2002

The Contextual Approach in Health Research: Two Empirical Studies

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Citation of this paper:

Kothari, Anita, "The Contextual Approach in Health Research: Two Empirical Studies" (2002). *Health Studies Publications*. 16.
https://ir.lib.uwo.ca/healthstudiespub/16

THE CONTEXTUAL APPROACH IN HEALTH RESEARCH: TWO EMPIRICAL STUDIES

By

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A Thesis

Submitted to the School of Graduate Studies

in Partial Fulfilment of the Requirements

for the Degree

Doctor of Philosophy

McMaster University

THE CONTEXTUAL APPROACH IN HEALTH RESEARCH

DOCTOR OF PHILOSOPHY (2002)
(Health Research Methodology)

McMaster University
Hamilton, Ontario, Canada

TITLE: **THE CONTEXTUAL APPROACH IN HEALTH RESEARCH: TWO EMPIRICAL STUDIES**

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NUMBER OF PAGES: 297

THE CONTEXTUAL APPROACH IN HEALTH RESEARCH: TWO EMPIRICAL STUDIES

ABSTRACT

Researchers are being encouraged to consider contextual influences on health-related outcomes. To support this perspective, two context-sensitive studies were conducted. The first study explored the utilization of a research report by Ontario public health units, and examined whether utilization differed by involvement in the research process. Research utilization was conceptualized as a three stage process (reading, information processing and application). Using a case study design, results from three "involved" public health units and three "uninvolved" units demonstrated that inclusion in the research process led to a greater understanding of the analysis and increased the value associated with the report. Involvement did not, however, lead to greater research utilization. An associated contextual analysis provided a rich backdrop, highlighting the general challenges of implementing research-based guidelines given front-line workers' current realities.

The second study examined the influence of contextual level (e.g., health region level) socioeconomic status on a woman's lifetime mammography screening uptake. A secondary data analysis was conducted using Ontario data from the 1996 National Population Health Survey. Logistic hierarchical multilevel modelling was used to examine the regional variation in mammography uptake, and to examine the role of contextual and individual level variables on regional variation. The estimated average proportion of Ontario women, aged 50-69, who reported ever having had a mammogram was 0.86. Results demonstrated modest variations among health regions in ever having had a mammogram. These variations could not be explained by the variables considered in this study. Individual level variables demonstrated an association with mammography uptake, as did regional level education and regional median family income. Furthermore, each of these latter two contextual variables demonstrated interaction effects with the individual level variable, "social involvement." Thus, contextual variables played a significant role in mammography uptake. Contextual circumstances ought to be considered during the development of breast health promotion programs and policies.

ACKNOWLEDGEMENTS

This dissertation could not have been written without a supportive network of colleagues, friends and family.

I was fortunate to be affiliated with a multidisciplinary supervisory committee. The members – Stephen Birch, George Browman, Cathy Charles and Geoff Norman – each challenged me through his or her own disciplinary frame of reference. By doing so, this thesis became more rigourous, the writing became clearer, and I became a better researcher.

My supervisor and advocate, Stephen Birch, deserves additional gratitude. He demands the highest quality work of himself, and by association I learned to expect the same from myself. Less than the best just wasn't worth doing. A strong sense of professional integrity, the protection of writing time, the advantages of humour, and the importance of family time – all of these I learned from him.

I would like to also add an honourary member to this committee: Lynne Lohfeld. She quickly stepped in with moral support and scholarly advice when asked, and graciously stepped back when the road became smoother. Lynne helped me envision the final product at that exact moment when I needed inspiration. I value her friendship, and especially the particular conversation which lead to the Preface.

I would like to thank publically Kelvyn Jones and Craig Duncan. Believe it or not, these two actually made hierarchical multilevel modelling seem like fun.

I owe my day-to-day motivation to my friends on the "PHinisheD Board." Although I've only met a handful of Board members in person, and despite the fact that we come from different walks of life and disciplines, these folks represented my student community. They cheered me up when goals seemed unattainable, and they celebrated my achievements. I am honoured to share this Phinishing moment with such fine people.

There were many friends in the Hamilton area who allowed me to camp out on their couch when I commuted from Ottawa. Their hospitality, and home-cooked meals, were greatly treasured. Special thanks are extended to Kate & Tim, Meera & Karl, and Kal & Sarodha, who always made feel like part of the family.

This work was supported financially by The Medical Research Council of Canada and The Centre for Health Economics and Policy Analysis. In particular, Tom Abernathy and the Central West Health Planning Information Network facilitated the writing of this thesis through studentships, contract work and by providing networking opportunities. This overall support was appreciated. Of course, the research could not have been conducted without the cooperation and enthusiasm of the participating Ontario public health units and their staff – many thanks.

I could not let this opportunity slip by without expressing thanks to my family. Year after year, they continued to support me even when they weren't quite sure what I was doing. It didn't matter, of course. As long as I was happy, they were happy.

Last, and most importantly, I have to thank my wonderful husband, Robert Stainton. If it weren't for him I wouldn't have started, nor would I have finished this dissertation. His absolute faith in my abilities carried me through the rough patches. Together we continued to build a rich life during the thesis, instead of waiting for life to start after graduation. Because of him I remained calm, and focussed on our larger priorities. A simple 'thank you' is not enough! So, this dissertation is dedicated to him, and to my two lovely daughters, Moonisah and Saima, who turned me into a "Mommy" three months before I became a "Doctor."

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PREFACE

The Contextual Approach

This doctoral thesis is composed of two empirical studies that share a common aim – to maintain a contextual perspective during the discovery of new knowledge in health research. The studies are presented consecutively, but taken together they demonstrate that a contextual perspective can be applied to very different types of investigations. Before discussing the studies, what is meant by a contextual approach is introduced in this preface. Some benefits of the contextual approach are highlighted, as are some shortcomings associated with the current literature. These points of discussion serve as a backdrop for the two thesis studies.

To begin, it is worth noting that reductionist models of health and health research are being supplemented with more context-sensitive approaches (Diez-Roux 1998; Link & Phelan 1995; McKinaly 1993; Stokols 1992; Susser, Watson, et al. 1985; Syme 1986; Syme & Berkman 1976). Traditional reductionist models require that health-related problems be broken down into smaller units of analysis. Such subproblems then become available for study in their own right, and subsequent research findings associated with a subproblem are generalized to the original problem. These models are applied to the ways in which:

- health is conceptualized
- poor health is thought to be caused
- health (and illness) is studied
- the effectiveness of interventions is assessed
- and to the ways in which findings from health research are implemented in programs and policies

Contextual approaches, on the other hand, are concerned with understanding the surrounding circumstances alongside with understanding the associated health problem or issue. Advocates of context-sensitive approaches claim that treating larger problems as independent smaller units might miss important relationships between units, and between units and the overall problem. For example, instead of explaining ill health as inadequate health care services (reductionist approach), ill health can be described using frameworks that integrate, and consider the interrelatedness of, the social, physical and economic environment and declining health status (contextual approach) (Evans & Stoddart 1990). In terms of conducting research, contemporary epidemiologists seek out individual risk factors for diseases (reductionist approach). In contrast, non-reductionists recommend a return to a more classical type of epidemiology, where people, problems and settings are studied as a whole (contextual approach) (Pearce 1996). Context-sensitive approaches can also be identified in the application of research findings. For example, the practice of public health has experienced a shift in tradition; the "new public health" focuses on broader-based social interventions as a complement to trying to modify individual risk behaviours (Dean & Hunter 1996).

In the desire to overcome reductionist tendencies among health researchers, the advantages of a contextual approach have been presented from various angles (Diez-Roux 1998; Link & Phelan 1995; McKinaly 1993; Rose 1985; Stokols 1992; Susser, Watson, et al. 1985; Syme 1986; Syme & Berkman 1976). One of the arguments is that current interventions mostly concentrate on "downstream" acute care needs, but greater emphasis needs to be placed on "upstream" ones that target overarching, persistent conditions (e.g., social and political structures) (Link & Phelan 1995). Another argument is that there has been little success with changing individual lifestyle behaviours. Therefore, changing contexts to facilitate healthy behaviours in populations might be more successful (Rose 1985; Syme 1986). A related argument is that individually-based strategies encourage "victim-blaming" and dissociate the social component of health-related behaviours (Emmons 2000). In light of these and other arguments, health researchers have been encouraged to devote attention to contextual elements when designing research studies.

A context-sensitive approach was incorporated in this doctoral dissertation. As a result, some concerns and ambiguities related to conducting context-sensitive research became apparent. Although these concerns arose and were revisited many times during the planning and implementation of the research, they are discussed here, at the beginning of this work. As a result, the reader will have a firmer grasp of both the overall direction of the thesis and the subtle design choices made within each of the two studies presented in the upcoming chapters.

Three Concerns About the Contextual Approach

The first concern is that while the literature contains many arguments for doing context-sensitive research, there are few empirical examples which treat contextual conditions in a truly meaningful way. Those that treat it at all tend to include context as simply one more *isolated* variable (e.g., Anderson, Sorlie, et al. 1996). The danger is in slipping into traditional modes of conceptualizing which fail to relate contextual variables to other variables. This could be avoided by the use of a comprehensive conceptual framework, through the analytical investigation of interaction effects, and/or by engaging in a thorough discussion of study findings. That is, what is required is an approach that reflects the nature of society, where sub-populations are in fact nested within, and influenced by, other populations and environments. Without acknowledging the interrelatedness of variables, researchers and policymakers might perceive the individual and the contextual determinants of a phenomenon as two completely separate, independent effects. What is more meaningful is hypothesizing an overlap or interaction between the two effects, and then seeking to understand the nature of this interaction. Thus, pursuing this overlap was a consideration in this dissertation.

The next concern relates to a definition of context. Discussions in the health research literature revolve around the measurement and analysis of context, and less around what is meant by context. This lack of discussion has resulted in a default position: that context is the social, physical or economic environment. The default position has its place, but it is limited, and should be supplemented by other possibilities.

Informal statistical parlance likens context to the background “noise”, and outcomes as the “signal” in a radio transmission. In some situations, the noise or context could be the social, physical or economic environment. In other situations the noise could mean key legislation, local politics or historical context, as they affect health outcomes. For example, determining the success of tobacco control initiatives could be well informed by studying legislation, politics or historical background. The default position around context has also compelled health researchers to automatically classify context as a broad-based measure (as has been done throughout this thesis). The noise could be described, however, as an internal mental state, which is an individual level factor. It might be important to understand, for example, how lay perceptions about health influence the effectiveness of interventions in a systematic way. As a consequence, targeted health education messages could be used with associated interventions to achieve a synergistic response in particular sub-populations.

An attempt was made to avoid the default position in this thesis. Instead, it was more helpful to think about context as *the relevant circumstances that surround the unit of analysis*, which might include, but is not limited to, the social, physical and economic circumstance. There is no claim here that this is the best description of context. Instead of only thinking about the social, physical or economic environment, however, this description opened up the possibility for other types of contextual influences to be identified.

The last concern is that despite the recommendations to consider context, the health literature is just starting to make progress in terms of promoting innovative ways to conduct and apply context-sensitive research. This progress is exemplified by the growing literature on multilevel modelling in health research, reviewed in the second thesis study. In contrast, the evidenced-based movement, an opposite approach, has gained momentum. Evidenced-based medicine is a process whereby clinicians are encouraged to systematically retrieve, and critically evaluate and apply research findings to their practice population. This movement has given rise to a collection of related activities, language, journals, etc. In essence, however, evidenced-based medicine strips away context and replaces it with the best possible average response to an illness among highly selected study populations. In contrast to this growing movement, a similar momentum has not been put forward as strongly by contextual advocates.

So the challenge of incorporating a contextual approach is traced to the minimal number of examples or specific guidance in the health research literature. This gap in the literature is especially relevant to health promotion and disease prevention activities, where the phrase "web of causation" is often used to describe the complexities of public health programs. Such interventions are likely to be delivered in ways that are influenced by local conditions. And these interventions are subsequently taken up or practised by an individual who is also heavily influenced by his or her circumstances. If context influences the delivery, practice, outcome or value of an intervention, then the extent of that influence needs to be taken into account before the intervention reaches its target audience. Otherwise, an inaccurate measure of effectiveness might be assumed by researchers, decision-makers and program recipients (Birch 1997).

