authority administration offices. A stratified sample of FPs who met the inclusion criteria were recruited by mailing them a complete survey package.

To increase the external validity of the study, a high rate of return was desired. The survey was distributed and administered using methods known to enhance physician participation. A revised, step-wise Dillman Method[58] was used to encourage response:

1. Initial mailing
2. Follow up reminder postcard
3. Second full mailing
4. Phone call reminder

2.7 Data Entry

The Primary Investigator (PI) (author) set up the SPSS data dictionary to correctly code the item types and values needed. Raw data from each uniquely numbered survey questionnaire booklet was entered to produce the SPSS database in preparation for statistical analysis. Some respondents returned partially completed surveys or provided unexpected multiple responses; all were directly coded as provided. Details of how such were accommodated are provided in *Chapter 3 Results*.

Quality was managed by conducting one hundred percent checking. This was jointly performed post data entry by the PI and an assistant, who compared the coded data with each survey booklet and reconciled any discrepancies.

2.8 Data Analysis

Appropriate analysis of the data collected from the survey was done using SPSS Version 19.

Analysis – Outcome #1

Bivariate analysis examined whether there were any associations between *Screeners* and *Non-Screeners* on physician characteristics, attitudes toward screening, perception of guidelines and screening behaviour:

Mann-Whitney-U tests were conducted for continuous independent variables and Chi-Square was used for categorical variables.

Analysis – Outcome #2

Analyses were conducted with the outcome of whether to order one of three possible screening tests in each of the five complicated scenarios. Therefore, 15 comparisons were made (three possible tests by five possible scenarios); each analysis compared decisions made in the uncomplicated scenario against the decision made by the same physician in one of the five complicated scenarios. Due to the repeated nature of the study in that the same participants were asked to provide their screening responses under different conditions, McNemar's Chi square test was used to assess if the proportion that would screen differed between the each of complicating dynamics (Scenarios 2 to 6) and the uncomplicated scenario (Scenario 1). Because differences in proportions will be the result of participants changing their screening practices under the different conditions, and that these changes can be in either direction (i.e. from "not screen" in the uncomplicated scenario changing to "screen" in complicated or "screen" in uncomplicated changing to "not screen" in complicated), it is the net difference in this change that is statistically important.

Additionally, the influence of recommendation perception on screening behaviour was assessed. Analyses were conducted comparing the proportion of physicians who would screen using each test in each of the scenarios against their perceptions of the guidelines

being recommended or not recommended respectively. Due to the repeated nature of the study, recognizing that the same participants were assessed concerning their practice within multiple scenarios, the association between the perception that the test is recommended and whether or not it was performed was evaluated for each scenario separately. To account for multiple testing, Bonferroni correction was applied to the significance level, with 0.05 divided by 6 scenarios to produce a new alpha of 0.008. Only statistical test results with p-values below this level were considered statistically significant.

2.9 Reliability and Validity

To ensure validity and to ensure appropriateness of the reading level, the survey was piloted on three FPs. This was followed by an interview to improve clarity and comprehensiveness of the questionnaire.

This study also contains a section, consisting of clinical case scenarios where testing is done in the context of a controlled environment, one where independent variables are manipulated to examine decision-making behaviour. In this section, the strength of the internal validity is not felt to be at the expense of external validity; the clinical scenarios presented are intended to model a real-world clinical encounter.

References on questionnaire design and quality assessment were consulted during questionnaire development.[59-68]

To increase the external validity of the study, a high rate of return was desired. This was promoted in this study by using best practices identified in the literature including administration of the survey using the step-wise revised Dillman Method, discussed in Section 2.6 above.

2.10 Ethics Approval

Ethics approval was obtained from the Research Ethics Board of the University of Western Ontario (Appendix F).

Chapter 3
Results

3.1 Introduction

This study consisted of a cross-sectional survey of family physicians (FPs) practicing in Saskatchewan. Of the 250 FPs contacted, 49 responses were deemed acceptable, after adjusting for surveys which were incomplete on key questions, yielding a final response rate of 20%. The demographics of the final study participants are presented in Table 3-1 (Questionnaire Section IV); available provincial and national data are also listed for comparison. In spite of the small sample size and the low response rate, the characteristics of the study sample are similar to those for Saskatchewan and Canadian FPs, offering some support for generalizability of the findings. However, the sample has a higher proportion of female and rural FPs, compared to the provincial or national populations.

Based on their reported practice behaviour (Section II, question 2a), FPs were divided into two groups, *Screeners* and *Non-Screeners*, defined as:

1. *Screeners* - those who report they order lung cancer screening tests for asymptomatic ever-smoking patients;
2. *Non-Screeners* - those who report they do not order lung cancer screening tests for asymptomatic ever-smoking patients.

Out of 49 FPs, 34 (69%) were classified as *Screeners* and 15 (31%) as *Non-Screeners*. Of those who screened, CXR was ordered by up to 73% of FPs making it the most commonly ordered screening test contrary to prevailing guidelines.

Table 3-1 Physician Characteristics

Physician Factors	**All participants (N = 49)****	**Total Saskatchewan FP Population (N = 1089)*†**	**Total Canadian FP Population (N = 34 810)*†**
Sex, n (%)			
Male	25 (52%)	(69%)	(59.6%)
Female	23 (48%)	(31%)	(40.4%)
Age, n (%)			
<50 years	32 (67%)	†	†
≥50 years	16 (33%)	†	†
CCFP certification, n (%)			
Yes	24 (50%)	(51.9%)	(54.6%)
No	24 (50%)	(48.1%)	(45.4%)
CFPC membership, n (%)			
Yes	44 (92%)	†	†
No	4 (8%)	†	†
Group practice, n (%)			
Yes	38 (81%)	(82.2%)	(78%)
No	9 (19%)	(17.8%)	(22%)
Teaching affiliation, n (%)			
Yes	21 (44%)	†	†
No	27 (56%)	†	†
Practice location, n (%)			
Urban	25 (52%)	(55.3%)	(63%)
Rural/regional	23 (48%)	(44.7%)	(37%)
Practice hours/week,			
Mean (SD) ††	30.8 (13.8)	†	†
Median (IQR) ††	35 (24, 40)	†	†
Years in practice			
Mean (SD) ††	13.9 (12.2)	†	†
Median (IQR) ††	30.8 (13.8)	†	†

**National Physician Survey 2010*, The College of Family Physicians of Canada, Canadian Medical Association and Royal College of Physicians and Surgeons of Canada

† Comparable datum not available from *National Physician Survey 2010* because it was either not collected, definitions differ from current study or not reported

**Participants within column may not sum to N due to missing values

††SD stands for standard deviation, IQR for Interquartile range

3.2 Physician Factors and Screening Behaviour

Table 3-2 presents the results for physician factors and compares *Screeners* and *Non-Screeners* (Questionnaire Section IV). A statistically significant difference was found where *Screeners* worked more hours per week than *Non-Screeners*. Differences were marginally significant for practice location; *Screeners* were more likely to be from rural practices (56%) versus *Non-Screeners* (29%). There were no statistically significant differences for the remaining variables.

Table 3-2 Physician Factors and Screening Behaviour

Physician Factors	**Screening practices, n (%)***			
	All participants (N = 49)‡	**Screeners (n = 34)**	**Non-Screeners (n = 15‡)**	**p-value§**
Sex, n (%)				
Male	25 (52)	18 (53)	7 (50)	0.85
Female	23 (48)	16 (47)	7 (50)	
Age, n (%)				
<50 years	32 (67)	25 (74)	7 (50)	
≥50 years	16 (33)	9 (27)	7 (50)	0.18**
CCFP certification, n (%)				
Yes	24 (50)	16 (47)	8 (57)	0.53
No	24 (50)	18 (53)	6 (43)	
CFPC membership, n (%)				
Yes	44 (92)	30 (88)	14 (100)	0.31**
No	4 (8)	4 (12)	0 (0)	
Group practice, n (%)				
Yes	38 (81)	26 (77)	12 (92)	0.41**
No	9 (19)	8 (24)	1 (8)	
Teaching affiliation, n (%)				
Yes	21 (44)	13 (38)	8 (57)	0.23
No	27 (56)	21 (62)	6 (43)	
Practice location, n (%)				
Urban	25 (52)	15 (44)	10 (71)	0.09
Rural/regional	23 (48)	19 (56)	4 (29)	
Number of practice hours/week,				
Mean (SD)	30.8 (13.8)	34.9 (10.6)	21.0 (16.1)	
Median (IQR)	35 (24, 40)	36 (27.3, 40)	16.5 (8.3, 36.3)	**0.006**
Number of years in practice				
Mean (SD)	13.9 (12.2)	13.5 (11.6)	14.8 (14.1)	
Median (IQR)	30.8 (13,8)	10.5 (3.8, 20)	7 (3.3, 30.3)	0.95

*Denominator is the number of participants responding to the question

‡ Totals within columns do not sum to n due to missing values.

§p-values comparing *Screeners* and *Non-Screeners'* screening practices for categorical variables assessed by Chi square test with **Fisher's exact test where indicated. Medians for continuous variables compared by Mann-Whitney-U testing.

3.3 Physician Attitudes & Practices by Screening Group

Table 3-3 compares FPs' lung cancer screening attitudes and practices by screening group (Questionnaire Section II, questions 3-13). Participants' agreement with statements listed in the table, was dichotomized as yes or no responses. The following discussion of important findings makes brief mention of the corresponding statements; please refer to the table for the full statement text.

A significantly larger proportion of Screeners (85%) than Non-Screeners (50%) agreed with the statement that missing a case of lung cancer would result in increased screening for some time afterwards.

Similarly, a significantly larger proportion of *Screeners* (67%) than *Non-Screeners (21%)* agreed with the statement that they would routinely screen if there was a positive family history of lung cancer.

A significantly larger proportion of *Screeners* (88%) than *Non-Screeners* (57%) agreed with the statement that they would routinely screen if there was occupational exposure such as asbestos, silica and chemicals.

A significantly larger proportion of *Screeners* (79%) than *Non-Screeners* (29%) agreed with the statement that they would routinely screen if there were co-morbid conditions such as COPD

A significant minority of *Screeners* (13%) and a majority of *Non-Screeners* (79%) agreed with the statement that they would not recommend CXR for screening because they thought there was potential to cause more harm than good.

Medico-legal considerations had no impact on screening behaviour among FPs in either group.

Both Screeners and *Non-Screeners* were equally likely to apply lung cancer guidelines to each individual patient's needs.

Table 3-3 Physicians' agreement with statements on attitudes and practices by screening group

Statement	Agreement				
	Screeners n = 34		Non-Screeners n = 15		p-value†
	Yes n (%)*	No n (%)*	Yes n (%)*	No n (%)*	
The guidelines for lung cancer screening are just guidelines.	27 (82)	6 (18)	14 (100)	0 (0)	0.16
I apply lung cancer screening guidelines to each individual patient's needs.	25 (76)	8 (24)	11 (79)	3 (21)	1.0
I tend to follow lung cancer screening guidelines when they are published by an organization that I trust.	31 (94)	2 (6)	12 (86)	2 (14)	0.57
If I missed a case of lung cancer I would tend to screen more patients for that particular disease for some time afterwards.	28 (85)	5 (15)	7 (50)	7 (50)	**0.03**
I will routinely recommend a lung cancer screening test when there is insufficient evidence, in order to avoid medical-legal repercussions.	7 (21)	26 (79)	2 (15)	11 (85)	1.0
I will routinely recommend a lung cancer screening test for patients if there is a positive family history of lung cancer	22 (67)	11 (33)	3 (21)	11 (79)	**0.009**
I will routinely recommend a lung cancer screening test for asymptomatic patients when there is a history of occupational exposure to asbestos, silica, or other chemicals.	29 (88)	4 (12)	8 (57)	6 (43)	**0.046**

Statement	Agreement				
	Screeners n = 34		Non-Screeners n = 15		p-value[†]
I will routinely recommend a lung cancer screening test when patients have co-morbid conditions such as COPD.	26 (79)	7 (21)	4 (29)	10 (71)	**0.002**
I do not recommend CXR for lung cancer screening because I think it has the potential to cause more harm than good.	4 (13)	28 (88)	11 (79)	3 (21)	**<0.0001**
I do not recommend CT Chest for lung cancer screening because I think it has the potential to cause more harm than good.	20 (63)	12 (38)	10 (71)	4 (29)	0.74

*Denominator is the number of participants responding to the question.
[†] p-values comparing *Screeners* and *Non-Screeners* screening practices for categorical variables assessed by Fisher's exact test due to frequent small expected cell sizes.
Number of responses to a specific statement within the groups may not sum to group total due to missing values.
Percentages may sum to more than 100% due to rounding.

3.4 Physicians' Perceptions of Lung Cancer Screening Guidelines

Table 3-4 reports FPs' perceptions of lung cancer screening guidelines (Questionnaire Section I). There was a statistically significant difference in that *Screeners* were more likely (52%) than *Non-Screeners* (7%) to perceive that CXR was recommended for their smoking patients. There were no statistically significant differences for the remaining variables. Of note, *Screeners* (69%) and *Non-Screeners* (46%) found the guidelines for lung cancer screening for asymptomatic smokers to be unclear.

Table 3-4 Perceptions of Lung Cancer Screening Guidelines

Guideline Perception by test n (%)[‡]	All (N=49**)	Screeners (n=34**)	Non-Screeners (n=15**)	p-value†
For never-smokers				
CXR				
Recommended, n (%[‡])	6 (12)	6 (18)	0 (0)	0.16
Not recommended[§], n (%)	43 (88)	28 (82)	15 (100)	
CT scan				
Recommended, n (%)	2 (4)	2 (6)	0 (0)	1.0
Not recommended, n (%)	47 (96)	32 (94)	15 (100)	
Sputum cytology				
Recommended, n (%)	4 (8)	3 (9)	1 (7)	1.0
Not recommended, n (%)	45 (92)	31 (91)	14 (93)	
For ever-smokers				
CXR				
Recommended, n (%)	18 (38)	17 (52)	1 (7)	**0.003**
Not recommended, n (%)	30 (62)	16 (49)	14 (93)	
CT scan				
Recommended, n (%)	7 (15)	6 (18)	1 (7)	0.41
Not recommended, n (%)	41 (85)	27 (82)	14 (93)	
Sputum cytology				
Recommended, n (%)	9 (18)	8 (24)	1 (7)	0.24
Not recommended, n (%)	40 (82)	26 (77)	14 (93)	
Clear guidelines for ever-smoking patients, n (%)				
Yes, n (%)	17 (38)	10 (31)	7 (54)	0.19
No, n (%)	28 (62)	22 (69)	6 (46)	

†p-value comparing *Screeners* and *Non-Screeners* screening practices assessed by Fisher's exact test due to frequent small expected cell sizes.
‡Denominator for all percentages is the number of participants responding to the question
§Not recommended responses to all questions include "recommended against", "insufficient evidence" and "conflicting guidance"
**Participants within columns may not sum to N or n due to missing values

3.5 Choice of Screening Test among *Screeners* by patient's smoking status

Table 3-5 reports the choice of screening tests (Questionnaire Section II, questions 1 b and 2 b) among *Screeners*. Since the criterion for *Screeners* and *Non-Screeners* was based on whether or not FPs screen asymptomatic, ever-smoking patients, FPs in the *Screener* group will all indicate that they screen these patients while *Non-Screeners* by definition will not have screened, and, unsurprisingly, all of them indicated that they would not screen never-smokers either. Among *Screeners*, 16 of the 34 FPs (47%) also screened never-smokers. So although *Screeners* are more likely to indicate at least some degree of screening among never-smokers compared to *Non-Screeners*, the data suggest that this tendency is still considerably less than when evaluating ever-smokers (100%). Among *Screeners*, CXR was the most frequently ordered test (97%) for ever smoking patients and (94%) for never smoking patients.

Table 3-5 Choice of Screening Test by Smoking Status among *Screeners* (n=34)

	Never-smokers (Section II Q 1 b)	Ever-smokers (Section II Q 2 b)
Screening Test		
CXR, n (%)		
Yes	15 (94)	33 (97)
No	1 (6)	1 (3)
Would not screen	18*	
CT, n (%)		
Yes	0 (0)	2 (6)
No	16 (100)	32 (94)
Would not screen	18*	
Sputum, n (%)		
Yes	5 (31)	8 (24)
No	11 (69)	26 (77)
Would not screen	18*	

*Out of 34 Screeners(FPs who will order screening test in ever-smoking patients) 18 did not report ordering screening tests in never-smoking patients

3.6 Influence of Non-medical Factors on Screening Behaviour

Table 3-6 reports the influence of non-medical factors on screening behaviour (Questionnaire Section II, questions 14a-14h). Results were not statistically different for the variables but approached marginal significance in their screening behaviour if the test was easily accessible or if the test was easy to administer, *Screeners* more frequently order screening tests (77%) than *Non-Screeners* (50%).

Table 3-6 Physician agreement that non-medical factors would influence test ordering behaviour

Statement	Screeners n = 34		Non-Screeners n = 15		p-value†
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	
A patient is anxious about having the disease	29 (85)	5 (15)	9 (69)	4 (31)	0.24
A patient requests the test and insists on having it done	32 (94)	2 (6)	12 (86)	2 (14)	0.57
I hear that my colleagues are recommending it to their patients	9 (27)	25 (74)	2 (14)	12 (86)	0.47
Specialists I work with recommend ordering the test	26 (77)	8 (24)	12 (92)	1 (8)	0.41
The test is inexpensive	21 (62)	13 (38)	6 (43)	8 (57)	0.34
The test is easily accessible	26 (77)	8 (24)	7 (50)	7 (50)	**0.09**
The test is easy to administer	26 (77)	8 (24)	7 (50)	7 (50)	**0.09**
The test will take less time to order than to convince a patient they do not need it	14 (41)	20 (59)	5 (36)	9 (64)	1.0

†p-values comparing *Screeners* and *Non-Screeners'* screening practices for categorical variables assessed by Fisher's exact test due to frequent small expected cell sizes.
Number of responses to a specific statement within the groups may not sum to group total due to missing values.
Percentages may sum to more than 100% due to rounding.

3.7 Influence of Lung Cancer in Self or Close Relative and Smoking on Screening Behaviour

Table 3-7 reports the influence of a lung cancer diagnosis for physician personally or for someone close or of smoking status on screening behaviour (Questionnaire Section V, questions 1-3).

There were no statistically significant differences between *Screeners* and *Non-Screeners* in the proportion who had experienced a diagnosis of lung cancer themselves or anyone close to them. This response could not be further assessed by smoking status since 29 out of 51 participants answered both questions as smoker and as non-smoker and as such could not be clearly assigned as either smoker or non-smoker.

Table 3-7 Close experience with lung cancer and smoking status

	All participants N = 49	**Screeners n = 34[†]**	**Non-Screeners n = 15[†]**	**p-value[‡]**
Have you or anyone close to you ever been diagnosed with lung cancer? n (%)				
Yes	13 (27)	11 (32)	2 (14)	0.29
No	35 (73)	23 (68)	12 (86)	
Would seek screening for self, n (%)				
Yes	5 (11)	5 (15)	0 (0)	0.30
No	41 (89)	28 (85)	13 (100)	

[†]Participants within columns may not sum to n due to missing values.
[‡]Fisher's exact test

3.8 Influence of Patient Factors in Clinical Vignettes

Table 3-8 reports the proportion of participants who indicated they would screen for each of the six scenarios (Questionnaire Section III). CXR was the most frequently ordered test.

Table 3-8 Proportions of participants screening using CXR, CT, or sputum cytology in uncomplicated and complicated scenarios

	n (%)
CXR	
Uncomplicated Scenario	
No complications	23 (48%)
Complicating dynamic	
Expectation	21 (44%)
Anxiety	28 (58%)
Family History	30 (63%)
Poor relationship	23 (48%)
All four dynamics	35 (73%)
CT Chest	
Uncomplicated Scenario	
No complications	3 (6%)
Complicating dynamic	
Expectation	2 (4%)
Anxiety	3 (6%)
Family History	3 (6%)
Poor relationship	2 (4%)
All four dynamics	8 (17%)
Sputum cytology	
Uncomplicated Scenario	
No complications	9 (19%)
Complicating dynamic	
Expectation	6 (13%)
Anxiety	5 (10%)
Family History	7 (15%)
Poor relationship	6 (13%)
All four dynamics	8 (17%)

3.9 Influence of Patient Factors in Clinical Vignettes

Table 3-9 compares the proportion of participants who screened in the uncomplicated scenario (Scenario 1) with each of the complicated scenarios (Scenario 2 – 6). The purpose of the analysis is to determine if the factor(s) introduced in each scenario significantly affects the decision to order each lung cancer screening test. The p-value shown indicates if there is a statistically significant effect due to the introduction of this factor. It is computed using the McNemar test for matched pairs of data, in this case the comparison of results for the uncomplicated scenario with each of the complicated scenarios. Note that participants are not divided into the previous *Screener/Non-Screener* categories. The table divides participants into two groups, those who screened in the uncomplicated scenario and those who did not. Within each group, results are further subdivided into those who would/would not screen to make it easier to see changes in behaviour between the scenarios and groups.

A walkthrough will be presented to make this clearer. The first set of yes and no values indicate that 23 participants said they would screen using a CXR in the uncomplicated scenario (Scenario 1), while 25 participants said they would not. So based on this response, the respondents were divided in two groups; *Uncomplicated Screeners* and *Uncomplicated Non-Screeners*.

We then looked at the responses of *Uncomplicated Screeners* to see what they would do in complicated scenarios. We found that if the patient expects the test, 15 of the 23 (65%) that did screen in Scenario 1 would also screen when the complicating dynamic expectation was added (Scenario 2), while 8 (35%) would not.

Similarly, among the 25 participants who indicated they would not screen in the uncomplicated situation, 6 (24%) now would screen when the patient expects the test as in Scenario 2. However, 19 participants (76%), did not change their position and would not screen whether the patient expected the test or not.

So the question is, does adding the dynamic of expectation to the patient- physician interaction change the proportion of participants who would screen? To assess this, our interest is in those who change their screening decisions between the two scenarios. On the left hand side we see that, when we add the element of expectation (Scenario 2), 8 of the 23 participants (35%) who would have screened in Scenario 1 choose not to screen with a CXR in Scenario 2, while 6 of the 25 participants who would not have screened in Scenario 1 (right side), choose to screen in Scenario2. The McNemar statistic examines the difference in the choices made in each of these scenarios. In case of Scenario 2 versus Scenario 1, there is no statistically significant change in choices (p-value=0.79. As such we can draw no overall conclusion about the impact of patient expectation on screening decisions – in some it appears to decrease the tendency to screen, while in others it seems to increase it.

Similarly, the results do not show a statistically significant change with the addition of complicating dynamics of anxiety, family history or poor relationship are added as individual complicating dynamics in each of the scenarios. We do however, find the results to be clinically relevant as 40% participants who did not screen in Scenario 1 indicated they will screen if positive family history was added (Scenario 4)

Results show a statistically significant difference for participants' responses in the uncomplicated scenario (Scenario 1) compared to responses for the multiple dynamic scenario (Scenario 6) p-value=0.006.

There is no statistically significant indication that FPs will change their screening practices with chest CT or sputum cytology when the dynamics of patient expectation, patient anxiety, family history, or poor patient-physician relationship are present compared to when they are not. Overall it appears that FPs are generally unlikely to screen ever-smokers with chest CT under any scenario situations.

Table 3-9 Comparison of the proportions of participants screening using CXR, CT, or sputum cytology in uncomplicated versus complicated patient-physician interactions

CXR	**Screen in uncomplicated scenario**				
	Yes, n = 23 (48%)		**No,** n = 25 (52%)		
	Screen in complicated scenario				
Complicating dynamic	**Yes**	**No**	**Yes**	**No**	**p-value***
Expectation	15 (65%)	8 (35%)	6 (24%)	19 (76%)	0.79
Anxiety	21 (91%)	2 (9%)	7 (28%)	18 (72%)	0.18
Family History	20 (87%)	3 (13%)	10 (40%)	15 (60%)	0.09
Poor relationship	18 (78%)	5 (22%)	5 (20%)	20 (80%)	1.0
All four dynamics	21 (91%)	2 (9%)	14 (56%)	11 (44%)	**0.006**

CT Chest	**Screen in uncomplicated scenario**				
	Yes, n = 3 (6%)		**No**, n = 45 (94%)		
	Screen in complicated scenario				
Complicating dynamic	**Yes**	**No**	**Yes**	**No**	**p-value***
Expectation	1 (33%)	2 (67%)	1 (2%)	44 (98%)	1.0
Anxiety	2 (67%)	1 (33%)	1 (2%)	44 (98%)	1.0
Family History	2 (67%)	1 (33%)	1 (2%)	44 (98%)	1.0
Poor relationship	1 (33%)	2 (67%)	1 (2%)	44 (98%)	1.0
All four dynamics	1 (33%)	2 (67%)	7 (16%)	38 (84%)	0.18

Sputum cytology	**Screen in uncomplicated scenario**				
	Yes, n = 9 (19%)		**No**, n = 39 (81%)		
	Screen in complicated scenario				
Complicating dynamic	**Yes**	**No**	**Yes**	**No**	**p-value***
Expectation	5 (56%)	4 (44%)	1 (3%)	38 (97%)	0.38
Anxiety	5 (56%)	4 (44%)	0 (0%)	39 (100%)	0.13
Family History	5 (56%)	4 (44%)	2 (5%)	37 (95%)	0.69
Poor relationship	4 (44%)	5 (56%)	2 (5%)	37 (95%)	0.45
All four dynamics	7 (78%)	2 (22%)	1 (3%)	38 (97%)	1.0

*McNemar's test comparing the proportion of participants who would screen in the uncomplicated scenario to the proportion screening in each of the complicated scenarios

3.10 Proportion of participants screening within each scenario by perception of screening recommendation

Table 3-10 reports on the influence of perception of screening guideline recommendations on screening decision making. For this analysis, the significant p-value was set at 0.008 to account for multiple testing. In scenarios where the patient-physician interaction was uncomplicated, patients expected the test, or patients had a family history of disease, participants were statistically significantly more likely to screen with a CXR if they perceived that it was recommended than if it was not. Recommendations did not clearly change screening practice if the patient was anxious, had a difficult relationship with the physician, or had multiple dynamics, as participants who did not perceive the test as recommended often showed some tendency to screen under these conditions.

From the group of FPs who did not perceive CXR was recommended and did not screen (21), a clinically significant number of them were influenced to screen if the patient was anxious or there was a positive family history of disease (for each factor, an increase from 8 to 13 out of 21, 63%) and with multiple dynamics (an increase from 8 to 19 out of 21, 138%).

So we can conclude that perception of recommendations influences FPs decision-making for lung cancer screening with CXR. However, when faced with patient factors of anxiety, difficult relationship and multiple complicating factors FPs decision to screen over-rides their perception meaning that these factors influence their decision-making.

Perception of recommendation regarding screening with CT did not appear to make a difference as to whether participants would screen or not. Although 7 individuals indicated that they felt CT is recommended as a screening tool in ever-smokers, its use was infrequently indicated in the scenarios.

Perception of recommendation regarding screening with sputum cytology appeared to make a difference in all scenarios as to whether or not a FP decided to screen. In each scenario approximately half to two-thirds of the nine FPs who felt that screening with

cytology in ever-smokers is recommended indicated that they would screen, while less than 10% of those who felt that cytological screening was not recommended, indicated they would order it. This contrast was statistically significant in all comparisons regardless of the presenting dynamic.