Two Studies Within the Contextual Approach

The two studies in this thesis were designed to incorporate a contextual perspective in ways that attempt to overcome these concerns. They are, however, two very different kinds of studies, using different study populations, methodological techniques and outcomes of interest. Their commonality lies in understanding how contextual variation contributes to, or influences, outcomes related to breast cancer early detection programs.

The first study examined the use of research findings in public health units. Here, a research report about breast cancer early detection practices was circulated among public health units in Ontario. The interest lay in examining the utilization of this report. This first study was situated in the community, where events could not be influenced by the researcher; the research question was more applied in nature. The findings from the study are directly and almost immediately applicable to policies and programs – a "close to policy" kind of research problem.

The second study examined the utilization of mammography screening by women in Ontario. The extent to which individual and contextual level factors could explain differences in screening was explored. This study, in contrast to the first, used pre-existing databases to obtain variables of interest. Consequently, the researcher was able to have more influence on the way in which the investigation was designed. This study can be characterized as a "close to research" kind of investigation.

The two studies also differ in the type of research design used. The first study, a multi-case study, permitted a detailed exploration of both the occurrence of interest (e.g., the use of research findings) and the context. The case study design is used by quantitative and qualitative researchers alike, and the selected approach sits, in hindsight, somewhat in the middle of the continuum between quantitative and qualitative research. While the approach integrated comparison groups into the design, it also had a "qualitative flavour" deriving from the way in which cases were sampled, and data collected and analysed. The second study, in contrast, sits firmly within the quantitative domain. It was planned and implemented in accordance with classical quantitative design features. Furthermore, the analytical technique was based on an extension of regression modelling, called hierarchical multilevel modelling.

Thus, through these two studies, this thesis attempts to complement generalized knowledge from the study findings with contextual knowledge. Hopefully this endeavour will promote more meaningful discourse about what context is, and how it can be studied more effectively by the health research community. And as research experience accumulates, what will need to be demonstrated is whether this combination of knowledge contributes to a healthier patient, and to a healthier population.

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RESEARCH UTILIZATION BY PUBLIC HEALTH UNITS IN ONTARIO

CHAPTER ONE: INTRODUCTION

A context-sensitive approach to health research was integrated into this first study. The topic of interest was the interface between researchers and users of research, and about the ways in which research findings were incorporated into users' professional activities. Different processes are associated with this interface: the process of producing the research, distributing or communicating the research, understanding the research, and applying the research. Over the years, various models, such as diffusion or dissemination models, have been developed to emphasize or study different parts of these processes.

The interest in research transfer can be attributed to a number of factors. Health research has experienced a burst of activity, resulting in a huge quantity of studies. A corresponding use of such research has not been evident, however. Variations in clinical practice suggested that the most recent scientific information was not being incorporated by practitioners (Davis & Howden-Chapman 1996; Lomas & Anderson 1989). Policymaking has been characterized as lacking an evidence-base, as illustrated by the recent health reforms in various countries, which have been implemented generally without reference to research results (Davis & Howden-Chapman 1996). As well, empirical studies in the social sciences demonstrated that research rarely influenced public policy (Auriat 1998; Beyer & Trice 1982; Dobbins, Ciliska, et al. 1999; Lester & Wilds 1990; Leviton & Hughes 1981; National Center for the Dissemination of Disability Research 1996; Sabatier 1978; Shulha & Cousins 1996). Whether these situations can be characterized as lack of relevant research to guide action, lack of appropriate medium by which to transmit the research, or an awareness of studies but deliberate non-use of them are topics pursued by research transfer scholars.

Understanding these situations in a comprehensive manner requires attention to contextual details. For one, decision-makers who are interested in the study findings also need to be aware of the circumstances in which the outcomes were generated. For example, external political pressure might be the reason why some strategies are successful and others are not. Implementing such strategies without corresponding political rewards might not produce the results expected. Second, the phenomenon of research transfer occurs not in an isolated laboratory but rather in the community, where contextual factors will surely have their greatest impact. Thus, the research design ought to reflect reality by allowing for contextual influences to be detected.

There were naturally occurring events in the health community that presented an opportunity to study one aspect of research transfer. So while the study was deliberately designed to incorporate a contextual perspective, the specific research question of interest was motivated by an external situation and the current focus on research transfer.

These study events were instigated by some public health units in Ontario. In 1945, municipal-level public health units were established in the province. Although their role within the health care system has changed over the years, public health units continue to play a vital part in maintaining the health of communities through communicable disease control, maternal and child health programs, health promotion activities, dental health activities and environmental hazards monitoring. In Ontario, public health units are mandated by the Health Protection and Promotion Act. Specific programs are outlined, and standardized across the province, in the Mandatory Public Health Programs and Services Guidelines under this Act (Association of Local Public Health Agencies 1998).

The events associated with the public health units, which constitute the setting for this study, are described below. A justification for the study research question is presented against this background, followed by an outline of the study itself.

Background Events Leading to Study

In 1997, under the Early Detection of Cancer Program of the Mandatory Public Health Programs and Services Guidelines, the Ontario Ministry of Health set out the following objective for public health units:

> "To increase to 70% the proportion of women aged 50-69 who receive screening mammography through the Ontario Breast Screening Program by the year 2010."
> (Ontario Ministry of Health 1997)

The Guidelines also outline the minimum requirements for conducting group-based and broad education campaigns, for initiating strategies developed in conjunction with community groups and for providing continuing education of health professionals with respect to breast cancer screening.

In the Central Western region of Ontario, public health units are organized into networks corresponding to each of the Guidelines' Mandatory Programs. For example, under the Ministry's Early Detection of Cancer Program, a Cancer Prevention Network was formed in Central West Ontario. Such networks are informal arrangements for the purposes of sharing information and resources in the region. The network's membership consists of (cancer) program staff from the seven public health units in Central West and the regional administrator of the Ontario Breast Screening Program.

In response to the Early Detection of Cancer Program objective quoted above, the Cancer Prevention Network met in November 1998 and agreed to commission a study of Ontario women's breast cancer screening practices. This was done to assist public health units in developing strategies to meet the Ministry's challenge. In December 1998 they met again to specifically identify the information they wanted in this research report (e.g., the proportion of women in Ontario who had a mammogram within the last two years). At that meeting the Cancer Prevention Network discussed their information needs with the Director of the Central West Health Planning Information Network (a Health Intelligence Unit), who was invited to attend the meeting. The Central West Health Planning Information Network agreed to oversee the development of the report.

A study consisting of a secondary analysis of data from Statistic Canada's 1996/97 National Population Health Survey (NPHS) was conducted for this report. The data were analysed and the report written by the author in the summer of 1999, under the supervision of the Central West Health Planning Information Network.

The final version of the report was entitled *Breast Cancer Screening Practices in Ontario* (Central West Health Planning Information Network 1999). The report presents various results, based on a study sample from the NPHS, broken down by Ontario health region: 1) the demographic features of the sample (women aged 50 - 69), 2) the characteristics of women who report having had a mammogram in their lifetime, 3) reasons why women do not obtain a mammogram, 4) women's intent to obtain a mammogram, 5) clinical breast examination practices, and 5) breast self-examination practices.

Before arriving at the final version of the report, members of the Cancer Prevention Network were given the opportunity to provide feedback on a draft version, which was distributed, along with a presentation of the report contents, at a Network meeting in December 1999. Members were able to comment on the draft at the meeting or follow-up later by telephone, fax or email (comments were directed to the Central West Health Planning Information Network).

As a result of an informal agreement between Central West Health Planning Information Network and the Ontario Ministry of Health, all public health units in Ontario received the *Breast Cancer Screening Practices in Ontario* report to support their breast health activities.

Research Utilization and Public Health

Few would deny that it is worthwhile to use research findings to guide the development of health-related activities and programs. For public health units in particular there are at least four possible reasons to incorporate research findings into professional activities.

The first reason refers to the advantages of scientific information in relation to other kinds of information. Health programs might be developed based on information from field or professional experience, the desires of the local community or based on similar activities being carried out elsewhere. In other situations, programs might have a strong historical basis such that the status quo is perceived to be adequate. The scientific community's normative stance is, however, that research ought to be conducted such that valid and reliable findings can be used for effective program planning. Such findings are largely objective and are generally considered distant from political pressures, unlike the other sources of information named above. Consequently, it is suggested that research findings ought to represent a major source of information during the planning or evaluation of current or new public health program activities.

The second reason for using research findings is the need for greater accountability. The health sector has been facing increased financial uncertainty in the current political and economic climate. All health agencies, including public health units, have been forced to be more critical than in the past of their own activities in terms of moneys spent and outcomes achieved. Given these political realities, public health units cannot escape the need to be accountable for their activities. Health programs which were informed by research findings are more likely to represent a justifiable way to spend tax dollars.

In fact, public health units in Ontario are mandated to provide services that conform to recent research findings. Outlined in the General Standards of the 1997 public health regulatory framework, it is a goal of program planning and evaluation to "ensure that local programs address the health needs of the community, with cost-effective, efficient, evidence-based approaches" (Ontario Ministry of Health 1997). Thus, a legislative imperative, the third reason, exists to encourage the use of research findings by public health practitioners.

The fourth reason is the political interest in understanding the uptake of research findings by health agencies. It seems that health policymakers have been recently focussed on the benefits and usefulness of research studies and findings. For example, the 1997 Prime Minister's National Forum on Health discussed this topic as one of four themes, and broadly defined evidence-based decision-making as "the systematic application of the best available evidence to the evaluation of options and to decision-making in clinical, management and policy settings" (Canadian Health Services Research Foundation 2000). The same year saw the development of The Canadian Health Services Research Foundation. The organization's mandate is to understand how health research can play a role in health-related decision-making (Canadian Health Services Research Foundation 2000). The organization funds research projects which include a strong research transfer component. Health-related funding agencies and politicians are pushing for increased attention to research findings. As this political orientation becomes dominant in the health arena, public health units are obliged to conform to this orientation.

Herein lies the problem of interest. For various reasons, public health units ought to be incorporating research findings into their activities. In Ontario, public health decision-makers have identified a need for research (Ciliska, Hayward, et al. 1999). Outside of the health domain, the use of research to inform decision-making is a topic that has received considerable attention, especially by those who produce and distribute research. The related literature converges on one important finding: that simply to distribute research is not enough if research findings are to be incorporated into policies and programs (Auriat 1998; Beyer & Trice 1982; Dobbins, Ciliska, et al. 1999; Lester & Wilds 1990; Leviton & Hughes 1981; National Center for the Dissemination of Disability Research 1996; Sabatier 1978; Shulha & Cousins 1996). Thus, traditional methods of distributing research are less likely to be helpful for public health units. Strategies need to be identified to facilitate the use of research by public health practitioners.

The Research Question

A number of studies have been devoted to identifying factors that act to encourage (or discourage) the use of research. These will be discussed shortly. One of these factors, labelled "interaction" between the researcher/disseminator and the potential user of research, has been flagged as potentially significant in facilitating research utilization. This factor became the issue of interest in this study.

Members of the Cancer Prevention Network interacted with the disseminator in order to generate the *Breast Cancer Screening Practices in Ontario* report. Specifically, the members decided that they needed such a report and they arranged for its development. Second, they specifically detailed the information they wanted in the report. Third, they had the opportunity to discuss any aspect of a draft version of the report with the organization responsible for producing and disseminating the report (Central West Health Planning Information Network). Through program staff membership in the Cancer Prevention Network, some public health units in Central West Ontario were involved in the development of the *Breast Cancer Screening Practices in Ontario* report.

The existence of the two different types of public health units in Ontario – those who were involved and those who were not – provided an opportunity to compare the extent to which involvement with report generation influenced utilization. In effect, this study evaluated an approach that was currently in practice. Thus, to determine if this type of interaction, "involvement," was an effective approach for public health units, this study asked,

Is user involvement in the research process associated with greater research utilization than lack of involvement within public health units in Ontario?

The literature, as will be described in Chapter Two, supports this direction of outcome: that involvement leads to greater utilization.

The study was designed such that contextual influences on research utilization could be examined. Particular differences in contextual variables between the involved and the uninvolved group were of primary interest. The contextual circumstances common to all groups were also of interest. The contextual analysis enriched the understanding of the outcomes related to the research question.

Terminology

Often the various terms related to research transfer, namely research dissemination and research utilization, are used interchangeably in the literature. In this document they refer to specific activities. These distinctions are highlighted in the following boxes and described in detail in Chapter Two.

Research transfer refers to the generic process of distributing and using research findings for policymaking and program planning. The process can involve two or more interested parties; at a basic level, it could involve a researcher and a decision-maker (or other user). An intermediate person or an organization, called the "disseminator", might also participate in the transfer process.

Research dissemination refers to the communication of select research findings to particular audiences, such as policymakers. Channels of communication include such things as academic journals, discussion papers or conference presentations.

Research utilization emphasizes the uptake of research findings by particular audiences or users for their professional activities. *Research implementation strategies* often are employed to encourage utilization, such as a one-page summary of the research study.

The Disseminator

There are disadvantages and advantages associated with using a disseminator to encourage the research transfer process. The disseminator may work in partnership with the researcher, or he or she might work independently of the researcher. That is, he or she might be solely focussed on locating appropriate research for the user. One major advantage with this is that the researcher does not have to spend his or her resources engaging in a non-research activity (i.e., dissemination or research implementation). Another advantage is that the disseminator might be familiar with the language and practices associated with both parties, and as a result is able to translate the research findings in a meaningful way. On the other hand, a disseminator might (unknowingly) misrepresent the research findings to the user. While all three parties – the researcher, the disseminator, the user – bring different values and goals to the research transfer process, the effect of these different motivations on research utilization has not been explored empirically.

The distinctions between a researcher and a disseminator are not immediately relevant to the current research question, and their differences might serve to distract from the main issues. For this reason the distinctions between a researcher and a disseminator will be temporarily put aside in this study.

Presentation of this Study

The study begins with a synthesis of the literature pertaining to research utilization. Insights from a variety of areas, namely education, policy analysis and evaluation research, were valuable for this study. Although the study respondents work within the health domain, within their jobs they educate (the public and other stakeholders), they evaluate their own programs and they engage in political activities when securing funds or conducting advocacy work. For these reasons it was felt that the cross-disciplinary insights would be transferrable to the public health setting.

The literature synthesis was key to informing the way in which the study was designed. Current areas of discussion in the literature in effect pointed to the gaps and challenges in the field. Not all of the gaps could be investigated in one study. Therefore, areas of discussion that were particularly informative for the study research question were given prominence.

A conceptual framework follows the review of previous studies. The need for one emerged from a finding in the literature synthesis – that there is a lack of a consensus on a research utilization conceptual framework. Consequently one was developed to guide this study's design, execution and interpretation of results.

Following the framework, the next chapter details the study methodology. A multiple case study, with comparison groups, was used to investigate the research questions. Features from both quantitative and qualitative research were used such that the rigour of the research process could be maximized.

The study results are presented in tandem with a discussion of the analysis and implications of the findings. Overall, results from three "involved" public health units and three "uninvolved" units demonstrated that inclusion in the research process led to a greater understanding of the analysis and increased the value associated with the report. Involvement did not lead, however, to increased application of the research. Furthermore, a contextual profile provided a rich backdrop which highlighted the general challenges of implementing research-based practice given front-line workers' current realities.

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CHAPTER TWO: A SYNTHESIS OF THE RESEARCH UTILIZATION LITERATURE

The literature in the research utilization field was used to inform the research question and the study design. Findings from the selected articles were organized into two sections. The first focusses on conceptual issues and major empirical findings from the literature, while the second section discusses methodological concerns and insights. Critical commentary about the studies, in relation to the research question, is also offered. This chapter concludes by identifying key themes from the literature; these represented current areas of discussion that were particularly relevant to the thesis study. These were subsequently integrated into the design of the study.

Synthesis Strategy

A variety of strategies were used to identify relevant articles. First, Medline (1975-2000), HealthStar (1975-2000), Embase (1988-2000), Dissertation Abstracts (1996-2000), EconLit (1975-2000), Eric (1975-2000), PsychInfo (1975-2000) and Sociofile (1975-2000) computerized bibliographic databases were searched for relevant articles. The word "research" was combined with "utilization" or "dissemination" or "transfer" to conduct a textword search; limits were not placed around language in this search. Second, personal files and files of other researchers were searched for articles.

Third, references of all selected articles were reviewed for additional articles. Fourth, an author search of the names of prolific researchers in the field was conducted using the abovementioned computerized databases. Fifth, an annotated bibliography on research utilization was reviewed (Agency for Health Care Policy and Research 1992).

A choice had to be made between selecting only health-related literature or accessing the research utilization literature as a whole. The latter path was taken on the grounds that lessons from the broader field would be useful, and because the pool of non-clinical health research utilization studies proved to be few in number.

Articles were considered relevant for this synthesis if they focussed on the utilization of research by organizations, decision-makers or government, rather than by the general public, patients or clinicians. Articles were not relevant if they focussed on diffusion of technologies or on users' or researchers' attitudes and beliefs toward research in general.

Two distinct categories emerged from the collection of articles: conceptual works and empirical works. A majority of articles were devoted to discussing ideas and concepts about research utilization or to applying research utilization strategies to a particular discipline (e.g., nursing). These articles, while not empirical, were included as they contained informative insights. Review articles and empirical studies, although less numerous, were given prominence in this synthesis. Unpublished papers or working documents, such as those written for non-governmental organizations, also contained relevant information and an attempt was made to obtain these using the Internet or by contacting the author(s) directly[1].

Literature Synthesis

Section One: Major Conceptual and Empirical Findings

Conceptual Development of Research Transfer Models

In this study, research transfer was defined as the generic process of distributing and using research findings for policymaking and program planning. The process can involve two or more interested parties; at a basic level, it could involve a researcher and a decision-maker (or other user). An intermediate person or an organization, called the "disseminator", might also participate in the transfer process.

Research transfer models represent the effort to understand how research is distributed, received and acted upon and can be traced back in the literature to the early 1940s. Rural sociologists, Ryan and Gross, are credited with developing the classical "diffusion" model based on their interviews with 259 farmers. Using this model they determined rates of hybrid corn seed adoption, characterized late and early adopters, and identified the communication channels that encouraged use of the new seeds (Rogers

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[1] The purpose of this literature synthesis was to develop a critical appreciation for the major concepts and issues in the field. As described above, a systematic process was implemented to identify and screen articles. Advocates of systematic reviews also suggest the consistent assessment of articles for methodological quality. This recommendation was not helpful here for a number of reasons. Many of the articles were not empirical studies (but no less useful than the empirical studies). And those that were empirical addressed a variety of interventions, outcomes and study populations, making it impossible to identify a comparable unit of analysis. Furthermore, the use of different research traditions made it difficult to standardize a manageable set of methodological criteria. Given these challenges and the general purpose of the synthesis, the attempt to methodologically assess articles was abandoned.

1983).

Ideas about the interface between the disseminator and the user of research have evolved from the diffusion model to models of dissemination, and then to research utilization models. These models provided the foundation for empirical studies in the field – i.e., how the process was visualized, determined the research questions of interest. The aim of this sub-section is to provide a sketch of some of the prominent models that preceded the current notion of research utilization, and to highlight potential future developments.

Passive Model of Research Transfer

From that early agricultural demonstration, the diffusion or "passive" model of research transfer became established in other areas between 1960 and 1980 (Backer 1991). Under this model, scholars conducted research and distributed findings in journals or at academic conferences; users interested in applying research findings to programs and policies were left to locate appropriate studies on their own initiative.

The passive model reflected the assumption that the simple dispersion of research findings was sufficient to ensure uptake and implementation. Users were seen as naturally information-seeking, and researchers and users were assumed to be working toward a common end-state. It was also assumed that researchers were in the best position to identify and produce the kinds of information needed by users (Auriat 1998).

Such passive models failed to recognize the incremental nature of policy-making and program development (Patton, Grimes, et al. 1977), as well as the other environmental constraints faced by users. Consequently, the passive model was not helpful in encouraging the application of research findings (Auriat 1998; Landry, Amara, et al. 1999).

One of the strengths of this model, however, was that it represented an initial attempt to focus on research characteristics that affected research uptake; the model emphasized that research perceived to be of high quality was more likely to be noticed by users than research perceived as poor quality (later it was recognized that quality was a necessary but not sufficient condition for users' attention) (Alkin 1985; Auriat 1998; Beyer & Trice 1982; Cousins & Leithwood 1986; Lester & Wilds 1990; Leviton & Hughes 1981; National Center for the Dissemination of Disability Research 1996; Sabatier 1978; Weiss & Bucuvalas 1980).

Targeted Model of Research Transfer

The next type of research transfer model was the dissemination or "targeted" model, which continued to presume that distributing research findings was a one-way process from disseminator to user. Unlike the early diffusion model, dissemination models acknowledged different types of users, with varying information needs. Consequently, a more focussed or "targeted" distribution approach was recommended; i.e., select information was transferred at particular times and/or to particular users (Knott

& Wildavsky 1980).

In this study, research dissemination refers to the communication of select research findings to particular audiences, such as policymakers. Channels of communication include such things as academic journals, discussion papers or conference presentations.

Rogers' "Diffusion of Innovations" model was developed during the same period (Rogers 1983)[2]. Despite the name, Rogers' model was more aptly categorized as a dissemination model. It was less passive than traditional diffusion models given that it considered different types of users. One could also argue that Rogers pushed the boundaries of the dissemination model by studying the role of other user-related and innovation-related factors.

For example, Rogers described the dispersion of an innovation or spread of new ideas through a population over time. Adoption of the innovation by the user community was characterized as a flat S curve - slow at first, then rapid adoption followed by a levelling off. Adoption was thought to occur through the stages of: knowledge, persuasion, decision, implementation and confirmation. Depending on the rate of innovation uptake, users were classified as either innovators, early adopters, middle

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[2] Other models of dissemination, in domains outside the scope of this literature review, have also been developed. For example, J. McKinlay discusses the dispersion of medical innovations (McKinlay, J. From promising report to standard procedure: seven stages in the career of a medical innovation. Milbank Memorial Fund Quarterly 1981; 59(3):374-411). As well, much work has been done with respect to the uptake of scientific information by clinicians (e.g., Oxman AD, Thomson MA, Davis DA, Haynes RB. No magic bullets: A systematic review of 102 trials of interventions to improve professional practice. Canadian Medical Association Journal 1995; 153(10):1423-1431).

majority or late adopters. The spread of information could be influenced by individual, environmental, or innovation-specific characteristics. Rogers' model continues to this day to provide a conceptual foundation for the transfer of health promotion research findings to the general public.

The dissemination model marked an awareness that the research transfer process required greater attention if users were to be reached. It acknowledged that research findings being presented in standard academic formats were a barrier to use, and that users' time lines were different than researchers' time lines.

One limitation of the dissemination model was the idea that research findings were a pre-packaged solution to the problem at hand. The issue of under-utilization was framed as "the information is out there, it just needs to be disseminated appropriately" (Knott & Wildavsky 1980; Lomas 1997; National Center for the Dissemination of Disability Research 1996). Furthermore, research transfer was still seen as a unidirectional process, and feedback from the user was not incorporated into the research (Estabrooks 1999; Landry, Amara, et al. 1999). Users were not involved in determining research priorities nor participating directly in the research process. As a result, research findings that were "well" disseminated but not used were often attributed to deliberate non-use (Knott & Wildavsky 1980).