Table 3-10 Proportion of participants screening within each scenario by perception of screening recommendation

CXR	Overall N=48*		Perceived as recommended, n=18		Not perceived as recommended, n=29		p-value[†]
	Screen, n (%)		Screen, n (%)		Screen, n (%)		
	Yes	No	Yes	No	Yes	No	
Uncomplicated	23 (48)	25 (52)	14 (78)	4 (22)	8 (28)	21 (72)	**0.001**
Expectation	21 (43)	27 (57)	14 (78)	4 (22)	7 (24)	22 (76)	**0.001**
Anxiety	28 (58)	20 (42)	14 (78)	4 (22)	13(45)	16 (55)	0.04
Family history	30 (62)	18 (38)	16 (89)	2 (11)	13 (45)	16 (55)	**0.005**
Poor relationship	23 (48)	25 (52)	12 (67)	6 (33)	10 (34)	19 (66)	0.04
All four dynamics	35 (73)	13 (27)	15 (83)	3 (17)	19 (66)	10 (34)	0.32

Chest CT	Overall N = 48*		Perceived as recommended, n=7		Not perceived as recommended, n=40[†]		p-value
	Screen, n (%)		Screen, n (%)		Screen, n (%)		
	Yes	No	Yes	No	Yes	No	
Uncomplicated	3 (6)	45 (94)	1 (14)	6 (86)	2 (5)	38 (95)	0.39
Expectation	2 (4)	46 (96)	0 (0)	7 (100)	2 (5)	38 (95)	1.0
Anxiety	3 (6)	45 (94)	1 (14)	6 (86)	2 (5)	38 (95)	0.39
Family history	3 (6)	45 (94)	1 (14)	6 (86)	2 (5)	38 (95)	0.39
Poor relationship	2 (4)	46 (96)	1 (14)	6 (86)	1 (3)	39 (97)	0.28
All four dynamics	8 (17)	40 (83)	2 (29)	5 (71)	6 (15)	34 (85)	0.59

Sputum cytology	Overall N = 48*		Perceived as recommended, n=9		Not perceived as recommended, n=39		p-value
	Screen, n (%)		Screen, n (%)		Screen, n (%)		
	Yes	No	Yes	No	Yes	No	
Uncomplicated	9 (19)	39 (81)	6 (67)	3 (33)	3 (8)	36 (92)	**0.0005**
Expectation	6 (12)	42 (88)	5 (56)	4 (44)	1 (3)	38 (97)	**0.0004**
Anxiety	5 (10)	43 (90)	4 (44)	5 (56)	1 (3)	38 (97)	**0.003**
Family history	7 (15)	41 (85)	5 (56)	4 (44)	2 (5)	37 (95)	**0.001**
Poor relationship	6 (12)	42 (88)	6 (67)	3 (33)	0 (0)	39 (100.0)	**<0.0001**
All four dynamics	8 (17)	40 (83)	6 (67)	3 (33)	2 (5)	37 (95)	**0.0002**

*One participant did not provide a response to the vignette questions; among the remaining 48, two did not state their perception of CXR and CT respectively in ever-smokers;

†p-values from Fisher's exact test due to frequent small expected cells sizes and α = 0.008 to compensate for multiple comparisons (0.05/6 scenarios).

3.11 Conclusions

Results showed a substantial variation in reported lung cancer screening behaviour among FPs. Participants were classified as *Screeners* (69%) or *Non-Screeners* (31%) based on whether or not they reported ordering screening tests for their asymptomatic ever-smoker patients. Among *Screeners*, 16 of the 34 FPs (47%) also screened never-smokers.

Screeners were more likely to work more hours per week than *Non-Screeners* but were otherwise not distinguishable with respect to gender, age, College Certification or membership, type of practice, practice location or teaching affiliation.

Despite the fact that national guidelines did not recommend CXR as a screening test, it was the most frequently ordered test.

Missing a case of lung cancer resulted in increased screening behaviour for some time afterwards in both *Screeners* (85%) and *Non-Screeners* (50%). Similarly, a positive family history of lung cancer, occupational exposure such as asbestos, silica and chemicals or presence of comorbid conditions such as COPD resulted in a statistically significant difference in screening behaviour in *Screeners* (67%) and *Non-Screeners* (21%).

A minority of *Screeners* (13%) and a majority of *Non-Screeners* (79%) did not recommend CXR for screening because they thought there was potential to cause more harm than good. Medico-legal considerations had no impact on screening behaviour among FPs in either group.

Both *Screeners* and *Non-Screeners* were equally likely to apply lung cancer screening guidelines to each individual patient’s context.

Screening behaviour was influenced in favour of screening if the test was easily accessible or if the test was easy to administer, *Screeners* (77%) and *Non-Screeners* (50%).

Thirty-nine percent of FPs perceived CXR was recommended for lung cancer screening even though the prevailing guidelines at the time of data collection did not recommend CXR as a lung cancer screening test. It is interesting to note that both Screeners and Non-Screeners found the guidelines for lung cancer screening for asymptomatic ever smokers to be unclear.

It is worth noting that 18 participants thought CXR was recommended, but when faced with a scenario, 23 actually ordered one. Their responses changed when the question was one about recommended guidelines or a hypothetical case scenario suggesting that patient factors are a major influence on FP screening decision-making behaviour.

The fact that 48% screened in the uncomplicated scenario contrary to prevailing national guidelines, suggests that there must be other factors (besides the complicating dynamics assessed in this study) influencing their decision-making.

Among the participants who would not screen in the uncomplicated scenario, some indicated they will screen in the presence of additional factors (expectation, anxiety, family history, poor relationship) indicating that these factors influence their decision-making.

FPs' decision making is influenced by their perception of guidelines, however the presence of certain patient factors over rides their perception and influences their decision-making.

Chapter 4
Discussion

4.1 Introduction

This study made several important findings regarding the lung cancer screening practices and decision-making of family physicians (FPs) practicing in urban and rural Saskatchewan. First, the results showed a substantial variation in the reported lung cancer screening behaviour of FPs, both in their decision to screen and choice of screening test, with a majority of participants reporting they screened for lung cancer. Second, chest X-ray (CXR) was the most commonly ordered screening test. Third, based on whether or not they reported ordering screening tests for their asymptomatic ever-smoker patients, 69% were classified as *Screeners*. Fourth, clinical decision-making was assessed via clinical vignettes; the results demonstrated that up to 73% of FPs would order CXR for screening, contrary to prevailing guidelines. A significant number of FPs indicated they would screen in response to multiple patient factors (expectation, anxiety, family history, poor patient-physician relationship) in contrast to an uncomplicated patient scenario. This was true even for FPs who had indicated in another question that they perceived the guidelines to be against screening.

This study is unique, the first study regarding lung cancer screening in Canada. It contributes to the literature about existing FPs' practices and decision-making regarding lung cancer screening and highlights implications to health care cost, patient care, CME initiatives, and clinical practice guidelines.

4.2 Physician Factors and Screening Behaviour

Screeners were more likely to work more hours per week than *Non-Screeners* but were otherwise not distinguishable with respect to sex, age, college certification or membership, type or location of practice, teaching affiliation or number of years of practice. This is similar to what Tudiver et al found,[2,53] in that all of the above-mentioned factors did not significantly influence primary care physicians' (PCPs) screening

decisions for breast, colorectal and prostate cancer. However, recent studies on lung cancer screening by PCPs found increased screening was associated with physicians having more than 10 years in practice in one study[9], and in another more than 20 years[39]. A larger sample size might demonstrate similarities or differences between *Screeners* and *Non-Screeners*, thereby permitting further comparison with the findings of other studies.

4.3 Influence of Physician Attitudes on Screening Behaviour

Some statistically significant differences were found between *Screeners* and *Non-Screeners* when asked if they would screen in the presence of potentially influential physician or patient factors (one factor per question).

Screeners were more likely to be influenced to screen than *Non-Screeners* by one physician factor and by three patient factors. Missing a case of lung cancer influenced FPs stated behaviour to increase screening. This result is consistent with the influence of this physician factor in Tudiver`s qualitative study[10] for other cancers. Similarly, positive family history, occupational exposure such as asbestos, silica and chemicals, and the presence of comorbid conditions such as COPD resulted in increased screening behaviour. These patient factors consist of known risks for developing lung cancer other than by smoking.[7] The positive influence of these factors on screening can be explained by *Screeners* using evidence-based decision making for a population at risk (ignoring issues surrounding choice of screening test).

Non-Screeners (79%) were more likely than *Screeners* (13%*)* to not recommend CXR for screening due to the belief that it had the potential to cause more harm than good. The strong influence for *Non-Screeners* is consistent with evidence-based decision making informed by risk of potential harm.[7] This physician factor is consistent with its identification by Tudiver[10]. However, it was found to have a relatively weak screening influence for screening using PSA and mammograms in Tudivers' survey.[53]

4.4 Physicians' Perception of Lung Cancer Screening Guidelines

Screeners were more likely (52%) than *Non-Screeners* (7%) to perceive that CXR was recommended for their smoker patients. Yet, there are no guidelines, which recommend use of CXR as screening test under any patient conditions. It is interesting to note that both *Screeners* (69%) and *Non-Screeners* (46%) found the guidelines for lung cancer screening for asymptomatic ever smokers to be unclear. The results of this study demonstrate wide variation in lung cancer screening practices between FPs and frequent ordering of tests not recommended in national guidelines. It is important to address this variation as well as other guideline discordant practices as they have significant, unnecessary clinical and cost implications.[69-71] As an example, guideline discordant care for lung cancer in elderly patients results in poor survival outcomes.[72] Unnecessary tests may cause avoidable radiation exposure and anxiety that may be induced by false positive results.[7]

In part, these results imply a gap in knowledge with respect to lung cancer screening guidelines. The survey item which collected these data directly measured perception, not knowledge. It was not possible to know in advance which of potentially many guideline(s) the respondent was informed by, so direct questioning about knowledge of a specific guideline or guidelines would be premature and outside the scope of the study. Asking about perception also avoided potential risk of non-response if a participant felt he/she was being tested/assessed on specific guideline knowledge. None the less, even though the survey item measured perception, it also indirectly measured knowledge, finding some knowledge gaps with respect to related parts of a specific guideline. This was true for the perception that guidelines recommended CXR for smoker patients, when no major guidelines did so. This finding highlights one significant gap, but are there others? More comprehensive research, measuring detailed knowledge of specific guidelines would be valuable and necessary to find all the gaps. They could then be addressed by revised guidelines, arranging CME training, or publishing guidelines in journals. To allow access and wider dissemination, guidelines for lung cancer screening can be made part of the electronic medical record (EMR).[44]

Future research should explore why FPs order CXR as a screening test, especially among those who perceived guidelines did not recommend using CXR as a lung cancer screening test. This could be achieved by conducting qualitative research, either in-depth interviews or focus groups.

Both *Screeners* and *Non-Screeners* were equally likely to state that they apply lung cancer guidelines to each individual patient's context consistent with findings in literature.[73,74]

4.5 Choice of Screening Test among Screeners

Screeners comprised 69% of FPs. Among these *Screeners*, 47% also screened never-smokers.

CXR was the most frequently ordered lung cancer screening test, reported by 67% of FPs, despite the fact that national guidelines did not recommend CXR for this purpose. This was confirmed by the results from clinical scenarios with multiple dynamics (Scenario 6), where 35 out of 48 FPs (73%) said they would screen using CXR. This seems to indicate a higher prevalence than reported in a prior U.S. study, which utilized a survey questionnaire to measure attitudes, beliefs and behaviour for lung cancer screening. It concluded that a substantial number of physicians (amongst FPs and pulmonologists) reported they screen for lung cancer using CXR (25%) despite the fact that it was not recommended.[9]

The question about why FPs order CXR screening tests remains unanswered. Since a surprisingly large number of participants indicated they screen using CXR in this study, further research to identify the factors that influence decision- making for lung cancer screening should be conducted. A qualitative research design can explore this in future. This knowledge will help to address the frequency of its use as it results in unnecessary investigations and has unnecessary cost implications[69,70] without any return in improved health care delivery.

4.6 Influence of Non-medical Factors on Screening Behaviour

Screening behaviour was influenced in favour of screening if the test was easily accessible or if the test was easy to administer. This finding did not reach statistical significance but was a clinically relevant difference that in a larger sample may have been significant. This finding may help to shed some light on why FPs did not report ordering a CT scan and sputum cytology at a high frequency. It might be that CXR was the most ordered screening test because of its availability at most rural, regional and urban sites. CXR might also be ordered as a baseline comparison reference, believed to be an inexpensive way to detect potential lung cancer via abnormal changes in subsequent images.[5] CT Scanners are not available in rural facilities and radiologists at regional sites may refuse tests for screening purposes because of staffing issues or may triage as a CT that can be done several months later. It may also be that FPs offer CT chest as a screening test but patients refuse it to avoid driving or because some of them may be dependent on family members living at remote sites. As well, sputum cytology may yield high false negative tests and it may be that FPs consult pulmonologists for bronchoscopy and sputum cytology instead of ordering it themselves.

4.7 Influence of Lung Cancer in Self or Anyone Close and Smoking Status on Screening Behaviour

There were no statistically significant differences between *Screeners* (32%) and *Non-Screeners* (14%) based on themselves or close relatives having lung cancer on screening behaviour. These results are consistent with the Tudiver survey[53] which did not report significant influence. Note that this physician factor was represented in the current study population, reported by (27%) participants, with the larger proportion being *Screeners.* A larger sample size might demonstrate similarities or differences between *Screeners* and *Non-Screeners.*

4.8 Influence of Patient Factors in Clinical Scenarios

Section III of the survey consisted of the vignette-based study, which explored participants' intended behaviour under the influence of patient factors also called complicating scenarios. The outcome was the decision to order one or more types of lung cancer screening tests in each scenario. The goal was to discover the influence of these factors on FPs' decision-making.

Results for clinical scenarios for the baseline uncomplicated scenario (Scenario 1) showed 48% of participants would order a CXR to screen for lung cancer. The results showed a statistically significant increase in the screening behaviour in the presence of multiple patient factors (Scenario 6 – all four dynamics) $p=0.006$. When positive family history was added as complicating factor, the results showed a clinically relevant increase in CXR screening behaviour. Only a larger study would determine whether these trends are statistically significant.