Two-Communities Models of Research Transfer

The research utilization model of research transfer is based on the "two-communities" metaphor (Caplan 1979; Wingens 1990) that characterizes most of the current conceptual and empirical positions in the literature (Lester & Wilds 1990). These models place an emphasis on closing the gap between the disseminator and the user communities in an effort to increase the use of research findings. In the previous model, classes of users were targeted with appropriate channels of communication. In the research utilization model, specific users are identified. In this study, the term research utilization emphasizes the uptake of research findings by particular audiences or users for their professional activities.

There does not appear to be a clear demarcation in time between the popularity of the dissemination and the two-community model. It would seem that research efforts have gravitated toward the latter model. In practice, however, it is not uncommon for those interested in research transfer to use the language or concepts associated with the dissemination model as a starting point, before launching into ideas around the use of research.

The phrase "two-communities" refers to the gap between the disseminator and the users' professions. The incompatibility is manifested through such things as different jargon and methods of communication (Oh & Rich 1996). Consequently, the respective parties subscribe to different notions of what is relevant in the research, which is closely related to the differing values that the parties bring to the process (Oh & Rich 1996). These differences are also thought to lead to distrust and tension between the disseminator and the user (Weiss & Bucuvalas 1980). Bridging the gap between the two can lead to better sensitivity of each other's position and research needs (Lomas 1997), and can, perhaps, identify an overlap in goals and values.

Various means are being used to bridge the gap. For example, many universities have liaison offices to promote research to outside organizations, and granting agencies now request that researchers and (future) users submit grant proposals in partnership – rewarding parties who work together from the outset.

One of the advantages of this model is that the utilization of research findings is identified as an explicit, desirable and important outcome. Previous models focussed on better dissemination strategies – e.g., sharper formatting, oral presentations in addition to written reports, targeting champions in the organization – but paid less attention to how or if the research findings were actually implemented. As researchers become more aware of how research findings are utilized, subsequent research questions can be shaped by this greater awareness.

One of the limitations of this model, however, is that it assumes that explanations for non-use are limited to misunderstandings (in the early days, much of the research attention was limited to the communication process). As well, with increased attention to utilization, often researchers are expected to guide the implementation of findings – a task they are not trained to carry out. Finally, the responsibility or initiative for promoting utilization still comes from the researcher community – as illustrated by the liaison offices and granting agencies mentioned above – and researchers might bear the costs of such enterprises.

Future Model Developments

There are indications in the literature that the research utilization model may be in the process of developing even further. The macro context in which research utilization is taking place is receiving greater attention – the user's environmental and organizational domains are now being seen as significant variables in the research utilization process (Beyer & Trice 1982; Dobbins, Ciliska, et al. 1999; Larsen 1980; Lester & Wilds 1990). While the two-communities view tends to focus on the professional divide between disseminator and user, the contextual view suggests that overarching, dynamic factors might also explain utilization behaviour.

Clearly there is overlap between the two positions – that organizational and environmental factors, and the professional divide, act in tandem to influence underutilization. This overlap was of particular interest in this study. That is, research utilization was characterized with an understanding of the contextual circumstances in which it occurred.

Shulha and Cousins note that this reconceptualization will shift the unit of analysis from the individual decision-maker to the "learning" organization (Shulha & Cousins 1996). Alternatively, other researchers call for an integrated model that gives appropriate attention to dissemination channels, professional differences and contextual influences on utilization (Oh & Rich 1996).

To summarize, the diffusion, dissemination and research utilization models represent a conceptual progression in the extent to which users are active participants or barriers to the use of research findings. Most studies conducted over the last twenty years are based on the assumption that the gap between the disseminator and user needs to be overcome for research utilization to occur. More recently other researchers are suggesting that this assumption is too static, and instead are introducing dynamic organizational and political considerations to their work. This study is an example.

The two-communities view represents the most advanced model of the research transfer process to date. Understanding user involvement in the research process can be informed by other studies that attempted to bridge the gap between the disseminator and user worlds. Whether this is a comprehensive enough model for describing underutilization is yet to be seen. For this reason, some attention will also be devoted to organizational and environmental circumstances in this study.

Defining Research Utilization Outcomes

Outcomes related to the dissemination model might have been measured in terms of the number of different audiences that read a research report, for example (Knott & Wildavsky 1980). Successful outcomes under the two-communities model, in contrast, are generally defined in terms of how, or if research findings are used. Issues related to the meaning of research utilization and the frequency with which it occurs are presented in this sub-section.

Instrumental, Conceptual & Political Use

Initial attempts to detect evidence of research utilization concentrated on changes that could be documented, such as changes in policies or programs. These attempts proved to be disappointing as research seldom seemed to be incorporated into tangible outcomes (Weiss 1988).

Researchers began to question how utilization was being defined (Bedell, Ward, et al. 1985; Caplan 1977; Rich 1977). Weiss (1979) broadened the original notion of simple *instrumental use*, where research is used to inform a concrete decision, to include *conceptual (or enlightenment) use,* where findings from research reorient decision-makers' attitudes to and perceptions of a social problem. Thus, instrumental use usually reflects incremental changes that are immediately implemented, whereas conceptual use may require many years before any major overhaul of policies or procedures is evident – it may take time for findings that challenge the status quo to be digested and acted upon by decision-makers. Weiss also identified *tactical use,* where the process of research is used to divert attention or demonstrate responsiveness to a problem ("we're conducting research on that issue right now"), and *political (or symbolic) use,* where findings are used to support a predetermined decision.

In their review of the literature, Beyer and Trice (1982) found that studies were not conclusive about how often instrumental use occurred. On the other hand, conceptual use – which places less demands on the user – was found to be a frequent type of use in the empirical literature. As well, the authors found extensive symbolic use, often as a predecessor to instrumental use (Beyer & Trice 1982). Other reviews of the literature concluded that it is difficult to determine when one type of use, such as instrumental, ends and another, such as symbolic, begins (Leviton & Hughes 1981; Shulha & Cousins 1996).

The definitions promoted by Weiss continue to predominate in the literature, and studies using them can be compared and findings generalized to various settings. Conceptually they are easy to understand. Other types of utilization might be missed, however, by limiting, or only looking for, outcome measures related to conceptual, instrumental and symbolic utilization. For example, other types of utilization might emerge in relation to a worker's specific job responsibilities. Moreover, these types of utilization might be critical for those who design research implementation strategies.

Staged Approaches to Use

A strategy that captures both the earlier dissemination and the newer utilization perspective is a staged approach to define use. Borrowing heavily from Rogers' Diffusion of Innovations theory, some authors speak of these stages: receiving, reading, understanding, deciding and implementing research results (National Center for the Dissemination of Disability Research 1996; Knott & Wildavsky 1980). Others call attention to differences in adoption and implementation, in an attempt to recognize and measure partial utilization (Beyer & Trice 1982).

A strong advantage of the staged approach is that it lends itself to easy measurement; specific questions about each stage can be formulated and quantified. It also assumes a linear sequence of events which are passed through before implementation will occur. As in the previous definitions of utilization, the pre-ordained categories may act as blinders to other types of use.

Comparison of Utilization Across Studies

Other researchers have chosen to let study participants describe research utilization in their own terms (i.e., taken an open-ended or more naturalistic approach), and these emerging constructs have been analysed in the literature.

Dunn (Dunn & Holzner 1982) conducted an inventory of research utilization works in which concepts, procedures and measures were extracted from 65 studies. He remarked that the various ways in which utilization was conceptualized made it difficult to compare findings across studies (Dunn 1983). He also criticized, however, the simple conceptualizations of use (e.g., instrumental, conceptual and political use) that do not reflect its inherent complexities (Dunn 1983).

In a separate review of 65 empirical studies, Cousins and Leithwood determined that use was conceptualized and measured in three ways (Cousins & Leithwood 1986). They found that research findings were used for (i) decision-making and (ii) to educate decision-makers, (conforming to Weiss' descriptions of instrumental and conceptual use). They also contended (iii) that use could be described as a "psychological processing of evaluation results" (p.332), distinct from decision-making or changing beliefs.

Asking participants to define utilization makes it difficult to compare results across studies. To its advantage, however, this approach allows participants to identify a richer range of utilization outcomes than the standard instrumental, conceptual and political ones. In doing so, it recognizes the validity of different types of utilization specific to a participant's own job situation or other contextual circumstances. Thus, if the interest lies in determining *how* research findings are used, then the open-ended approach may be more informative. Such an approach was used in this study to gather information about utilization.

Determinants of Utilization

The majority of empirical studies in this general area have been concerned with elucidating the factors associated with research utilization. These factors include those which act as barriers to the process, as well as those that facilitate it. They have been repeatedly organized into different categories, with varying levels of detail. They are classified into five categories here: the *origin* of the research and/or the dissemination strategy, the *substantive nature* of the research findings, the *feasibility* of implementing findings, the *transmission strategy* used to communicate the research findings, the *relations* between researcher and user, the *user's characteristics* and the *environmental characteristics*. Table 1.1 lists categories and factors taken from other review articles; note that some authors might have organized these factors slightly differently. Sabatier

(1978) describes the following:

> "...technical information is most likely to be influential when it involves high-quality research on a specific issue by a prestigious scientist who has excellent credibility with the decision maker. The findings should be generally consistent with those of other researchers, should be presented in a timely and suitable fashion, and should not imply a substantial change from the policy predisposition of the decision maker." (p.410)

Rather than focussing on the merits of each individual factor, attention is turned to their strengths and shortcomings as a set. Overall, this body of research has been criticized for the major assumption upon which it is based (Rich 1997; Weiss 1981). Rich (1997) calls it the input/output assumption: that participants are able to report how decisions or behaviours were affected by "discrete bits of information" or research. This implies that participants can articulate how a problem or decision was solved and separate out the 'new' research knowledge from prior research knowledge and professional experience. It is not the aim of this study to address the input/output assumption. Rather, the assumption influenced the choice of utilization outcome measures for this study and is revisited in the "attribution of outcomes theme" at the end of this chapter.

While the factors are interesting in themselves, the literature does not help in determining which subset is most useful for explaining outcomes (Lester & Wilds 1990; Sabatier 1978). Minimal attention has been devoted to synthesizing the identified factors with conceptualizations of research transfer: there is a lack of an accepted and valid theoretical framework, with clear terms and empirically testable hypotheses, to describe differences in research utilization (Wingens 1990). This lack of a framework affects subsequent issues in the study of research utilization, such as the measurement of utilization.

Attempts to develop frameworks (Beyer & Trice 1982; Cousins & Leithwood 1993) remain somewhat isolated and have not been used as the basis for subsequent investigations by other researchers, which could then lead the way for refinement and validity assessments. In addition, these frameworks are not comprehensive but restricted to the perspective(s) addressed by the author in question. For example, research transfer frameworks situated in policy-making domains concentrate on factors that reduce political uncertainty (Sabatier 1978; Soumerai, Ross-Degnan, et al. 1997).

Despite these shortcomings, it is recognized that this set of factors represents a massive effort to determine how to best transfer research findings. It represents a variety of specific research questions and methods of inquiry about an issue of interest across disciplines. This subsection ends with a quote from Patton (Patton, Grimes, et al. 1977), who paraphrases Weiss:

> "The issue at this time is not the search for a single formula of utilization success, nor the generation of ever-longer lists of possible factors affecting utilization. The task for the present is to identify and refine a few key variables that may make a major difference in a significant number of evaluation cases." (p. 142)

Interaction Between the Disseminator and User

One common thread in the conceptual and empirical literature is the idea that interaction of some sort between the disseminator and the user is crucial for successful research utilization. For example, Altschuld et al (Altschuld, Yoon, et al. 1993) conducted a mail survey of senior administrators in schools of education. They discovered that the combined factors of attitude and involvement in the production of research both were required to differentiate users from non-users of research. The authors concluded (p. 284): "The concept of involvement is one that connotes ownership and a sense of responsibility not only for the utilization of results, but also for the quality of the study leading to them." Other authors have come indirectly to the conclusion that interaction between disseminator and user is an important factor for research utilization (Anderson, Cosby, et al. 1999; Johnson 1980; Soumerai, Ross-Degnan, et al. 1997).

Researchers talk of effective interactions (Caplan 1979), linkage networks (Huberman & Cox 1990), sustained interactivity (Huberman & Cox 1990), being utilization-focussed (Patton 1988), synthesis pedagogics (Tyden 1996), interaction models (Landry, Amara, et al. 1999), interactive processes (Cousins & Leithwood 1993), and collaboration (Caplan 1979), among other things. The underlying rationale for increasing interaction is the need to bridge the gap between the disseminator/researcher and user worlds. To date, the abovementioned concepts have not been analyzed or unpacked to determine exactly what the various authors mean, nor what benefits they hope to achieve that will facilitate research utilization. To begin this unpacking it may help to focus on some authors who explicitly set out to study interaction between the disseminator and user.

Interaction to Help Users Understand Research

Some researchers suggest that the main reason to encourage interaction between the two parties is to help users understand research findings.

Caplan (1979) seemed to take this view. He felt that interaction was not beneficial in all circumstances. *Effective interactions* are required, which are dependent on the type of problem the research was meant to address. From his work, Caplan concluded that micro-level problems which benefit from the instrumental use of research findings do not require interaction between the disseminator and user. Larger policy issues (macro-level), however, were dependent upon a number of information sources and relied on the individual user's skills to filter and synthesize the research. Consequently, Caplan favoured *collaboration* to facilitate conceptual utilization, by which he meant interaction between parties in sorting and assessing the available research for macro-problem solving.

Working in the educational field, Cousins and Leithwood (1993) developed the idea of *interactive processes*. This notion represents the active transfer of research findings through workshops, conferences, mini-courses, etc. Their empirical results demonstrated that:

- social processes affected conceptual understanding of material
- the interactive processes led to engagement in follow-up or implementation plans, affecting conceptual development
- the interactive processes led to direct involvement in follow-up or implementation plans, affecting both conceptual and instrumental outcomes
- on-going contact with others increased the usefulness of the material

The authors concluded that interactive processes, as one component of a knowledge utilization framework, have a substantial effect on knowledge utilization.

Interaction for the purposes of understanding research can be relatively easy to implement. This strategy does not call for long-term relationships that require constant maintenance. Furthermore, it holds the advantage of helping users relate the findings from one study to the larger body of knowledge to which it contributes.

Interaction to Exchange Knowledge

Interaction can also be used to exchange knowledge about professional norms and expectations. This type of interaction represents an exchange rather than the one-way dialogue described in the previous model.

Tyden (1996) was involved in a study with Swedish municipal-level environmental and health officers, where the notion of *synthesis pedagogics* was used to bridge the gap between researchers and decision-makers. Tyden talks about mutual activity, the equal importance of both parties and strong 'bridgeheads' on both sides who possess a comprehensive stock of knowledge (hence *synthesis* of new with older knowledge). Factors associated with successful bridging included: continuity, acceptance, participation and activity, humility and ability to listen, flexibility, frankness, motivation, insight and empathy.

Similarly, Landry and colleagues (Landry, Amara, et al. 1999) use the idea of *interaction models* (based on Huberman's work, outlined below), to describe interaction between the disseminator and user. The authors expect that interaction between the disseminator and user will increase linkages (e.g., informal personal contacts, committee participation, dissemination to non-academic organizations) and personal communication, both leading to improved production and dissemination of knowledge (and, down the road, increased utilization).

This approach suggests cultivating sensitivity to the other parties' position but makes no promises about changing the research question or research product – a position that some researchers may find attractive. It requires the forging and (at least minimal) maintenance of relationships. Without sincerity, however, this approach carries the danger of simply co-opting the user without meaningful dialogue.

Interaction to Make Research More Responsive to User Needs

The final interpretation of interaction refers to a partnership between the disseminator and the user. The research may be altered to accommodate the user's needs, and the disseminator takes an active role in the implementation phase. While seemingly an ideal strategy to bridge the gap between the two parties, it is one that requires enormous effort to carry out effectively.

Huberman (Huberman 1990; Huberman & Cox 1990) speaks of *linkages* which can be characterized by levels of frequency and intensity. This *sustained interactivity* leads to better sensitivity about the user's context; with this understanding, the disseminator can relate the research findings to local circumstances or focus implementation efforts on those parts of an organization that may be more receptive to the findings. In this type of relationship, researchers are more apt to be accessible during implementation of the results and are more aware of aspects of the findings that may be controversial for an organization. For the user, a meaningful relationship can forge bonds of trust and mutual respect, as opposed to the guarded relationship that might otherwise develop. As a result, users will "engage more fully with the study, both cognitively and operationally" (Huberman & Cox 1990).

Patton (1988) emphasizes the idea of accountability for utilization of research findings. He suggests that those involved in conducting evaluation research also be responsible for ensuring that results are implemented. To accomplish this, Patton strongly recommends working relationships between researchers and users, where the two act together to generate research questions, circulate draft reports, develop implementation plans and (eventually) measure utilization outcomes.

These examples demonstrate that creating interactions between the disseminator and user mean different things to different researchers. There are a range of outcome expectations as a result of these interactions, and a variety of ways for the contacts to be established. This area is just beginning to receive empirical attention; currently, the mechanisms for these interactions, such as workshops, often lack justification. Cousins and Leithwood remark (1993):

> "Insufficient emphasis has been placed on analyzing the types of interaction that would be most productive and would lead to sustained policy change and local impact. ...What sorts of factors or conditions give rise to interactive processes?

> What sorts of processes appear to have the greatest impact on information use? What factors mingle with interactive processes to impact upon use?" (p.313)

There are various dimensions of this concept that require greater attention. Charles and DeMaio's (Charles & DeMaio 1993) framework of lay participation, for the purposes of health care decision making, provides some insight about these dimensions. For example, the authors recognize the different levels, or intensities, of participation. They also point to the different types of decisions that might have to be made; a parallel here would be the idea that different types of research documents (e.g., needs assessments or systematic overviews) might require different degrees of involvement for successful outcomes. A needs assessment may only require involvement at the data collection stage, while a systematic overview might require involvement at the problem identification, data collection and dissemination stage, for example.

This thesis focussed on a particular type of interaction between the disseminator and user. Careful attention was given to defining this interaction and determining whether it fit within any of the categories described above.

Section Two: Methodological Issues in Research Utilization Studies

Research Designs and Data Collection

Cross-Sectional Surveys

Cross-sectional surveys were by far the dominant method of data collection, and as a whole shared some common weaknesses. These included low response rates, social desirability bias and, in most cases, recall bias. Furthermore, surveys were rarely corroborated with measures of actual behavior. To illustrate, Lester (1993) conducted a mail survey of state agency officials and obtained a response rate of 56.5% after follow-up letters and a second mailing. The survey instrument was designed to obtain information about the user's characteristics and attitudes toward policy research. Respondents were not asked about specific research reports but had to rely heavily on memories of their own general behavior.

In their defense, surveys are minimally intrusive, represent a standard method of data collection and can be administered to a large sample.

Qualitative Approaches

Qualitative approaches that rely only on long, open-ended interviews with subjects have been criticized on the grounds that findings from these interviews usually are not supported by other sources of evidence, and authors fail to report information about coding reliability (Ciarlo 1981). Weiss' study (1989) of the use of research information by US Congressional Committees illustrates these weaknesses. Unstructured interviews were conducted with 83 respondents, but lack of information about the analysis makes it difficult to assess reliability. Such studies are a challenge to replicate, in part because journal limitations force researchers to report study methods only briefly. These types of studies have the distinct advantage, however, of allowing participants to define utilization or other concepts in their own terms, and for facilitating in-depth exploration of interesting situations.

Case studies, either individual cases or across cases, have been used by some investigators. For example, Huberman (1990) conducted a very detailed multi-case study that traced the dissemination path of research projects as they were received by the target audiences. By using a prospective design and multiple data collection methods, he was able to investigate, in-depth, a number of research questions. In general, case study approaches involve a compromise between representativeness and contextual specificity, and often lead to different interpretations of the same situation (Booth 1990).

The problem becomes even more complicated when insider accounts remain the sole source of data. In one study (Levin 1992), the author, a high-ranking civil servant, used three cases to exemplify research utilization within the Manitoba Ministry of Education. While the author was privy to information that outside researchers would not be able to access, insiders are faced with the difficulty of objectively analysing the study situation. This may lead to emotional involvement and/or the inability to judge the impact of their own work (Booth 1990).

Experimental Designs

Experimental designs are somewhat lacking in the field of research utilization. Coursey (1989) acknowledges that all designs involve trade-offs, and experimental designs are no exception. Hence their perceived limitations around generalizability.

Other types of designs have a weaker ability to draw causal inferences. Triangulation – the use of multiple researchers, multiple methods and/or multiple data sources to corroborate research findings – has been developed as a strategy to overcome this disadvantage. The ability of triangulation to actually strengthen causal inferences remains theoretical at best (Coursey 1989). Cousins and Leithwood reviewed studies which used simulated experimental designs but felt that these scenarios did not adequately represent the complexity of the decision-making environment (Cousins & Leithwood 1986; Hutchinson 1995).

Longitudinal Designs

Few longitudinal studies are found in the research utilization literature (Larsen 1980). Larsen (1985) was the only investigator identified in this review who collected data at two points in time. The author remarked that the staged approach of utilization measurement (e.g., read the research, understood the research, discussed the research, used the research for decision-making) implicitly assumes time as an important variable affecting the outcome, but most studies using the staged approach do not incorporate time as either a longitudinal or causal factor (Larsen 1985).

Some of the design concerns just discussed are relevant to many different kinds of research studies. Most important here are the concerns specific to the study of research utilization. The first of these refers to Coursey's point around causal inferences. From this review of the literature, it seems that more researchers ought to establish whether the research utilization outcome – specific policy, program or change in attitude – occurred as a result of research findings or whether it would have occurred *regardless* of the research findings ever reaching the user. To date, most research utilization studies do not consider this design element. This weakness might be overcome by a thorough understanding of the contextual circumstances surrounding the unit of analysis, or by studying a similar unit (e.g., organization, individual, etc.) that was not exposed to the research findings.

Given that most of the data in research utilization studies are collected through the user, recall and social desirability biases are especially pertinent. A second concern, then, is the need to corroborate the user's claims of research utilization with other sources of evidence. This message was touched on previously but deserves repeating. Unless the question is posed in a neutral way, respondents will report at least minimal attention to research. These claims can be supported by evidence of actual behaviour, changes in beliefs with pre- and post-surveys, or accounts from an uninterested party, such as a program recipient or a partner organization. For example, Bedell et al (Bedell, Ward, et al. 1985) interviewed staff members from 30 mental health agencies, at three levels of staffing (front line staff, middle management and administration), to corroborate findings.

The last design concern for research utilization studies pertains to the types of utilization expected from the user, given the user's specific mandate and sphere of authority. Reasonable expectations with respect to utilization can guide the data collection process. It can also protect one from erroneously concluding that utilization did not occur when in fact that particular type of utilization would seldom occur given the user's job specifications. For example, it might be invalid to seek out strategic instances of research utilization if the user's job is narrowly focussed on service delivery, not on broader advocacy or organizational positioning tasks.

Measurement of Utilization

Measuring Via Scales

Measurement issues are closely linked to research design and data collection issues. In the case of research utilization studies, measurement is also linked to the disciplinary perspective associated with the researcher. Perhaps for this reason a multitude of scales have been used to measure research utilization (Dunn 1983) but none (nor a core group) has gained acceptance as a feasible, valid and reliable "gold standard." Some might argue that this diverse approach contributes to innovate ways of measurement and design.