On the other hand, non-screeners in the uncomplicated scenario showed a tendency to increase screening in each complicated scenario with statistical significance found when all four dynamics were in play. The non-screeners in the uncomplicated scenario seem to be leaning toward screening when complicating dynamics are added while the screeners in uncomplicated scenario leaned in the opposite direction. Only a larger study would determine whether these trends are statistically significant. If they are, further qualitative research might address the differences in approach to their practice.

There were no statistically significant indications that FPs will change their screening practices with chest CT or sputum cytology when the dynamics of patient expectation, patient anxiety, family history, or poor patient-physician relationship are present compared to when they are not. Overall, it appears that FPs were generally unlikely to screen ever-smokers with chest CT under any scenario. It is interesting to note, however, that only approximately half of the nine participants who would have screened using sputum cytology in the uncomplicated scenario would not do so in more complex situations. Further research might explore the rationale behind this observation.

FPs were more likely to make decisions according to their perception of guidelines as was observed in the responses for the uncomplicated scenario (Scenario 1) and in the presence of patient expectation (Scenario 2) and family history (Scenario 3) for CXR and in all complicating scenarios for sputum cytology. However, the presence of certain patient factors in the simulated clinical scenarios (patient anxiety, poor patient-physician relationship and multiple dynamics) influences their decision-making over-riding their perception of guidelines.

These findings are consistent with the results of Haggerty et al[2] who found that decision-making by some FPs, who normally followed evidence-based practice (guideline perception) was overridden in the presence of influential patient factors. Decision-making was influenced by patient anxiety or expectation for the cancers they studied (breast, colon and prostate). This study of lung cancer screening decision-making demonstrated this phenomenon for multiple patient factors (patient anxiety, expectation, positive family history, poor patient-physician relationship).

The notion that patient factors may lead FPs to override their decision to follow guidelines is further supported by other findings of this study. When asked in a single-item opinion-based question if CXR is recommended for lung cancer screening, 18 participants responded that they perceived that CXR was recommended; yet, when faced with an uncomplicated patient scenario, 23 indicated they would order a CXR. The fact that 48% screened in the Uncomplicated Scenario contrary to prevailing national guidelines, suggests that there must be other factors (besides the complicating factors assessed in this study) influencing their decision-making. In summary, presence of multiple factors (patient anxiety, expectation, positive family history of lung cancer, poor patient-physician relationship) significantly influenced FPs decisions to screen and over-rides their perception of guidelines. These findings illustrate the influence of patient factors on evidence-based medicine for lung cancer screening decision-making.

Makers of clinical practice guidelines should consider patient context to formulate better guidelines. Recent research promotes incorporating patient preferences and context into the guideline development process and are easy to use for physicians.[73] Patient

preferences and context are essential to shared decision making. The level of compliance depends on patient involvement and consideration of their specific context highlighting the need to improve the guideline development process. Strong recommendations are discouraged where the best decision depends on patient factors – preferences, context, goals, values.[75]

The high self-reported prevalence in single item questions and measured inclination to screen in clinical scenarios using CXR needs to be addressed. These findings on lung cancer screening decision-making should be of considerable interest in the current culture of health care cost reduction, for example, the *Choosing Wisely Canada*[76] campaign encouraging patient-physician dialog about unnecessary tests, treatments and procedures.

4.9 Implications

The study findings on FPs' lung cancer screening decision-making suggest the following important clinical implications:

1. Ordering of CXRs, which is against evidence-based guidelines adds unnecessary costs and burden on the health care system.
2. Guideline discordant investigations and false positive tests cause anxiety thereby increasing morbidity and further exposure to radiation with more investigations and consultations without any benefit to the patient.
3. Lack of knowledge of guidelines leads to variation in practice, highlighting the need for wide dissemination of evidence-based guidelines by CME, and/or integration within an EMR.
4. Various strategies in guideline development such as incorporating patient preferences, and engagement of patient values and preferences in decision-making may be employed to implement guidelines.[44,73,74,77-84]
5. The need for guideline makers and those implementing quality improvement strategies that measure adherence to guidelines to recognize that some variability is to be expected.[73,74]

4.10 Strengths

The study made use of evidence that incorporating a clinical vignettes design is a preferred methodology to assess physician behaviour and decision-making in surveys. Single-item questions responses are subject to recall bias and do not allow behaviour assessment in varying patient-specific contexts which are observed in routine clinical encounters. A clinical vignette methodology allowed simulating real life clinical encounters and permitted studying FP's intended behaviour in the presence of varied patient factors. Clinical vignettes have been shown to be a valid and cost-effective method to assess physician clinical decision-making, including those in cancer care.[85-88] Peabody[85] concluded that clinical case vignettes appear to be a valid and comprehensive method to focus on actual clinical practice in an outpatient setting, rather than physician competence. That study ranked the relative effectiveness of assessing clinical decision-making as 1) standardized patients, 2) clinical case vignettes and 3) chart abstraction. Research, specifically on vignette-based surveys[88] demonstrated they were more time efficient than record reviews or using standardized patients, and more cost-effective than standardized patients to assess clinical decision-making. Thus, the current survey that included clinical scenarios used the best evidence-based methodology available.

4.11 Limitations

The study has the following known limitations:

1. The ability to generalize to all FPs in Saskatchewan is limited by the low response rate. It is not possible to know if the sample was representative of the screening behaviour of the provincial population of FPs. However, it did appear that FP characteristics in our sample were comparable to provincial and Canadian FPs.
2. The study was limited to FPs in Saskatchewan, so the results may not reflect behaviour of all Canadian FPs.
3. The sample size was small making it difficult to detect clinically relevant differences. Statistical significance may not have been seen for many analyses because the sample size was relatively small and for repeated measures, the

Bonferroni adjustment was a strong correction to the p-value. However, there appeared to be clinically relevant trends and additional significance might be seen with a larger sample size. The proportions are susceptible to changes with small variation in the allocation of participants, again due to small sample size.

4. The results are based on FPs' reported behaviour and may be subject to desirability bias. Further research might be done to validate self-reported data, for example by comparison with chart audit of medical records.
5. The survey design can explore behaviour but not reasons behind the behaviour. Future qualitative study can address this concern.

4.12 Direction for future research

The results of the present study emphasize the need to better understand reported lung cancer screening behaviour and decision-making suggesting four potential research studies.

1. Research to examine why FPs screen patients for lung cancer and why they order CXR as a screening test. This research would examine the factors identified in this study and any additional factors that influence FPs' lung cancer screening decision-making. This could be achieved by conducting qualitative research, either in-depth interviews or focus groups.
2. After exploring qualitatively the factors influencing FPs' lung cancer screening, a national Canadian survey of FPs regarding their behaviour and decision-making for lung cancer.
3. Research to assess FPs' actual lung cancer screening behaviour by chart audit to address desirability bias and recall bias in self-reported behaviour in surveys.
4. Research to explore how guideline makers might engage FPs in the development of guidelines in the context of family practice. The results may then be used to inform guideline makers so that they can address concerns raised by their users.

References

(1) Canadian Task Force on the Periodic Health Examination, Canada, Health C. The Canadian guide to clinical preventive health care. Ottawa: Health Canada; 1994.

(2) Haggerty J, Tudiver F, Brown JB, Herbert C, Ciampi A, Guibert R. Patients' anxiety and expectations: how they influence family physicians' decisions to order cancer screening tests. Can Fam Physician. 2005 Dec;51:1658-9.

(3) Siegel RL, Miller KD, Jemal A. Cancer statistics, 2015. CA Cancer J Clin. 2015 Jan;65(1):5-29.

(4) Moyer VA. Screening for lung cancer: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med. 2014 Mar 4;160(5):330-8.

(5) Lam S, Lam B, Petty TL. Early detection for lung cancer. New tools for casefinding. Can Fam Physician. 2001 Mar;47:537-44.

(6) Stanbrook MB, Flegel K. A pause for thought on lung cancer screening. CMAJ. 2009 Apr 14;180(8):793.

(7) U.S.Preventive Services Task Force. Lung cancer screening: recommendation statement. Ann Intern Med. 2004 May 4;140(9):738-9.

(8) Palda VA, Van Spall HGC. Screening for Lung Cancer: Updated Recommendations from the Canadian Task Force on Preventive Health Care. The Canadian Task Force on Preventive Health Care. 2003 August [cited 2009 Jul 15];Available from: http://www.canadiantaskforce.ca/docs/CTF_Lung_Ca_Screen_Aug03.pdf.

(9) Gomez M, Nietert PJ, Ford DW, Zoller J, Silvestri GA. Physician Attitudes Towards Lung Cancer Screening. Chest. 2008 Oct 1;134(4):159001.

(10) Tudiver F, Brown JB, Medved W, Herbert C, Ritvo P, Guibert R, et al. Making decisions about cancer screening when the guidelines are unclear or conflicting. J Fam Pract. 2001 Aug;50(8):682-7.

(11) Melamed MR, Flehinger BJ, Zaman MB, Heelan RT, Perchick WA, Martini N. Screening for early lung cancer. Results of the Memorial Sloan-Kettering study in New York. Chest. 1984 Jul;86(1):44-53.

(12) Frost JK, Ball WC, Jr., Levin ML, Tockman MS, Baker RR, Carter D, et al. Early lung cancer detection: results of the initial (prevalence) radiologic and cytologic screening in the Johns Hopkins study. Am Rev Respir Dis. 1984 Oct;130(4):549-54.

(13) Fontana RS, Sanderson DR, Taylor WF, Woolner LB, Miller WE, Muhm JR, et al. Early lung cancer detection: results of the initial (prevalence) radiologic and cytologic screening in the Mayo Clinic study. Am Rev Respir Dis. 1984 Oct;130(4):561-5.

(14) Marcus PM, Bergstralh EJ, Fagerstrom RM, Williams DE, Fontana R, Taylor WF, et al. Lung cancer mortality in the Mayo Lung Project: impact of extended follow-up. J Natl Cancer Inst. 2000 Aug 16;92(16):1308-16.

(15) Marcus PM, Bergstralh EJ, Zweig MH, Harris A, Offord KP, Fontana RS. Extended lung cancer incidence follow-up in the Mayo Lung Project and overdiagnosis. J Natl Cancer Inst. 2006 Jun 7;98(11):748-56.

(16) Chest radiography: a summary of the evidence supporting selective clinical practice guidelines and recommendations for implementation. Saskatoon, Saskatchewan: The Saskatchewan Health Services Utilization and Research Commission; 1997 Sep.

(17) British Columbia Council Clinical Practice Guidelines. Chest x-rays in asymptomatic adults (monograph on-line)[updated July 2000]. Victoria,BC: Ministry of Health,Management SupportBranch,Resource Management Division; October 1996; 1996 Oct 1.

(18) Navratnum S, Sharma S, Tang SC, Champion P. The Manitoba consensus meeting on screening for lung cancer. Current Oncology. 2001;7(3):187-9.

(19) Mattson ME, Pollack ES, Cullen JW. What are the odds that smoking will kill you? Am J Public Health. 1987 Apr;77(4):425-31.

(20) Ooi WL, Elston RC, Chen VW, Bailey-Wilson JE, Rothschild H. Increased familial risk for lung cancer. J Natl Cancer Inst. 1986 Feb;76(2):217-22.

(21) Ooi WL, Elston RC, Chen VW, Bailey-Wilson JE, Rothschild H. Familial lung cancer--correcting an error in calculation. J Natl Cancer Inst. 1986 Oct;77(4):990.

(22) Skillrud DM, Offord KP, Miller RD. Higher risk of lung cancer in chronic obstructive pulmonary disease. A prospective, matched, controlled study. Ann Intern Med. 1986 Oct;105(4):503-7.

(23) Nawa T, Nakagawa T, Kusano S, Kawasaki Y, Sugawara Y, Nakata H. Lung cancer screening using low-dose spiral CT: results of baseline and 1-year follow-up studies. Chest. 2002 Jul;122(1):15-20.

(24) McCunney RJ. Rebuttal from Dr McCunney. Chest. 2015 Apr 1;147(4):877-8.

(25) Sobue T, Suzuki T, Matsuda M, Kuroishi T, Ikeda S, Naruke T. Survival for clinical stage I lung cancer not surgically treated. Comparison between screen-

detected and symptom-detected cases. The Japanese Lung Cancer Screening Research Group. Cancer. 1992 Feb 1;69(3):685-92.

(26) Sladden MJ, Ward JE. Do Australian family physicians screen smokers for lung cancer? Chest. 1999 Mar;115(3):725-8.

(27) Rodnick J. Physicians who do not follow screening guidelines. Am Fam Physician. 2006 Jan 1;73(1):161-2.

(28) Tudiver F, Herbert C, Goel V. Why don't family physicians follow clinical practice guidelines for cancer screening? Family Physician Study Group, Sociobehavioral Cancer Research Network, National Cancer Institute of Canada. CMAJ. 1998 Oct 6;159(7):797-8.

(29) Cabana MD, Rand CS, Powe NR, Wu AW, Wilson MH, Abboud PA, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. JAMA. 1999 Oct 20;282(15):1458-65.

(30) Pasternak RC, McKenney JM, Brown WV, Cahill E, Cohen JD. Understanding physician and consumer attitudes concerning cholesterol management: results from the National Lipid Association surveys. Am J Cardiol. 2004 Nov 4;94(9A):9F-15F.

(31) Koopmans J, Ross LF. Does familiarity breed acceptance? The influence of policy on physicians' attitudes toward newborn screening programs. Pediatrics. 2006 May;117(5):1477-85.

(32) Wiesenfeld HC, Dennard-Hall K, Cook RL, Ashton M, Zamborsky T, Krohn MA. Knowledge about sexually transmitted diseases in women among primary care physicians. Sex Transm Dis. 2005 Nov;32(11):649-53.