As one example of a scale, Knott and Wildavsky (1980) take a staged approach to utilization and provide operational definitions for the reception, cognition, reference, effort, adoption, implementation and impact of research findings. This scale implicitly considers conceptual and instrumental use and is ordinal in nature. Lester subsequently weighted the stages and derived an overall index score of research utilization for his study (Lester 1993). It is also being used by Landry and colleages (Landry, Amara, et al. 1999), who are interested in how social science research is being utilized, in whether this use differs by discipline, and in identifying factors associated with utilization. Despite its popularity, no comprehensive reports concerning the reliability and validity of Knott and Wildavskys' scale were identified in this review of the literature.

Lack of attention to reliability and validity is a common critique of the scales, questionnaires and interview schedules used in this field (Dunn 1983; also see Dunn 1983 for a selected review of scales).

Measuring Instrumental, Conceptual and Symbolic Use

Scales remain attractive to those researchers who maintain that limiting measurement to categories of instrumental, conceptual and symbolic use does not adequately measure utilization (Landry, Amara, et al. 1999). (Although recent work by Estabrooks (1999) demonstrated that even simple questions can capture these three types of utilization in meaningful ways).

The measurement of conceptual use continues to be problematic, suffering from both social desirability bias and lack of precision. Symbolic use also carries measurement problems, as users often may not even know they are using the research symbolically or are unwilling to admit they are doing so. Instrumental use, which is defined as tangible, documented use, potentially can be measured with some degree of validity. To date instrumental use has not been detected with much frequency.

Measuring Non-Use, and What is Not Measured

Larsen (1985) takes a novel approach in her study of 39 community mental health centres. Of the seven categories that she used to sort research utilization, three captured non-use of information: information considered and rejected, nothing done (with the information), and information under consideration. By doing so, Larsen legitimized non-use as an acceptable research utilization outcome.

Dobbins et al (1999), writing within the field of the health research, remark that the uptake of research results ought to lead to a change which ultimately will improve the health of patients. However, the empirical work, whether within or outside the health domain, does not attempt to measure these types of far-reaching impacts (Boggs 1992; Rich 1997), probably due to the length of time required for such impacts to occur.

Other aspects of research utilization measurement are also given minimal, if any, attention in the literature (Rich 1997). Utilization is not generally explored by type of information (e.g., needs assessment versus systematic literature review). Differences in utilization as a function of the type of field (e.g., environmental versus health policies), or by different types of users (e.g., service delivery staff versus upper level management), also are not considered.

In general, researchers in the research utilization field are criticized for not adequately describing how they measure utilization (Beyer & Trice 1982; Rich 1997). This weakness may be due to the difficulty in attributing particular research findings to particular outcomes. Nevertheless, as Beyer and Trice (1982) remark, the measure of use that is chosen ought to reflect the types of utilization behaviours that could be expected, while at the same time allowing comparisons with previous utilization studies.

Another explanation for the lack of common operational definitions may stem from the general lack of a theoretical framework for research utilization, as was suggested earlier in this synthesis. In his methodological critique of empirical studies, Dunn (Dunn, Dukes, et al. 1984) noted that a common feature was the lack of an adequate a priori specification of the construct, theory and hypothesis under investigation.

This literature synthesis underscores the importance of clearly defining utilization in the current investigation. This endeavour was supported by the development of a conceptual framework, presented in the next chapter. Furthermore, the design of this study attempted to minimize weaknesses and maximize the strengths of previous research. A multiple case study design, using comparison cases, was selected to this end.

Themes for the Current Study

The purpose of this synthesis was to convey an understanding of the conceptual and empirical state of knowledge in the broader research utilization field. This understanding served to inform the focus, design and findings of the present study. In particular, five themes emerging from this review were particularly relevant to the research question: 1) significance of interaction between disseminator and user, 2) lack of consensus concerning a utilization conceptual framework, 3) the meaning of research utilization, 4) organizational and environmental influences on utilization and 5) problems with attributing outcomes.

Significance of Interaction

The research utilization field has concentrated thus far on generating a list of factors associated with research utilization (see Table 1.1). Put another way, the field has been concerned primarily with breadth. Now attention needs to be diverted from what the factors are to understanding how these factors operate (e.g., which are the most decisive) and attempting to characterize each factor in-depth. The latter need – developing a deeper understanding of a given factor – was the primary focus in this study.

"Interaction between the disseminator and the user" has been flagged as an important factor in the research utilization process. It represents a potentially significant influence on research utilization and is deserving of more systematic attention. Currently, little is known about the way in which different types of interaction influence utilization. Consequently, this study attempted to determine if a specific type of interaction was associated with research utilization.

Lack of Conceptual Framework

The lack of an agreed upon conceptual framework for understanding factors that influence research utilization both stems from, and reinforces, differences in terms (e.g., definition of utilization), differences in measures and lack of overall unified momentum in research direction. This study did not attempt to integrate all these issues into a complex framework. To guide this study, a simple conceptual framework was developed using the research presented in this overview.

Meaning of Utilization

The review of the literature led to the decision to ask study participants to identify instances of utilization in their own words. This choice was made on two grounds. First, this approach was more flexible than using pre-defined categories. In this way, unique types of utilizations were allowed to emerge – types that might otherwise be missed. Second, unreasonable expectations of utilization – expectations that did not fit with participants' job responsibilities – were minimized.

These instances were analyzed, however, with a conceptualization of utilization that took a staged approach. By doing so, operational definitions were developed and systematically applied to the data. This also allowed findings to be compared with previous studies in the literature.

Organizational and Environmental Influences

The conceptualization of research transfer has progressed from general diffusion models to models sensitive to utilization outcomes. A recent interest within the literature is the way in which organizational and environmental elements influence research utilization (Beyer & Trice 1982; Dobbins, Ciliska, et al. 1999; Larsen 1980; Lester & Wilds 1990). This latter interest, the influence of context, represents an overall theme of this thesis as described in the preface. Hence, a case study design was selected for this study such that possible contextual influences could be explored.

Attributing Outcomes

In some sense all research utilization scholars assume that research findings "cause" the outcomes identified in their study (Rich 1997). Rarely are experimental or quasi-experimental features incorporated into study designs to lend credence to this assumption. Even in a descriptive study, such as this one, events or outcomes should be represented as accurately as possible. In an attempt to minimize biases when examining the findings from this study, the research design addressed two questions. First, "how do we know these results would not have occurred in the absence of interaction between the disseminator and user?". And second, "how do we know these utilization results were not one-off, or atypical?". To answer the first question and to properly attribute utilization outcomes, comparison case study groups were incorporated into the design. To answer the second question, multiple cases were studied to identify common utilization outcomes.

The next chapter outlines a conceptual framework for this study, followed by details of the research design.

TABLE 1.1: FACTORS ASSOCIATED WITH RESEARCH UTILIZATION

CATEGORY	FACTOR	FINDINGS	REFERENCE
ORIGIN	Credibility of information source	- Expertise less important than trustworthiness - Corroboration with other sources of information increases use	National Center for the Dissemination of Disability Research, 1996; Lester & Wilds, 1990; Cousins and Leithwood, 1986; Alkin, 1985; Leviton and Hughes, 1981; Sabatier, 1978
	Researcher's commitment to use	- Researchers take an active role in encouraging use	Cousins and Leithwood, 1986; Alkin, 1985
	Researcher's scope of authority	- Increased use if researcher can bring forth sanctions against the user, or can turn to another authority	Sabatier, 1978
SUBSTANCE	(Perceived) quality of the research	- Quality refers to rigour, appropriateness of methods - Independently, quality alone may have a lesser role in encouraging use than quality in conjunction with similarity of attitudes between user and research source - Relevance to issue at hand increases use	Auriat, 1998; National Center for the Dissemination of Disability Research, 1996; Lester & Wilds, 1990; Cousins and Leithwood, 1986; Alkin, 1985; Beyer & Trice, 1982; Leviton and Hughes, 1981; Sabatier, 1978
FEASIBILITY	Feasibility of implementing research findings	- Includes such things as cost, political feasibility, timeliness, skills of users, ability to manipulate variables	Lester & Wilds, 1990; Alkin, 1985; Beyer & Trice, 1982; Leviton and Hughes, 1981; Sabatier, 1978

CATEGORY	**FACTOR**	**FINDINGS**	**REFERENCE**
TRANSMISSION	Presentation of findings	- Better use when findings are presented in layman's terms, focussed on positive results rather than negative, results are clear, dissemination material is not lengthy, and researcher available for follow-up enquiries	National Center for the Dissemination of Disability Research, 1996; Lester & Wilds, 1990; Alkin, 1985; Beyer & Trice, 1982; Leviton and Hughes, 1981; Sabatier, 1978
	Dissemination medium	- Use is enhanced with personal interaction and multiple formats of presentation	National Center for the Dissemination of Disability Research, 1996; Alkin, 1985; Leviton and Hughes, 1981
	Intermediary person between researcher and user	- Linkage person found to increase utilization	Beyer & Trice, 1982
RELATIONS	Compatibility in attitudes and beliefs between researcher and user	- Use found to be strongly dependent on the similarity of attitudes, ideology and expectations between user and research source	Auriat, 1998; National Center for the Dissemination of Disability Research, 1996; Lester & Wilds, 1990; Alkin, 1985; Beyer & Trice, 1982; Sabatier, 1978
	Type of relationship between researcher and user	- On-going, interactive relationship promotes understanding (of user's readiness for change, motivation and external incentives) and trust between the two cultures - Frequency and intensity of interaction is critical - The user's degree of involvement in the research process may affect utilization	National Center for the Dissemination of Disability Research, 1996; Lester & Wilds, 1990; Cousins and Leithwood, 1986; Beyer & Trice, 1982; Alkin, 1985; Sabatier, 1978

CATEGORY	**FACTOR**	**FINDINGS**	**REFERENCE**
USER CHARACTERISTICS	User's personal motivation	- The user has an interest in the results, has a perceived need for research, and is able to understand information - Positive attitude towards research did not necessarily result in greater use of research	Dobbins & al, 1998; Lester & Wilds,1990; Cousins and Leithwood, 1986; Alkin, 1985; Beyer & Trice, 1982; Leviton and Hughes, 1981; Sabatier, 1978;
ENVIRONMENTAL CHARACTERISTICS	Political environment	- Unclear, highly complex issues (e.g., policy problem) less conducive to use - Greater conflict over the problems encourages greater use of research	Lester & Wilds, 1990; Sabatier, 1978
	Organizational orientation	- Organizational structure and reward system may promote use -Access to alternative information sources decreases utilization (especially conflicting perspectives)	Dobbins & al, 1998; National Center for the Dissemination of Disability Research, 1996; Lester & Wilds, 1990; Cousins and Leithwood, 1986; Alkin, 1985; Sabatier, 1978;

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CHAPTER THREE: A CONCEPTUAL FRAMEWORK FOR THE STUDY

The previous chapter synthesized the current state of knowledge about research utilization. The shift, from diffusion to utilization models, reflected a change in understanding about the research transfer interface. Over time, the process of transfer was perceived to be more dynamic than previously thought; related research gave rise to a list of factors associated with research utilization. There has also been an interest in appropriate definitions or forms of utilization, its frequency of occurrence and other utilization characteristics. More recently, attention has been devoted to analyzing the context within which utilization takes place.

Five themes were identified from the literature synthesis: the significance of interaction between disseminator and user, the lack of a conceptual framework, issues associated with the measurement of utilization, the importance of organizational and environmental influences on utilization, and appropriately attributing outcomes when studying research utilization. These themes informed the conceptual framework and study design.

Development of Conceptual Framework for Study

The research utilization literature lacks a unified, tested and accepted conceptual framework to predict the use of research findings (Dunn 1983; Shulha & Cousins 1996). Consequently, a simple conceptual framework was developed (Figure 1.1) to generate the main prediction for this study, and, in the next chapter, to identify relevant data for collection and analysis. The framework initially was based on the early models of research transfer that were concerned mostly with effective distribution of research findings:

Research Findings ➜ Dissemination (a)

The addition of utilization to this process is more recent. As described in the literature synthesis, researchers have adopted two basic approaches to measuring utilization. Either utilization is thought of in terms of conceptual, instrumental or symbolic outcomes, or else it is perceived as progressive stages through which users become more intimately aware of, and then apply, research findings (e.g., these stages might be called receiving, reading, understanding and finally implementing research findings). These two approaches represent a particular tension related to the measurement of utilization. The first approach has proven, through repeated findings in various studies, to be conceptually relevant. But, "conceptual use," "instrumental use" and "symbolic use" are difficult to define operationally. On the other hand, the approach that uses progressive stages can be incorporated into surveys with ease. Its advantage is that the predetermined stages limit the types of utilization that might be otherwise uncovered.