(33) Ray MN, Wall T, Casebeer L, Weissman N, Spettell C, Abdolrasulnia M, et al. Chlamydia screening of at-risk young women in managed health care: characteristics of top-performing primary care offices. Sex Transm Dis. 2005 Jun;32(6):382-6.

(34) Clark EC, Yawn BP, Galliher JM, Temte JL, Hickner J. Hepatitis C identification and management by family physicians. Fam Med. 2005 Oct;37(9):644-9.

(35) Hilsden RJ, McGregor E, Murray A, Khoja S, Bryant H. Colorectal cancer screening: practices and attitudes of gastroenterologists, internists and surgeons. Can J Surg. 2005 Dec;48(6):434-40.

(36) Ruff PA, Marotte JB, Terris MK. Primary care providers' attitudes toward prostate cancer risk factors at a Veterans Affairs health care facility. Mil Med. 2005 Feb;170(2):154-7.

(37) Federici A, Giorgi RP, Bartolozzi F, Farchi S, Borgia P, Guastcchi G. Survey on colorectal cancer screening knowledge, attitudes, and practices of general practice physicians in Lazio, Italy. Prev Med. 2005 Jul;41(1):30-5.

(38) Klabunde CN, Marcus PM, Silvestri GA, Han PK, Richards TB, Yuan G, et al. U.S. primary care physicians' lung cancer screening beliefs and recommendations. Am J Prev Med. 2010 Nov;39(5):411-20.

(39) Klabunde CN, Marcus PM, Han PK, Richards TB, Vernon SW, Yuan G, et al. Lung cancer screening practices of primary care physicians: results from a national survey. Ann Fam Med. 2012 Mar;10(2):102-10.

(40) Schwartz JS, Lewis CE, Clancy C, Kinosian MS, Radany MH, Koplan JP. Internists' practices in health promotion and disease prevention. A survey. Ann Intern Med. 1991 Jan 1;114(1):46-53.

(41) Bergner M, Allison CJ, Diehr P, Ford LG, Feigl P. Early detection and control of cancer in clinical practice. Arch Intern Med. 1990 Feb;150(2):431-6.

(42) Mauri D, Kamposioras K, Proiskos A, Xilomenos A, Peponi C, Dambrosio M, et al. Old habits die hard: chest radiography for screening purposes in primary care. Am J Manag Care. 2006 Nov;12(11):650-6.

(43) Henderson S, DeGroff A, Richards TB, Kish-Doto J, Soloe C, Heminger C, et al. A qualitative analysis of lung cancer screening practices by primary care physicians. J Community Health. 2011 Dec;36(6):949-56.

(44) Zitzelsberger L, Grunfeld E, Graham ID. Family physicians' perspectives on practice guidelines related to cancer control. BMC Fam Pract. 2004 Nov 15;5:25.

(45) Heidrich J, Behrens T, Raspe F, Keil U. Knowledge and perception of guidelines and secondary prevention of coronary heart disease among general practitioners and internists. Results from a physician survey in Germany. Eur J Cardiovasc Prev Rehabil. 2005 Dec;12(6):521-9.

(46) Lemon SC, Zapka JG, Estabrook B, Erban S, Luckmann R. Screening for colorectal cancer on the front line. Am J Gastroenterol. 2003 Apr;98(4):915-23.

(47) Farquhar CM, Kofa EW, Slutsky JR. Clinicians' attitudes to clinical practice guidelines: a systematic review. Med J Aust. 2002 Nov 4;177(9):502-6.

(48) Prochazka AV, Lundahl K, Pearson W, Oboler SK, Anderson RJ. Support of evidence-based guidelines for the annual physical examination: a survey of primary care providers. Arch Intern Med. 2005 Jun 27;165(12):1347-52.

(49) Shieh K, Gao F, Ristvedt S, Schootman M, Early D. The impact of physicians' health beliefs on colorectal cancer screening practices. Dig Dis Sci. 2005 May;50(5):809-14.

(50) Eaton CB, Galliher JM, McBride PE, Bonham AJ, Kappus JA, Hickner J. Family physician's knowledge, beliefs, and self-reported practice patterns regarding hyperlipidemia: a National Research Network (NRN) survey. J Am Board Fam Med. 2006 Jan;19(1):46-53.

(51) Curran V, Solberg S, Mathews M, Church J, Buehler S, Wells J, et al. Prostate cancer screening attitudes and continuing education needs of primary care physicians. J Cancer Educ. 2005;20(3):162-6.

(52) Clinical Practice Guidelines for the Prevention, Diagnosis and Management of Lung Cancer (Mar 2004). Cancer Council of Australia. 2015 [cited 2015 May 12];Available from: http://www.cancer.org.au/health-professionals/clinical-guidelines/lung-cancer.html.

(53) Tudiver F, Guibert R, Haggerty J, Ciampi A, Medved W, Brown JB, et al. What influences family physicians' cancer screening decisions when practice guidelines are unclear or conflicting? J Fam Pract. 2002 Sep;51(9):760.

(54) Hayat Roshanai A, Nordin K, Berglund G. Factors influencing primary care physicians' decision to order prostate-specific antigen (PSA) test for men without prostate cancer. Acta Oncologica. 2013;52(8):1602-8.

(55) Almeida CM, Rodriguez MA, Skootsky S, Pregler J, Steers N, Wenger NS. Cervical cancer screening overuse and underuse: Patient and physician factors. American Journal of Managed Care. 2013;19(6):482-9.

(56) Carlsen B, Aakvik A, Norheim OF. Variation in practice: A questionnaire survey of how congruence in attitudes between doctors and patients influences referral decisions. Medical Decision Making. 2008;28(2):262-8.

(57) Doria-Rose VP, White MC, Klabunde CN, Nadel MR, Richards TB, McNeel TS, et al. Use of lung cancer screening tests in the United States: results from the 2010 National Health Interview Survey. Cancer Epidemiol Biomarkers Prev. 2012 Jul;21(7):1049-59.

(58) Dillman DA, Smyth JD, Christian LM. Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method. Hoboken, New Jersey: **John Wiley & Sons, Inc.**; 2014.

(59) Lydeard S. The questionnaire as a research tool. Fam Pract. 1991 Mar;8(1):84-91.

(60) Fallowfield L. Questionnaire design. Arch Dis Child. 1995 Jan;72(1):76-9.

(61) Saw SM, Ng TP. The design and assessment of questionnaires in clinical research. Singapore Med J. 2001 Mar;42(3):131-5.

(62) Murray P. Fundamental issues in questionnaire design. Accid Emerg Nurs. 1999 Jul;7(3):148-53.

(63) Rattray J, Jones MC. Essential elements of questionnaire design and development. J Clin Nurs. 2007 Feb;16(2):234-43.

(64) McColl E, Jacoby A, Thomas L, Soutter J, Bamford C, Steen N, et al. Design and use of questionnaires: a review of best practice applicable to surveys of health service staff and patients. Health Technol Assess. 2001;5(31):1-256.

(65) Edwards PJ, Roberts I, Clarke MJ, Diguiseppi C, Wentz R, Kwan I, et al. Methods to increase response to postal and electronic questionnaires. Cochrane Database Syst Rev. 2009;(3):MR000008.

(66) Dillman DA, Smyth JD. Design effects in the transition to web-based surveys. Am J Prev Med. 2007 May;32(5 Suppl):S90-S96.

(67) Dillman DA. Why choice of survey mode makes a difference. Public Health Rep. 2006 Jan;121(1):11-3.

(68) Burns KE, Duffett M, Kho ME, Meade MO, Adhikari NK, Sinuff T, et al. A guide for the design and conduct of self-administered surveys of clinicians. CMAJ. 2008 Jul 29;179(3):245-52.

(69) Welch WP, Miller ME, Welch HG, Fisher ES, Wennberg JE. Geographic variation in expenditures for physicians' services in the United States. N Engl J Med. 1993 Mar 4;328(9):621-7.

(70) Caro JJ, Klittich WS, Strauss G. Could chest X-ray screening for lung cancer be cost-effective? Cancer. 2000 Dec 1;89(S11):2502-5.

(71) Fisher DA, Judd L, Sanford NS. Inappropriate colorectal cancer screening: findings and implications. Am J Gastroenterol. 2005 Nov;100(11):2526-30.

(72) Nadpara PA, Madhavan SS, Tworek C. Disparities in Lung Cancer Care and Outcomes among Elderly in a Medically Underserved State Population-A Cancer Registry-linked Database Study. Popul Health Manag. 2015 Jun 18.

(73) Montori VM, Brito JP, Murad MH. The optimal practice of evidence-based medicine: incorporating patient preferences in practice guidelines. JAMA. 2013 Dec 18;310(23):2503-4.

(74) Dirksen CD. The use of research evidence on patient preferences in health care decision-making: issues, controversies and moving forward. Expert Rev Pharmacoecon Outcomes Res. 2014 Dec;14(6):785-94.

(75) Andrews JC, Schunemann HJ, Oxman AD, Pottie K, Meerpohl JJ, Coello PA, et al. GRADE guidelines: 15. Going from evidence to recommendation-determinants of a recommendation's direction and strength. J Clin Epidemiol. 2013 Jul;66(7):726-35.

(76) Choosing Wisely Canada Campaign. www choosingwiselycanada org. 2015 [cited 2015 Jun 20];Available from: www.choosingwiselycanada.org.

(77) Zyzanski SJ, Stange KC, Kelly R, Flocke S, Shank JC, Chao J, et al. Family physicians' disagreements with the US Preventive Services Task Force recommendations. J Fam Pract. 1994 Aug;39(2):140-7.

(78) Olesen F, Lauritzen T. Do general practitioners want guidelines? Attitudes toward a county-based and a national college-based approach. Scand J Prim Health Care. 1997 Sep;15(3):141-5.

(79) Wolff M, Bower DJ, Marbella AM, Casanova JE. US family physicians' experiences with practice guidelines. Fam Med. 1998 Feb;30(2):117-21.

(80) Worrall G. Clinical practice guidelines: questions family physicians should ask themselves. Compr Ther. 1999 Jan;25(1):46-9.

(81) Garfield FB, Garfield JM. Clinical judgment and clinical practice guidelines. Int J Technol Assess Health Care. 2000;16(4):1050-60.

(82) Mottur-Pilson C, Snow V, Bartlett K. Physician explanations for failing to comply with "best practices". Eff Clin Pract. 2001 Sep;4(5):207-13.

(83) Greer AL, Goodwin JS, Freeman JL, Wu ZH. Bringing the patient back in. Guidelines, practice variations, and the social context of medical practice. Int J Technol Assess Health Care. 2002;18(4):747-61.

(84) Castiglione SA, Ritchie JA. Moving into action: We know what practices we want to change, now what? An implementation guide for health care practitioners. Canadian Institutes of Health Research. 2012 September 18 [cited 2015 Jul 9];Available from: http://www.cihr-irsc.gc.ca/e/45669.html.

(85) Peabody JW, Luck J, Glassman P, Dresselhaus TR, Lee M. Comparison of vignettes, standardized patients, and chart abstraction: a prospective validation study of 3 methods for measuring quality. JAMA. 2000 Apr 5;283(13):1715-22.

(86) Dresselhaus TR, Peabody JW, Lee M, Wang MM, Luck J. Measuring compliance with preventive care guidelines: standardized patients, clinical vignettes, and the medical record. J Gen Intern Med. 2000 Nov;15(11):782-8.

(87) Peabody JW, Luck J, Glassman P, Jain S, Hansen J, Spell M, et al. Measuring the quality of physician practice by using clinical vignettes: a prospective validation study. Ann Intern Med. 2004 Nov 16;141(10):771-80.

(88) Veloski J, Tai S, Evans AS, Nash DB. Clinical vignette-based surveys: a tool for assessing physician practice variation. Am J Med Qual. 2005 May;20(3):151-7.

(89) Stevens SS. On the Theory of Scales of Measurement. Science. 1946 Jun 7;103(2684):677-80.

(90) Deber RB, Thompson GG. Who still prefers aggressive surgery for breast cancer? Implications for the clinical applications of clinical trials. Arch Intern Med. 1987 Sep;147(9):1543-7.

(91) Sawka CA, O'Connor AM, Llewellyn-Thomas HA, To T, Pinfold SP, Harrison-Woermke D. Appropriateness of adjuvant systemic therapy for axillary node-negative breast cancer: a physician opinion survey. J Clin Oncol. 1995 Jun;13(6):1459-69.

(92) Tannock IF, Belanger D. Use of a physician-directed questionnaire to define a consensus about management of breast cancer: implications for assessing costs and benefits of treatment. J Natl Cancer Inst Monogr. 1992;(11):137-42.

(93) Sutherland HJ, Lockwood GA, Minkin S, Tritchler DL, Till JE, Llewellyn-Thomas HA. Measuring satisfaction with health care: a comparison of single with paired rating strategies. Soc Sci Med. 1989;28(1):53-8.

Appendix A
Lung Cancer Screening Survey Instrument

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE.

PLEASE RETURN THE QUESTIONNAIRE IN THE ENCLOSED ENVELOPE TO:
DR N. JAMIL

A STUDY OF HOW FAMILY PHYSICIANS MAKE LUNG CANCER SCREENING DECISIONS

THE DEPARTMENT OF FAMILY MEDICINE,
SCHULICH SCHOOL OF MEDICINE AND DENTISTRY

SECTION I

IN THIS SECTION WE WILL ASK YOU SOME QUESTIONS ABOUT YOUR PERCEPTION OF THE CURRENT GUIDELINES FOR SCREENING ASYMPTOMATIC PATIENTS FOR LUNG CANCER.

In this section "current guidelines" refers to any guidelines that you may have read *regardless of the organization or country they* were *published by.*

Please check or circle the response for each question.

1. **What do you perceive the current guidelines for screening for lung cancer say for asymptomatic patients with no risk factors?**

Screening Manoeuvre	*Recommended*	*Recommend Against*	*Insufficient Evidence*	*Conflicting Guidance*
Chest X-ray	□	□	□	□
CT Chest	□	□	□	□
Sputum Cytology	□	□	□	□

2. **What do you perceive the current guidelines for screening for lung cancer say for asymptomatic patients with smoking as a risk factor (i.e. current/past smokers)?**

Screening Manoeuvre	*Recommended*	*Recommend Against*	*Insufficient Evidence*	*Conflicting Guidance*
Chest X-ray	□	□	□	□
CT Chest	□	□	□	□
Sputum Cytology	□	□	□	□

3. **Do you consider the current guidelines for screening for lung cancer for asymptomatic patients with smoking as a risk factor (i.e. current/past smokers) to be clear and non-conflicting (i.e. two or more organizations have similar views)?**

   1. Yes
   0. No

SURVEY EVALUATION

YOUR COMMENTS ARE APPRECIATED, EITHER HERE OR ON A SEPARATE PAGE.

1. **Time to complete questionnaire? _____ minutes.**

2. **Effort to complete the questionnaire?**

   1 Easy
   2 Medium
   3 Tedious

3. **Overall, did the presentation of the questionnaire (font, layout, use of whitespace) make it readable?**

   1 Yes
   0 No

4. **Overall, were *instructions* clear, consise and specific/unambiguous?**

   1 Yes
   0 No

5. **Overall, were *questions* clear, consise and specific/unambiguous?**

   1 Yes
   0 No

6. **Overall, were *answers* directly related to what the questions probed?**

   1 Yes
   0 No

7. **Overall, did *answers* encompass all expected choices?**

   1 Yes
   0 No

8. **How can this questionnaire be improved? Please provide specific suggestions if possible on the presentation, instructions, questions and answers used in this questionnaire.**

SECTION V

IN THIS SECTION WE WILL ASK YOU SOME QUESTIONS ABOUT YOUR PERSONAL EXPERIENCE WITH LUNG CANCER AND LUNG CANCER SCREENING.

Please circle the number that corresponds with your answer for each question.

1. Have you or anyone close to you ever been diagnosed with lung cancer?

1 Yes
0 No

Please answer the following questions as appropriate.

2. *If you are a smoker:*
Have you sought (or will you seek) lung cancer screening for yourself?

1 Yes
0 No

3. *If you are not a smoker and have no other risk factors for lung cancer:*
Have you sought (or will you seek) lung cancer screening for yourself?

1 Yes
0 No

SECTION II

IN THIS SECTION WE WILL ASK YOU SOME QUESTIONS TO FIND OUT WHAT FACTORS INFLUENCE HOW YOU MAKE LUNG CANCER SCREENING DECISIONS WITH RESPECT TO ASYMPTOMATIC PATIENTS.

Please circle your response for each question.

1. In your practice, for asymptomatic patients who are never-smokers:

a. How often do you estimate you would routinely (every 1 or 2 years) screen for lung cancer?

0% 1-20% 21-40% 41-60% 61-80% 81-100%

b. What screening test(s) for lung cancer do you order?

CXR CT Chest Sputum cytology None

c. Re. question 1 (b) above, how often do you estimate you would order a chest x-ray as a percentage of your lung cancer screening tests?

0% 1-20% 21-40% 41-60% 61-80% 81-100%

2. In your practice, for asymptomatic patients with smoking as a risk factor (i.e. current/past smokers):

a. How often do you estimate you would routinely (every 1 or 2 years) screen for lung cancer?

0% 1-20% 21-40% 41-60% 61-80% 81-100%

b. What screening test(s) for lung cancer do you order?

CXR CT Chest Sputum cytology None

c. Re. question 2 (b) above, how often do you estimate you would order a chest x-ray as a percentage of your lung cancer screening tests?

0% 1-20% 21-40% 41-60% 61-80% 81-100%

Please circle the response that corresponds with the extent to which you agree or disagree with each of the following statements about lung cancer screening.

3.	**The guidelines for lung cancer screening are just guidelines. They are not absolute clinical rules.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
4.	**I apply lung cancer screening guidelines to each Individual patient's needs.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
5.	**I tend to follow lung cancer screening guidelines when they are published by an organization that I trust.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
6.	**If I missed a case of lung cancer I would tend to screen more patients for that particular disease for some time afterwards.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
7.	**I will routinely recommend a lung cancer screening test when there is insufficient evidence, in order to avoid medical -legal repercussions.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
8.	**I will routinely recommend a lung cancer screening test for patients if there is a positive history of smoking.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
9.	**I will routinely recommend a lung cancer screening test for patients if there is a positive family history of lung cancer**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
10.	**I will routinely recommend a lung cancer screening test for asymptomatic patients when there is a history of occupational exposure to asbestos, silica, or other chemicals.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
11.	**I will routinely recommend a lung cancer screening test when patients have co morbid conditions such as COPD.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE

SECTION IV

IN THIS SECTION WE WILL ASK YOU SOME QUESTIONS ABOUT YOU AND YOUR PRACTICE.

Please circle the number that corresponds with your answer for each question.

1. What is your gender?

1 Male
2 Female

2. What is your age group?

1 20-29 years
2 30-39 Years
3 40-49 years
4 50-59 years
5 60-69 years

3. Do you have Certification (CCFP) in the College of Family Physicians of Canada?

1 Yes
0 No

4. Are you a member of the College of Family Physicians of Canada?

1 Yes
0 No

5. How long have you been in practice?

_____ years

6. Are you in a group practice?

1 Yes
0 No

7. In what type of community is your practice located?

1 Urban setting
2 Rural setting
3 Regional Setting

8. How many hours per week do you see patients in your office(s) (not in hospital or emergency)?

_____ hours per week

9. Do you have a teaching affiliation?

1 Yes
0 No

Scenario #5

Mr. Frank Tonelli is a 52 year old who you have a poor relationship with. He rarely sees doctors because he has little trust in them. He needs a "full physical" for a life insurance application. He has no current health problems. He has a smoking history, no family history of lung cancer and has no occupational exposure and is not worried about having the disease. His examination is normal.

Based on the Information above, at the end of the visit what will you do?

Screening Manoeuvre	*Order*	*Not Order*
Chest X-ray	☐	☐
CT Chest	☐	☐
Sputum Cytology	☐	☐
Other: _____	☐	☐

Scenario #6

Mrs. Ina Shantz is a 41 year old difficult patient who you find challenging to work with. She often presents with unrealistic expectations regarding her care. Recently a friend of hers was diagnosed with lung cancer at age 43. This has increased her anxiety about her own chances of having lung cancer. She has a smoking history. Her father died of lung cancer at age 60. She wants to have a screening test done right away. She is healthy and has no previous history of lung disease. The clinical lung examination is entirely normal.

Based on the Information above, at the end of the visit what will you do?

Screening Manoeuvre	*Order*	*Not Order*
Chest X-ray	☐	☐
CT Chest	☐	☐
Sputum Cytology	☐	☐
Other: _____	☐	☐

12.	**I do not recommend CXR for lung cancer screening because I think It has the potential to cause more harm than good.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
13.	**I do not recommend CT Chest for lung cancer screening because I think It has the potential to cause more harm than good.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE

14. I will order a lung cancer screening test that I do not usually recommend if:

a)	**A patient is anxious about having the disease.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
b)	**A patient requests the test and Insists on having it done.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
c)	**I hear that my colleagues are recommending it to their patients.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
d)	**Specialists I work with recommend ordering the test.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
e)	**The test is inexpensive.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
f)	**The test is easily accessible.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
g)	**The test is easy to administer.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
h)	**The test will take less time to order than to convince a patient they do not need it.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE

SECTION III

IN THIS SECTION WE WILL ASK YOU TO INDICATE WHETHER OR NOT YOU WOULD ORDER A LUNG CANCER SCREENING TEST IN THE FOLLOWING DIFFERENT CLINICAL SCENARIOS.

Note: in the following scenarios, all patients are asymptomatic, current/past smokers.

Please check the box(es) that correspond with your answer for each question.

Scenario #1

Mr. Tom Eastman is a 56 year old male who has been consulting you for his hypertension which is well controlled with a beta blocker. He is a patient who you know well and have a good rapport with. He is scheduled today for a regular hypertension follow-up exam. He has heard of lung cancer screening tests from friends at work and wonders if you think he should have one done. He has a smoking history, no family history of lung cancer and has no occupational exposure and is not worried about having the disease. His blood pressure is 132/83 and the remainder of the examination is normal.

Based on the Information above, at the end of the visit what will you do?

Screening Manoeuvre	*Order*	*Not Order*
Chest X-ray	□	□
CT Chest	□	□
Sputum Cytology	□	□
Other: _____	□	□

Scenario #2

Mrs. Stephanie Myers is a 46 year old patient with whom you have an open and trusting relationship. At this visit she is requesting a screening test after reading on the Internet the high morbidity and mortality of lung cancer. Upon discussion you learn that she is not worried about her risk of lung cancer but rather sees the test as her right. She is healthy, has a smoking history, no family history of lung cancer or occupational exposure and no other related risk factors. The functional inquiry is negative for weight loss, cough and anorexia. The clinical lung examination is normal.

Based on the Information above, at the end of the visit what will you do?

Screening Manoeuvre	*Order*	*Not Order*
Chest X-ray	□	□
CT Chest	□	□
Sputum Cytology	□	□
Other: _____	□	□

Scenario #3

Mr. Vince de Ville is a 54 year old patient who you have a good relationship with. He is scheduled today for an annual check-up. He is quite anxious about his health and has brought in several articles off the Internet on lung cancer. He has a smoking history, no occupational exposure and his family history is negative for lung cancer. He is healthy and has no positive findings for lung cancer problems on physical exam.

Based on the Information above, at the end of the visit what will you do?

Screening Manoeuvre	*Order*	*Not Order*
Chest X-ray	□	□
CT Chest	□	□
Sputum Cytology	□	□
Other: _____	□	□

Scenario #4

Ms. Jenny Hill is a 53 year old who you have a good relationship with. She needs a "full physical" for a life insurance application. She has no current health problems. She has a smoking history. Her father died of lung cancer at age 60 but has no occupational exposure and is not worried about having the disease. The clinical lung examination is normal.

Based on the Information above, at the end of the visit what will you do?

Screening Manoeuvre	*Order*	*Not Order*
Chest X-ray	□	□
CT Chest	□	□
Sputum Cytology	□	□
Other: _____	□	□

Appendix B
Letter of Information

Letter of Information

Lung Cancer Screening Practices of Family Physicians in Saskatchewan

Introduction and Purpose of Study:

You are invited to participate in a study to explore your ideas, thoughts and experiences as a practicing family physician in Saskatchewan. The purpose of this letter is to provide you with the information you require to make an informed decision on participating in this research.

Who Can Participate:

You are invited to participate in this research if you are a practicing family physician in Saskatchewan. In order to be eligible to participate you must be between the ages of 25-65.

What Will the Study Involve:

Phase I of the study is a census survey to explore lung cancer screening practices.

In Phase II of the study, you may be invited to participate in an individual interview. The interview will take place at a location and time that is convenient for you and will take approximately thirty to forty-five minutes. The interview will be audio taped and transcribed verbatim.

Confidentiality and Privacy:

All information for the study is confidential. Each participant is assigned an ID number. All participant identifiers and ID numbers will remain in a master list in a password-protected database. The master list will remain separate from the data. The master list linking participant names to identifiers will be held separately from the data set and password protected or locked in a separate location (hard copy). The voice file of the interview will be sent off-site to a professional transcriptionist to be transcribed verbatim. If you use any names during the interview, they will be not transcribed but simply replaced with the word "name" or "place" (e.g. John = "name"). All electronic files will be password protected. All hardcopy forms and transcripts will be stored in a locked filing cabinet for security.

Voluntary Participation:

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time.

Risks and Benefits:

We see no risks associated with this research. The benefits include gaining a better understanding of the challenges you face regarding screening decisions for lung cancer and to influence improvements in this aspect of practice.

Do You Have Questions:

If the results of the study are published, your name will not be used and no information that discloses your identify will be released or published without your explicit consent to the disclosure.

If you have any questions about your rights as a research participant or the conduct of the study, please contact Dr. David Hill, Scientific Director, Lawson Research Institute at (###) ###-####. Representatives of The University of Western Ontario Health Sciences Research Ethics Board may require access to your study-related records or may follow up with you to monitor the conduct of the research.

If you have any questions regarding your participation in this study, please contact Dr. John Feightner, Principal Investigator at (###) ###-####

Thank you for your consideration.

Dr. John Feightner
Professor

Dr. Judith Belle Brown
Professor

Centre for Studies in Family Medicine
Department of Medicine
Schulich School of Medicine & Dentistry

Appendix C
Analysis of Tudiver Survey Instrument

C.1 Analysis

The sample questionnaire, appended to this discussion, was provided by Dr Tudiver[53] for review. It has the following structural attributes.

1. Section I – Questions about perceptions of current cancer screening guidelines
2. Section II – Questions about which factors influence cancer screening decisions
3. Section III – Clinical vignettes (two vignettes/cancer screen, six total) to inquire about decision to order cancer screening tests with variations in 4 patient factors
4. Section IV – Questions about respondent physician and practice characteristics
5. Section V – Questions about respondents personal experience with cancer and cancer screening

Note that the literature[53] refers to a two-part survey, where Part 1 includes Sections I, II, IV and V and Part 2 includes Section III. A fractional factorial design ensured that each physician received a unique questionnaire – Part 1 was common to all questionnaires but Part 2 was unique. Part 2 of the sample questionnaire had the following notable features:

1. Two prostrate cancer screening vignettes, males only, alternated good/bad patient/physician relationship
2. Two breast cancer screening vignettes, females only, alternated good/bad patient physician relationship
3. Two colorectal cancer screening vignettes, female, male, alternated good/bad patient physician relationship
4. The structure of each vignette modelled the flow of information/activity in a clinical encounter. In addition, the style of writing employed expressed the level of each of the four patient factors being investigated in a clinically meaningful manner. Sequentially, patient/physician relationship factor was explained first, then reason for the patients visit with relevance to specific cancer screening, then medical history factor (personal, family, risk factors), then patient factors

(expectation of screening test, significant anxiety) and then asymptomatic clinical examination results.