An attempt was made to incorporate the advantages of each approach in this study. To accomplish this, the way in which utilization outcomes were collected was differentiated from the ways in which they were conceptualized. To satisfy the desire for new and relevant uses of research findings, participants in this study were asked to identify utilization in their own terms (i.e., utilization was measured from the user's perspective with a semi-structured questioning approach). Utilization was conceptualized, however, as a process of receiving, information processing and applying (Rich 1997). By doing so, the extent of utilization could be characterized with standardized operational definitions at each stage:

The **receiving stage** denotes receiving and reading the research report. This does not necessarily mean, however, that the research findings were understood by the reader.

The **information processing stage** is related to assessing the merit or utility of the research report. This may rest in its physical characteristics (the lay out, the length, the language, etc.) (Beyer & Trice 1982), its perceived validity (methodological rigour) (Weiss & Bucuvalas 1980), or the specific research findings (Beyer & Trice 1982). Participants' comments about any of these three elements are taken to mean that some information processing took place.

In the final stage, **the application stage**, research findings are incorporated or integrated into the user's job. They might influence the way in which a problem is defined or approached, or, the findings might influence a decision (Rich 1997). This implies that the research findings were processed *and then generalized or related back* to the problem, decision or program at hand. In the most tangible examples, research findings directly led to some decision or action.

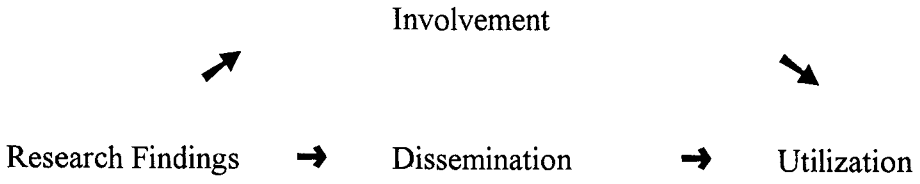
Thus, the initial framework was expanded to include utilization:

Research Findings ➜ Dissemination ➜ Utilization (b)

This study particularly stressed how involvement in the research process influenced utilization. As reviewed in the previous chapter, the notion of *interaction between the disseminator and potential user* has surfaced repeatedly in conceptual and empirical works. Interaction is seen as a viable solution to the two-communities problem faced by disseminators and users. The general consensus in the literature is that the more interaction, the more likely that research utilization will occur.

An unpacking of the interaction concept revealed that different terms were being used (e.g., collaboration (Caplan 1979), linkages (Huberman & Cox 1990), interactions (Landry, Amara, et al. 1999)), and that the two parties were engaged in at least three different types of interaction. The goal of one type of interaction was to help users understand research findings, since members of the two communities are marked by particular practices, norms and jargon (Caplan 1979; Cousins & Leithwood 1993). The second type of interaction was used to exchange knowledge about each other's professional domains (to bridge the gap between the two communities) (Landry, Amara, et al. 1999; Tyden 1996). The third type of interaction required that users take an active role in shaping the research, with the expectation that the research would be more responsive to their needs (Huberman 1990; Huberman & Cox 1990).

The current research setting provided an opportunity to study one type of interaction. The literature emphasizes interaction in terms of frequency of occurrence as well as type of interaction; this study focused only on type of interaction. In the current setting, potential users identified a need for a research report, identified the specific research information required, provided feedback on draft copies of the research report, and were given opportunities to consult with the disseminator about the findings. At the end of this study this type of interaction was compared to the three types described above. For now it is called "involvement" in the generation of the research findings, and it is expected to positively influence utilization:



(c)

In this study, some public health units were involved in the research process while other "comparison" public health units did not have this opportunity (i.e., as in diagram b). The differences in utilization outcomes between these two types of public health units were examined.

The user's **organization and the broader environment** can also influence the utilization outcomes. The importance of such contextual influences on health was addressed in the preface of this thesis. To detect such influences, a contextual perspective needs to be supported when carrying out health research. As a result, a case study design was selected for this study (more on this in the next chapter).

The organization is a potential influence on research utilization (Alkin 1985; Cousins & Leithwood 1986; Dobbins, Ciliska, et al. 1999; Lester & Wilds 1990; National Center for the Dissemination of Disability Research 1996; Sabatier 1978). For example, organizational structure, both formal and informal, may or may not support the use of research. The beliefs, ideologies, and interests of an organization may dictate the way in which it problem-solves, or its organizational history (e.g., staff turnover) may reflect particular responses to research. Corwin and Louis (1982) describe "vacuums" resulting from organizational properties such as these which led to decreased utilization of research. The current case study design was sensitive to organizational elements that might have had a strong influence on the study outcomes.

The environment outside the organization might also play a part in research utilization outcomes. The political dynamic has been identified as a variable deserving of greater attention for its role in research utilization (Lester & Wilds 1990; Levin 1992; Sabatier 1978). Patton and colleagues (Patton, Grimes, et al. 1977) found that political considerations were one of the most significant factors affecting the utilization of mental health research. In their study, research was used to reduce uncertainty within politically complex situations. Research findings were one piece of information used to clarify the implications of decisions.

Another environmental explanation might come from the characteristics of the catchment area. For example, a public health unit situated in a tobacco growing region may be less likely than other units to use research findings about the effects of smoking. Encouraging anti-smoking campaigns in such areas may be perceived as disrespectful of certain community members' livelihood. In contrast, particular areas may be labeled as "hot spots" for cancer. Consequently, those staff members responsible for cancer prevention activities might be particularly receptive to recent research on this issue.

In this case study design, information about the organization and the environment were used to characterize each health unit. In general, similar health units were selected as study cases. If significant differences in outcomes emerged between cases, it was expected that these differences could be attributed to differences in involvement. However, the data arising from the contextual circumstances could be used to evaluate alternative competing hypotheses. In this way the study accommodated the identification of unique contextual influences on the research utilization outcomes; the addition of contextual variables completes the framework in Figure 1.1.

The other **classical influential factors**, such as the packaging of research findings, did not differ between the public health units and therefore were not included in the conceptual framework. As described in the literature synthesis, the field of research utilization has been concerned mostly with determining which factors facilitate or impede the utilization of research findings. As this list of factors has grown, it has become both a help and a hindrance for those who believe that research findings can contribute to decision-making.

This list of factors is helpful in that it has changed the manner of research distribution. Those who want research findings to be used are now encouraged to consider much more than simply the appropriate packaging of a report (Caplan & Barton 1978). Studies suggest they must consider things such as whether the report has methodological credibility (Dunn 1980), whether the findings are feasible to implement (Beyer & Trice 1982), or whether there is a champion to facilitate utilization (Patton, Grimes, et al. 1977), for example.

The problem, from a practical standpoint, is that the disseminator cannot possibly invest the effort or resources required to integrate every factor found in the literature to facilitate the utilization process. Furthermore, the literature provides minimal support in identifying the most effective factors for increasing utilization or the relationship between factors. In Huberman's words (Huberman 1987, p.588),

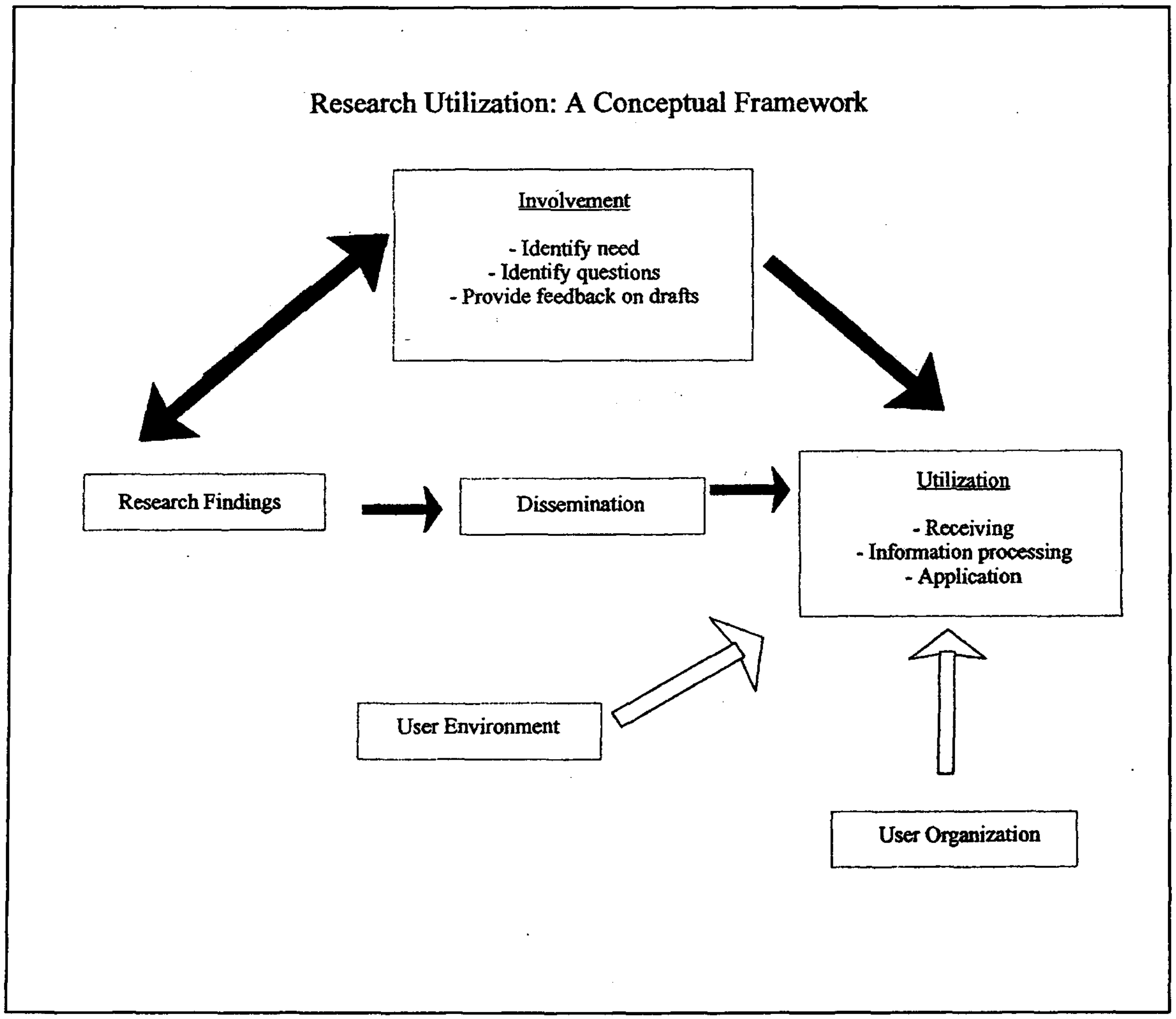
> "...you may agree on a set of explanatory variables, but not agree that these are the most important ones, nor agree on their conceptual interpretation – on what they signify, on why they are 'explanatory.'"

This study attempts to understand one of these factors, involvement between the disseminator and the user, in detail. Most of the other classical factors (Chapter Two, Table 1.1) did not differ between the public health units in this study (e.g., factors associated with the origin of the research, quality of the research and transmission of the research). Recognizing, however, that strong *perceptions* about quality and credibility (associated with the disseminator) might influence the utilization outcomes, study participants had the opportunity to voice such perceptions through the semi-structured questioning approach.

Study Predictions

Various predictions could be extracted from the conceptual framework. For this study, the prediction of interest rested with the involvement variable. It was predicted that involvement in the generation of the research findings would lead to greater utilization than would otherwise occur. The alternate hypothesis was that involvement would lead to less utilization of research findings.