Overall, Section III implemented a fractional, factorial design with six clinical scenarios, each representing a frame (which set the context) and each having 16 variations representing all possible combinations of the four patient factors (independent variables). Six frames implies 6 x 16 = **96 vignettes** were required in the end and many more written during the iterative development/edit phase. The fractional factorial design required the unique series always had one vignette with all patient factors present, one with no patient factors present, and a random variation in patient factors in the remainder. The vignettes were presented in random order to minimize sequence bias. It appears that the frame position was fixed (Scenario #1-#6) so randomness must have been introduced by which patient factor combination would appear in which frame.

The clinical case vignettes were developed and tested in 4 steps.

1. Initially authored by the clinical investigators based on their experience.
2. Submitted to 12 family physicians colleagues for empirical review of descriptions.
3. Minimum of 9/12 (75%) had to correctly identify the intended level of each patient factor, else modified or replaced.

Those requiring correction were submitted to another set of 12 physicians to filter again according to 75% rule above.

Appendix D
Tudiver Survey Instrument

A NATIONAL STUDY OF HOW FAMILY PHYSICIANS MAKE CANCER SCREENING DECISIONS

FAMILY HEALTHCARE RESEARCH UNIT
DEPARTMENT OF FAMILY AND COMMUNITY MEDICINE
UNIVERSITY OF TORONTO

SECTION I

IN THIS SECTION WE WILL ASK YOU SOME QUESTIONS ABOUT YOUR PERCEPTION OF THE CURRENT GUIDELINES FOR SCREENING ASYMPTOMATIC PATIENTS WITH NO RISK FACTORS FOR CANCER.

In this section "current guidelines" refers to any guidelines that you may have read regardless of the organization or country they were published by.

Please circle the number that corresponds with your answer for each question.

1a. What do you perceive the current guidelines for screening for prostate cancer with Prostate-Specific Antigen (PSA) say for asymptomatic men over age 50 with no risk factors?

1 Screening with PSA is recommended.
2 Screening with PSA is not recommended.
3 It is unclear whether PSA should be recommended.

1b. Do you consider the current guidelines for screening for prostate cancer with Prostate-Specific Antigen (PSA) of asymptomatic men over age 50 with no risk factors to be conflicting (i.e. two or more organizations have different views)?

1 Yes
0 No

2a. What do you perceive the current guidelines for screening for breast cancer with mammography say for asymptomatic women age 40 to 49 with no risk factors?

1 Screening with mammography is recommended.
2 Screening with mammography is not recommended.
3 It is unclear whether mammography should be recommended.

2b. Do you consider the current guidelines for screening for breast cancer with mammography of asymptomatic women age 40 to 49 with no risk factors to be conflicting (i.e. two or more organizations have different views)?

1 Yes
0 No

3a. What do you perceive the current guidelines for screening for colorectal cancer with Fecal Occult Blood (FOBT) say for asymptomatic patients over age 40 with no risk factors?

1 Screening with FOBT is recommended.
2 Screening with FOBT is not recommended.
3 It is unclear whether screening with FOBT should be recommended.

3b. Do you consider the current guidelines for screening for colorectal cancer with Fecal Occult Blood (FOBT) of asymptomatic patients over age 40 with no risk factors to be conflicting (i.e. two or more organizations have different views)?

1 Yes
0 No

4a. What do you perceive the current guidelines for screening for colorectal cancer with colonoscopy say for asymptomatic patients over age 40 with no risk factors?

1 Screening with colonoscopy is recommended.
2 Screening with colonoscopy is not recommended.
3 It is unclear whether screening with colonoscopy should be recommended.

4b. Do you consider the current guidelines for screening for colorectal cancer with colonoscopy of asymptomatic patients over age 40 with no risk factors to be conflicting (i.e. two or more organizations have different views)?

1 Yes

0 No

SECTION II

IN THIS SECTION WE WILL ASK YOU SOME QUESTIONS TO FIND OUT WHAT FACTORS INFLUENCE HOW YOU MAKE CANCER SCREENING DECISIONS WITH RESPECT TO ASYMPTOMATIC PATIENTS WITH NO RISK FACTORS.

Please circle the response that corresponds with the extent to which you agree or disagree with each of the following statements about cancer screening.

1.	**The guidelines for cancer screening are just guidelines. They are not absolute clinical rules.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
2.	**I apply cancer screening guidelines to each individual patient's needs.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
3.	**I tend to follow cancer screening guidelines when they are published by an organization that I trust.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
4.	**If I missed a case of cancer I would tend to screen more patients for that particular disease for some time afterwards.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
5.	**I will order a cancer screening test when the guidelines are unclear to avoid medical-legal repercussions.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
6.	**I will recommend PSA for men over age 50 if there is a positive family history of prostate cancer.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
7.	**I do not recommend PSA for men over age 50 because I think it has the potential to cause more harm than good.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
8.	**I do not recommend mammography for women age 40 to 49 because I think it has the potential to cause more harm than good.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
9.	**I do not recommend FOBT for patients over age 40 because I think it has the potential to cause more harm than good.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
10.	**I do not recommend colonoscopy for patients over age 40 because I think it has the potential to cause more harm than good.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE

11. I will order a cancer screening test that I do not usually recommend if:

a)	**A patient is anxious about having the disease.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
b)	**A patient requests the test and insists on having it done.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
c)	**I hear that my colleagues are recommending it to their patients.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
d)	**Specialists I work with recommend ordering the test.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
e)	**The test is inexpensive.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
f)	**The test is easily accessible.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
g)	**The test is easy to administer.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE
h)	**The test will take less time to order than to convince a patient they do not need it.**	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE

SECTION III

IN THIS SECTION WE WILL ASK YOU TO INDICATE WHETHER OR NOT YOU WOULD ORDER A CANCER SCREENING TEST IN SIX DIFFERENT CLINICAL SCENARIOS.

Please circle the number that corresponds with your answer for each question.

Scenario #1

Mr. Tom Eastman is a 56 year old male who has been consulting you for his hypertension which is well controlled with a beta blocker. He is a patient who you know well and have a good rapport with. He is scheduled today for a regular hypertension follow-up exam. He has heard of the PSA test from friends at work and wonders if you think he should have one done. He has no urinary problems. He has no family history of prostate cancer and is not worried about having the disease. His blood pressure is 132/83 and the remainder of the examination is normal.

Based on the information above, at the end of the visit what will you do?

1 Order a PSA test
0 Not order a PSA test

Scenario #2

Mr. Vince de Ville is a 54 year old patient who you have a poor relationship with. He is difficult to interact with because he is very demanding and expects you "to do things his way". He is scheduled today for an annual check-up. He is quite anxious about his health and has brought in several articles off the Internet on prostate cancer. He demands to have a PSA test done. His family history is negative for prostate cancer. He is healthy and has no positive findings for prostate problems on physical exam.

Based on the information above, at the end of the visit what will you do?

1 Order a PSA test
0 Not order a PSA test

Scenario #3

Mrs. Ina Shantz is a 41 year old with whom you have an open and trusting relationship. Recently a friend of hers was diagnosed with breast cancer at age 43. This has increased her anxiety about her own chances of having breast cancer. Her mother died of breast cancer at age 57. She wants to have a mammogram done right away. She has two children. She is healthy and has no previous history of breast disease. The clinical breast examination is entirely normal.

Based on the information above, at the end of the visit what will you do?

1 Order a mammogram
0 Not order a mammogram

Scenario #4

Mrs. Stephanie Myers is 46 years of age. She is a difficult patient who you find challenging to work with. She often presents with unrealistic expectations regarding her care. At this visit she is requesting a mammogram after reading on the Internet that all women should start having mammograms at age 40. Upon discussion you learn that she is not worried about her risk of breast cancer but rather sees the test as her right. She has three children. She is healthy, has no family history of breast cancer and no other related risk factors. The clinical breast examination is normal.

Based on the information above, at the end of the visit what will you do?

1 Order a mammogram
0 Not order a mammogram

Scenario #5

Ms. Janice Gibson is a 48 year old healthy woman who you find easy going and pleasant to care for. She is very concerned about her own health having just learned about a 56 year old neighbor who had a colostomy due to colon cancer. She wants to be tested immediately. Although you explain the risks involved she still insists on being tested. She has no family history of colorectal cancer nor any significant findings during the functional enquiry.

Based on the information above, at the end of the visit what will you do?

a) 1 Order a FOBT
0 Not order a FOBT

b) 1 Order a colonoscopy
0 Not order a colonoscopy

Scenario #6

Mr. Frank Tonelli is a 52 year old who you have a poor relationship with. He rarely sees doctors because he has little trust in them. He needs a "full physical" for a life insurance application. He has no current health problems. Upon obtaining a family history you learn that his older brother, age 55, has recently been diagnosed with an "early form of colon cancer". However, Mr. Tonelli is not worried that he is at risk and does not expect any specific testing with regard to colorectal cancer. The functional enquiry is negative for blood in the stool, abdominal pain, chronic constipation or changes in bowel habit.

Based on the information above, at the end of the visit what will you do?

a) 1 Order a FOBT
0 Not order a FOBT

b) 1 Order a colonoscopy
0 Not order a colonoscopy

SECTION IV

IN THIS SECTION WE WILL ASK YOU SOME QUESTIONS ABOUT YOU AND YOUR PRACTICE.

Please circle the number that corresponds with your answer for each question.

1. **What is your gender?**

   1 Male
   2 Female

2. **What is your age?**

   _____ years

3. **Do you have Certification (CCFP) in the College of Family Physicians of Canada?**

   1 Yes
   0 No

4. **Are you a member of the College of Family Physicians of Canada?**

   1 Yes
   0 No

5. **How long have you been in practice?**

   _____ years

6. **Are you in a group practice?**

   1 Yes
   0 No

7. **What is the population size of the city in which you practice?**

   1 1,000,000 or more
   2 500,000 to 999,999
   3 100,000 to 499,999
   4 25,000 to 99,999
   5 Less than 25,000

8. **How many hours per week do you see patients in your office(s) (not in hospital or emergency)?**

   _____ hours per week

9. **Do you have a teaching affiliation?**

   1 Yes
   0 No

SECTION V

IN THIS SECTION WE WILL ASK YOU SOME QUESTIONS ABOUT YOUR PERSONAL EXPERIENCE WITH CANCER AND CANCER SCREENING.

Please circle the number that corresponds with your answer for each question.

1. **Have you or anyone close to you ever been diagnosed with cancer?**

   1 Yes
   0 No

Please answer the following questions according to your gender and age if appropriate.

2. ***If you are male and age 50 or older:***
   Have you sought (or will you seek) prostate cancer screening with PSA for yourself?

   1 Yes
   0 No

3. ***If you are female and age 40 to 49:***
   Have you sought (or will you seek) breast cancer screening with mammogram for yourself?

   1 Yes
   0 No

4. ***If you are age 40 or older:***
   Have you sought (or will you seek) colorectal cancer screening with FOBT for yourself?

   1 Yes
   0 No

5. ***If you are age 40 or older:***
   Have you sought (or will you seek) colorectal cancer screening with colonoscopy for yourself?

   1 Yes
   0 No

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE.

PLEASE RETURN THE QUESTIONNAIRE IN THE ENCLOSED ENVELOPE TO:

FAMILY HEALTHCARE RESEARCH UNIT
DEPARTMENT OF FAMILY AND COMMUNITY MEDICINE
UNIVERSITY OF TORONTO

Your comments are appreciated, either here or on a separate page.

Appendix E
Detailed Methods for Questionnaire Development

E.1 Questionnaire Design Methodology

The following describes the approach taken to develop this study's survey instrument, a questionnaire adapted from the Tudiver et al. survey tool. The Tudiver et al. study explored factors that influence cancer screening decision-making for prostate, breast and colorectal cancer. Since the current study objectives were focussed specifically on lung cancer screening, the methodology used in this study was unique.

The Tudiver et al. survey instrument was adapted to fulfil the new study objectives. Their survey tool had questions on prostate, colorectal and breast cancer. They were replaced with questions specifically about lung cancer screening. Questions were also added to estimate the proportion of physicians screening by self-report and to identify which tests were preferred.

E.2 Questionnaire Items

The questionnaire developed for this study was a derivation of the validated survey instrument used by Tudiver et al.[2,10,53] with modifications to adapt it to study how family physicians make lung cancer screening decisions. The questionnaire is composed of 38 single item questions (some with multiple answer subparts) and six clinical case vignettes, organized into five sections:

I. Physician perceptions of guidelines for lung cancer screening;

II. Inquiry into which medical and non-medical factors influence the participating physician's lung cancer screening decisions;

III. Clinical case vignettes to study the influence of factors (patient anxiety, expectation, positive family history) on family physicians lung cancer screening behaviour;

IV. Practice characteristics and physician demographics;

V. Physician's personal experiences with lung cancer and lung cancer screening behaviour;

VI. Survey Evaluation to obtain respondent feedback on validity and reliability.

E.2.1 Section II Items to classify physicians as Screeners or Non-Screeners

The survey collected data needed to classify participants into two groups – *Screeners* and *Non-screeners*. Direct query was chosen to minimize error and introductory questions (Section II, Q1 and Q2) were developed to examine screening behaviour. The following discussion references the actual questionnaire attached as an appendix.

Questions 1 and 2 are identical except they address screening behaviour for two groups, non-smokers and current or past smokers. This broadens the survey to include screening behaviour towards non-smokers who sometimes develop lung cancer. Non-smokers are defined as patients who have never smoked. Current or past smokers are patients who currently smoke or have past history of smoking.

Questions 1a and 2a are ratio scale[89] questions. The data they provide have a true zero value and were treated as ratio data. We are soliciting ratio data with what appears to be an ordinal scale with response options presented in ranges. Ranges are presented because it's faster for the respondent to answer the question, lowering respondent burden. Less respondent burden will promote a higher rate of return which enhances the external validity of the study.

Question 1b and 2b are nominal scale[89] questions added to collect data on ordering behaviour for all types of lung cancer screening tests.

Question 3-14 are ratio –scale questions. The data they provided have a true zero value and were treated as ratio data. A 4-point Likert scale was used to ease data collection.

E.2.2 Section III Clinical Case Vignettes

The Tudiver et al questionnaire[53] made use of clinical case vignettes noting "they have been shown to be a useful, inexpensive, and effective method for eliciting physicians' decision-making behaviour in a simulated situation".[85] Peabody concluded that clinical case vignettes appear to be a valid and comprehensive method to focus on actual clinical practice in an outpatient setting, rather than physician competence.[85] Their prospective study ranked the relative effectiveness of the methods studied as:

1) Standardized patients, 2) clinical case vignettes and 3) chart abstraction. Case vignettes have been used to examine physicians' practice behaviour with cancer patients.[90-93]

Tudiver[53] stated "For research purposes, the usefulness of the clinical case vignette rests on the ability to vary specific factors (relevant independent variables under study) from one vignette to another, while keeping constant the surrounding factors of the case presented (the frame)." The same rationale applies to the revised clinical case vignettes developed for the study questionnaire.

The survey included 6 clinical case vignettes developed by one of the clinician investigators (NJ). The vignettes vary the patient factors (independent variable) shown in Table 1, with the dependent variable being a yes/no decision to order any of the three screening tests (CXR, CT Chest, Sputum Cytology).

Table 1 Patient Factors Present in Clinic Vignettes

Patient Factor	Factor Present in Clinical Vignette					
	Scenario #1 (Control)	Scenario #2	Scenario #3	Scenario #4	Scenario #5	Scenario #6
Patient expects to undergo screening		Y				Y
Patient anxious about having lung cancer			Y			Y
Positive family history of lung cancer				Y		Y

Patient Factor	Factor Present in Clinical Vignette					
	Scenario #1 (Control)	Scenario #2	Scenario #3	Scenario #4	Scenario #5	Scenario #6
Poor quality physician-patient relationship					Y	Y

E.3 Reliability and Validity

To ensure validity and to ensure appropriateness of the reading level, the survey was piloted on three family physicians. This was followed by an interview to improve clarity and comprehensiveness of the questionnaire. This feedback led to changes to two questions about physician demographics: age was obtained as a range instead of an actual age; type of practice was broadened to add *Regional* to existing *Rural* & *Urban* choices.

This study also contains a section to test actual physician behaviour in a simulated clinical setting by means of a clinical experimental study component, consisting of clinical case vignettes where testing is done in the context of a controlled environment, one where independent variables are manipulated to examine decision-making behaviour. The scenarios presented are intended to model real-world clinical encounters, enhancing external validity.

References on questionnaire design and quality assessment were consulted during questionnaire development[59-68].

To increase the external validity of the study, a high rate of return was desired. This was promoted in this study by applying best practices identified in the literature including administration of the survey using the step-wise revised Dillman Method.[58]

Appendix F
Ethics Approval

Research Western

Use of Human Participants - Ethics Approval Notice

Principal Investigator: Dr. John Freightner
Review Number: 17272E
Review Level: Delegated
Approved Local Adult Participants: 0
Approved Local Minor Participants: 0
Protocol Title: How Family physicians in western Manitoba make lung cancer screening decisions
Department & Institution: ,
Sponsor:
Ethics Approval Date: January 13, 2012 **Expiry Date:** June 30, 2012
Documents Reviewed & Approved & Documents Received for Information:

Document Name	Comments	Version Date
Revised UWO Protocol	The location of the student researcher has changed.	
Revised Letter of Information & Consent		

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced revision(s) or amendment(s) on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

The Chair of the HSREB is Dr. Joseph Gilbert. The UWO HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

Signature

Ethics Officer to Contact for Further Information

___ Janice Sutherland	✓ Grace Kelly	___ Shantel Walcott

This is an official document. Please retain the original in your files.

Appendix G
Curriculum Vitae

CURRICULUM VITAE - NUSRAT JAMIL

Licensure

The College of Family Physicians of Canada

Certification in Family Medicine (CCFP)

Medical Council of Canada

Licentiate Medical Council of Canada (LMCC)

Education Commission for Foreign Medical Graduates (ECFMG)

ECFMG

College of Physicians and Surgeons of Saskatchewan

Licence to practice Medicine in the Province of Saskatchewan

Certifications

- Advanced Trauma Life Support (ATLS)
- Advanced Cardiac Life Support (ACLS)
- Neonatal Resuscitation Procedure (NRP)
- Pediatric Advanced Life Support (PALS)
- Procedural Sedation
- Certification in Higher Education Teaching (CHET), Faculty of Graduate Studies, University of Manitoba

Education

Master of Clinical Science in Family Medicine (Thesis)
Department of Family Medicine, University of Western Ontario

Courses Completed:

- Advanced Patient Centred Medicine
- Research Methods in Family Medicine
- Teaching and Learning in the Health Sciences
- Theoretical Foundations of Family Medicine
- Clinical and Teaching Practicum
- Meet the Researchers Seminar Series
- Thesis Research

Certification in Higher Education Teaching (CHET)
Faculty of Medicine and Faculty of Graduate Studies, University of Manitoba, January, 2005
First Physician to obtain certification in history of program

Research and Academic Skills Development Fellowship
Department of Family Medicine, University of Manitoba, Jan 2006

Teaching Experience:

- Preceptor for Undergraduate Med I and II Clinical Skills Labs/Workshops

Courses Attended:

- Teaching Dossier and Promotion and Tenure
- TIPS
- Workshops for Clinical Research, SBGH Office of Clinical Research:
  - Introduction to Clinical Research
  - Guidelines, Policies and Regulations in the Conduct of Clinical Research
  - Project Management for Clinical Research
- Thesis Writing Seminar
- Teaching with PowerPoint
- Reference Manager

Family Medicine Residency

Department of Family Medicine, University of Manitoba, Jul 2002 to Jan 2005

Awards:

First Prize, Best Poster Presentation – *Proposed Study of the Efficacy and Safety of Labetalol and Methyldopa in Pregnancy Induced Hypertension Patients*. Family Medicine Annual Research Day, Oct 2003.

Courses:

- Advanced Trauma Life Support (ATLS)
- Advanced Cardiac Life Support (ACLS)
- Neonatal Resuscitation Procedure (NRP)
- Pediatric Advanced Life Support (PALS)
- Procedural Sedation
- Monthly Journal Clubs throughout Residency
- Physician as Teacher Series

Anaesthesia Residency
Department of Anaesthesiology
The Aga Khan University Hospital, Oct 1997 to Jan 1999

Rotating Internship
Departments of Medicine, Emergency, Surgery, Neurosurgery, Intensive Care and Anaesthesia
The Aga Khan University Hospital, Oct 1996 to Oct 1997

Externship in USA
Departments of Medicine, Cardiology, Endocrinology and Neurology
University of Minnesota, USA, Apr 1995 to Jul 1996

Conducted patient histories, physical exams, initial diagnoses and proposed treatment plans. Actively participated in Case Conferences and Case Presentations. Learned interpretation of Body CAT Scan. Researched and presented a specified weekly topic to staff, residents and students.

MBBS (Bachelor of Medicine and Bachelor of Surgery) Degree
Dow Medical College, Mar 1989 to Jun 1995
St. Joseph Convent College, Apr 1986 to Aug 1988

Teaching Experience

Postgraduate Teaching

- *Medical Council of Canada*
  - ***Examiner** – MCC Qualifying Exam, 2014*

- *College of Family Physician's of Canada*
  - ***Examiner** – CCFP Certification Exam, 2015*

- *University of Saskatchewan:*
  - ***Physician Champion** : Responsible for teaching licenced Family Physicians in Saskatchewan the curriculum of the College of Family Physician of Canada to attain certification*
  - ***Clinical Assistant Professor –** University of Saskatchewan, Community Faculty Appointment (2012 to present)*
  - ***Preceptor** (2012)**:** Mentored medical students, U of S in Emergency Room, Yorkton, Saskatchewan.*

- *University of Manitoba:*
  - *Speaker at Family Medicine Annual Residents Retreat at University of Manitoba 2009*
  - *Involved in Teaching Family Medicine Residents as a Fellow*
  - *Director Physician Mentorship Program Saskatchewan July 2009 to July 2011*
  - *Involved in Teaching and Evaluating Medical Students and Residents of University of Manitoba rotating through Emergency Medicine in Brandon*
  - *Mentoring and evaluating International Medical Graduates in Brandon Emergency Room for Manitoba Program for Licensing International Medical Graduates*

Undergraduate Teaching

- *Guest Lecturer at University of Manitoba*
  Courses taught:
  - *Communication skills*
  - *Physical Examination labs*
    - *Respiratory System*
    - *Cardiovascular System*
    - *Abdominal Exam*
    - *Musculo-skeletal System*
    - *Central Nervous System*

Teaching and Learning Portfolio

- *Tips to improve bedside teaching in the clinical training unit*
- *Tips for teaching in large and small groups*
- *Tips for teaching in the Ambulatory setting- A primer for community preceptors*
- *Tips for assessment and evaluation in large and small groups*
- *Tips on resident assessment (Mentor Feedback)*

Clinical Experience

Emergency Room Physician, January 2011 to Present
Yorkton Regional Health Centre

Family Physician, January 2009 to Present
Various Regional Health Authorities in Saskatchewan

Emergency Room Physician, July 2007 to April 2011
Brandon Regional Health Centre

Emergency Room Physician (Locum), November 2005 to 2012
Various sites in Manitoba

Family Physician (Locum), January 2009 to July 2011
Various sites in Saskatchewan

Community Family Physician Yorkton, August 2011 to Present
Private Practice

Research Experience

Lung Cancer Screening Practices of Family Physicians in Saskatchewan
Janus Research Grant from College of Family Physicians of Canada

Counseling Adolescents to Prevent Motor Vehicle Accidents
Qualitative method of in-depth interviews to study the perceptions of health care professionals about counseling adolescents for safe driving practices to prevent motor vehicle accidents in this population.

A study of Family Physician's screening practices for lung cancer in smokers
Cross Sectional Study (chart audit)

Does breast feeding and aerobic exercise help in reducing weight? Are the results significantly different from non-breast feeding, exercising mothers?
Clinical Descriptive Research Proposal

STI Prevention Plan in Adolescents
Development of Proposal with the following objectives:

- *To provide education and knowledge about safe sexual practices for prevention of STIs in adolescents in Family Medicine/Pediatric Clinics.*
- *To decrease morbidity rates secondary to STIs.*

To study the efficacy and safety of two drugs – methyldopa and labetalol with the goal to achieve better control of PIH leading to better maternal and neonatal outcomes
Randomized control trial (double blind study)

Medical Consultant to Health Canada, Clinical Drug Trials, Jan 2000 - 2007
Centre for Biologics Evaluation, Clinical Evaluations Division, Health Canada, Ottawa

Research Experience in USA
Alzheimer's Research Foundation, Minneapolis, Minnesota, USA., Oct 1995 to Aug 1996
Lab Study of drug administration by intra-nasal route via the cribriform bone, to increase drug concentration in the central nervous system, while minimizing peripheral side effects.

Public Health Experience

Director, Medical Aid and Domestic Violence Relief International, Ottawa July 2000
Founder of non-profit NGO, currently at project proposal and fundraising stage.
Director of Burn Unit Programs, International Network for the Rights of Victims of Violence in Pakistan, University of Louisville, USA, Oct 1999
Authored a Needs Assessment & Proposal for establishing a Burn Unit, for N.A. sponsorship.
Participation in other public health projects since pre-clinical years.

- *Sind Institute Of Urology And Transplant - Organised international conferences*
- *Volunteered in Free Clinics for the underprivileged - Organised by Karwane Khair, an NGO based in Karachi, Pakistan. Clinic provided free screening for diabetes & hypertension, healthy lifestyle education.*
- *Organized & participated in social welfare activities at DOW Medical College, Aga Khan University Hospital*

Administrative Positions:

- *Physician Advisory Committee, Sunrise RHA (2011 to 2015)*
- *Regional Medical Advisory Committee, Sunrise RHA (2011 to 2015)*
- *Chief of Emergency Medical Services, Sunrise RHA(2011 to 2015)*
- *Vice Chairperson, Mental Health Services, Yorkton (2011 to 20150*
- *Board Member PARIM - Professional Association of Residents In Manitoba.*
- *Urban-Member at Large(Former) - Manitoba Medical Association*
- *Director, Medical Aid and Domestic Violence Relief International (Former) - Ottawa*

Memberships & Affiliations

- *College of Family Physicians of Canada*
- *Saskatchewan Medical Association*
- *College of Family Physicians of Canada (Section of Teachers)*
- *College of Family Physicians of Canada (Section of Researchers)*
- *Doctors Manitoba*
- *Canada: Medical Aid and Domestic Violence Relief International, Canada*

Honours and Awards

- *College of Family Physicians and Canada - Janus Research Grant Award Year 2009*
- *University of Manitoba - Best Poster Presentation Award 2005*

Conferences

- *Faculty Development Seminars, University of Saskatchewan (SnoDocs), 2013,14&15*
- *North York General Emergency Medicine Update May 2009*
- *Faculty Development Seminars and Workshops University of Manitoba, 2008*
- *Communication skills workshop, Toronto July 2008*
- *MSK 2008, Whistler BC*
- *Emergency Medicine update 2008, Whistler BC*
- *Cancer Pro; Cancer Care Manitoba Brandon, Manitoba 2008*
- *North American Primary Research Group (NAPCRG)*, Banff, Oct 2003
- *Family Medicine Forum*, College of Family Physicians of Canada, Calgary, Oct 2003
- *Family Medicine Forum*, Manitoba College of Family Physicians, Winnipeg, Apr 2003
- *Annual Scientific Assembly,* Ontario College of Family Physicians, Toronto, Nov 2002.