Figure 1.1



Research Utilization: A Conceptual Framework

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CHAPTER FOUR: METHODS FOR A MULTIPLE CASE STUDY

A conceptual framework was developed to guide the current study; specific variables were selected with consideration to the way in which they influence research utilization. In this chapter, a description of the case study strategy, study design, unit of analysis, selection of cases, data collection and analysis is presented.

The Case Study Strategy

A number of different definitions of a case study have been proposed by researchers. According to the US General Accounting Office, for example, "a case study is a method for learning about a complex instance, based on a comprehensive understanding of that instance obtained by extensive description and analysis of that instance taken as a whole and in its context" (United States General Accounting Office 1990, p.14). Stakes' view is that ". . . case study is defined by interest in individual cases, not by the methods of inquiry used" (Stake 1994, p.236). Creswell (Creswell 1998, p.61) calls a case study ". . . an exploration of a bounded system or a case (or multiple cases) over time through detailed, in-depth data collection involving multiple sources of information rich in context." Yin's definition (1994) has two parts:

> "1) A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context; especially when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used, and 2) The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis."
>
> (p.13)

Upon further reflection, the definitions offered above represent different perspectives with respect to the philosophical foundations of a case study. Some researchers classify case studies within the qualitative research strategy or tradition (Creswell 1998; Denzin & Lincoln 1994), based on the philosophical constructivist perspective in which reality is subjectively construed. Those engaged in the act of research influence and in turn are influenced by personal constructions. In addition, the experience and perceptions of the actors involved become the crux of the research focus.

Yin, on the other hand, has written about case study as a research strategy with which to structure the data collection and its treatment (Yin 1994). Philosophically speaking, he places the case study strategy within the logical positivist tradition in which an external reality is believed to exist and can be somewhat objectively measured.

Once the discussion moves, however, from ontology and epistemology to one of methodology, the distinction between quantitative and qualitative research is blurred. For example, Yin maintains that the case study design can be patterned after basic scientific research, which includes "the development of hypotheses, the collection of empirical data and the development of conclusions based on the analysis of such data" (Yin 1993). Within this design Yin accommodates both qualitative and quantitative data collection methods (Yin 1994).

On the other side of the debate, qualitative researchers often collect data through prolonged attention to the details of a natural occurrence, with a deliberate open-mindedness to events as they unfold rather than using an a priori specification of a conceptual framework (Creswell 1998;Yin 1994). The extent to which qualitative researchers actually use theory to define initial research questions and gather data varies by method used (i.e., knowledge generation based on deduction). For example, ethnographers use cultural theories to frame their studies (Creswell 1998).

In addition, the combination of qualitative and quantitative methods is becoming more acceptable under the rubric of "mixed method designs" (Baum 1995; Caracelli & Greene 1993; Caracelli & Riggin 1994; Datta 1997; Greene, Caracelli, et al. 1989). Despite the incongruence in philosophical underpinnings of the two approaches, proponents of mixed method designs advance their cause on pragmatic grounds. The arguments for using both quantitative and qualitative methods focus on the similarities between the two: the sharing of a common research goal within a study, the recognition of a common societal goal: to increase knowledge, a common devotion to rigour and critique of the research process, the recognition that the complexity of research problems requires a breadth of perspectives, and that researchers should just "get on" with the process of doing research (Sale, Lohfeld, et al. 2001).

The current design took this pragmatic approach and incorporated innovative features within the case study design. While these features as a whole do not rest firmly in either the qualitative or quantitative camp, they did enhance the rigour of this research process. These features included:

- the a priori development of a conceptual framework and hypothesis, implying that a deductive approach was applied to parts of the study,
- the deliberate study of cases that were not involved with the generation of the research report (e.g., comparison groups),
- the use of semi-structured interview questions as the main data collection tool, which were then coded using an inductive approach.

Study Research Design

This study focussed on a contemporary rather than a historical situation. The research setting offered little control over prior circumstances or ensuing events, suggesting that context may play a role in the outcome. The total number of Ontario public health units is relatively few (n = 37), but the amount of data that was required from the selected sites was large to accommodate the broad research question, "Is user involvement in the research process associated with greater research utilization than lack of involvement?". For these reasons the general case study strategy fits with the current research endeavour.

A descriptive case study approach was taken as opposed to an exploratory approach (to generate questions for further study), or an explanatory approach (to determine causal patterns). The purpose of such an approach was to gain an in-depth understanding of research utilization outcomes and identify the circumstances surrounding the outcomes. For this study it meant describing the role of involvement, and possibly environmental and organizational contextual factors, as they influenced how research findings were received and read, processed and applied (Yin 1994).

This study was bounded by the time period September 1999 to September 2001.

Unit of Analysis

Studies of research utilization could be conducted at several different levels of analysis, such as at the individual, group or organizational level. Apart from some recent studies focussed on the organization, the research utilization literature does not make clear distinctions between these levels, and often data collected at one level are used to make inferences about another (Dunn, Dukes, et al. 1984; Shulha & Cousins 1996). Study outcomes can be inappropriately attributed in this situation.

Here, the individual was rejected as the unit of study as informal discussions with public health unit staff revealed that resource intensive projects often involve various staff in the organization, either at different stages in the project's development or due to the skills required to implement the project. This would then necessitate connecting with (e.g., interviewing) all of these individuals, since limiting the analysis to one individual might not reveal the full extent of outcomes. The time and costs associated with this would have been prohibitive.

There might be little practical distinction between selecting the organization – the public health unit – or selecting a group of staff members within the public health unit as the unit of analysis. To ask "did the public health unit use the *Breast Cancer Screening Practices in Ontario* report?" would involve identifying those staff members responsible for breast health within the unit and then collecting aggregate data from them *to represent* the organization's response[1]. Similarly, the question "did the team responsible for breast health within the public health unit use the *Breast Cancer Screening Practices in Ontario* report?" might require, in general, the same data collection strategy.

The difference between these two levels (group versus organization) might reveal itself, however, if *intent* to use the report, in addition to actual use of the report, was of interest. The group might, for example, have proposed ways to use the report which ultimately were not sanctioned by the organization. This study was interested in broad types of utilization (e.g., intended and actual), and it was this group – the group responsible for breast health – who was involved in the generation of the research report. Therefore, the unit of analysis (or the case) for this study was the group within the public health unit responsible for breast health issues. This group will be referred to as the Healthy Lifestyles team, although a different title was used by some of the participating

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[1] One might argue that interviewing the Medical Officer of Health of the public health unit, as the head of the organization, would provide the necessary level of information. This might be a suitable strategy if the interest was in general research utilization. Here, however, the interest was in a specific research report that was disseminated to staff.

public health units. This team's director, the Director of the Chronic Diseases and Injuries Program (or the equivalent as identified in the organizational chart) in each public health unit was asked to identify this team to ensure systematic identification.

Case Selection

Yin provides detailed recommendations for unit selection within a case study design (Yin 1994); the ways in which these recommendations were applied are described here.

Replicative logic rather than sampling logic was used to select cases (i.e., Healthy Lifestyles teams) among the population of cases (i.e., all teams within Ontario) (Yin 1994). With sampling logic, researchers strive to achieve a collection of data that is representative of the entire population. In contrast, replicative logic is akin to conducting repeated experiments to confirm results on predictive grounds. The rationale behind both types of logic lies in their goals of inference: while sampling logic leads to inferences about the entire population, replicative logic leads to inferences with respect to a conceptual framework (Yin 1994).

Literal and theoretical replication are replicative logic strategies. Literal replication, as the name suggests, calls for choosing cases such that the same results are expected from each case. Theoretical replication requires choosing cases such that different results are predicted on the basis of a conceptual framework (Yin 1994).

The framework and discussion presented in the last chapter suggested that utilization would differ between those Healthy Lifestyle teams who were involved in the research versus those who were not. A greater extent of utilization was expected from the involved teams. All Healthy Lifestyle teams who were involved were expected to demonstrate similar outcomes with each other. Similarly, all teams who were not involved were also expected to demonstrate similar outcomes with each other.

Replicative logic sampling was used to select cases. To focus on involvement, and not on other variables that might be relevant to the outcome of interest, similar Healthy Lifestyles teams were selected. Teams were compared with respect to the number of individuals comprising the team, layers of hierarchy within the team, formal educational training of individuals on the team, and proportion of new staff (defined as less than six months) on the team. Directors of the Chronic Diseases and Injuries Program provided the above information.

Seven Healthy Lifestyles teams, from the Central West region of Ontario, were involved in the research process. From this set (the "sampling frame"), three similar teams (i.e., that matched on the variables above) were deliberately selected for the purposes of literal replication (e.g., establish common findings).

Six Healthy Lifestyles teams[2] were not involved in the research process. Of these, three similar teams (i.e., similar to involved teams and similar to each other) were deliberately selected for the purposes of literal replication.

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[2] For ease of selection and data collection, the sampling frame for the uninvolved groups was limited to those Health Lifestyle teams within the Eastern Ontario health planning region.

A total of six Healthy Lifestyle teams (or cases) was sampled for this study. Characteristics of the public health units and their catchment areas are presented in the Results chapter.

Exclusions to the Sampling Frames

Some public health units are also a research and teaching site, called the Public Health Research, Education and Development Program (PHRED). In theory, all public health units have access to the resources from a PHRED. In practice, the public health units with a PHRED on-site benefit most from its academic skills. It would be reasonable to expect that these public health units would be more readily oriented to using research information. Nevertheless, there were not enough of them within the involved set of teams to replicate findings (indeed, there is only one). For this reason PHRED sites were excluded from the selection process.

During the selection process it was discovered that another researcher was about to launch a research utilization study with Ontario public health units. Attempts were made to ensure that different units were approached to participate in the respective studies. This cooperative effort resulted in the exclusion of one unit from the uninvolved sampling frame.

Refusal to participate occurred in one uninvolved case, on the grounds that the public health unit was too busy. The sampling frame was revisited and the next most similar Healthy Lifestyles team was selected.

Data Sources and Analysis

The conceptual framework identified the variables of interest: dissemination, involvement and utilization. Information about the user's organization and environment served to establish the study context and to determine contextual influences on utilization. Data pertaining to these variables were collected from different sources and/or using different methods. Specific questions around these issues, and the ways in which the data were obtained and analyzed, are summarized in Table 1.2 Access to the study site, and other ethical points of interest, are briefly addressed at the end of this section.

Sources of Data

Data sources consisted of the Healthy Lifestyles teams, their Directors, key informants and documents. Healthy Lifestyle teams were selected to provide first-hand information about the outcome, and to gain perceptions of the involvement process. As well, the team provided insights about contextual issues.

The team Directors provided two key pieces of information. First, they identified strategic priorities for the Division, and second, the Directors were queried about intentions to use the report which were subsequently derailed at the organizational level.

Key informants were selected for specific reasons. Paul Grey, Senior Business Analyst at the Public Health Branch (Ontario Ministry of Health) was interviewed to provide background information about funding and legislation with respect to public health units in Ontario. Tom Abernathy, the Director at the Central West Health Planning

Information Network, was selected to provide his perspective on the involvement and dissemination process. Carol Rand, now the Regional Operations Manager & Director of Community Oncology at the Hamilton Regional Cancer Centre, was interviewed for her general expertise about the Ontario Breast Screening Program. She also provided insight about breast health programs and related political issues.

Documents were important for understanding the contextual setting. Documented information also served to corroborate findings from other sources of data. Documents took the form of reports, meeting agendas, newsletters, meeting minutes and annual reports. Minutes from the Cancer Prevention Network meetings provided information about the involvement process.

Use of multiple sources of data characterizes the case study design (Yin 1994). Hence, as noted at the outset of this chapter, the information from these sources was used collectively to investigate the research question.

Data Collection

A one-hour, group interview data collection method (Hedges 1985) was used to collect information from the Healthy Lifestyles teams. The interviews occurred approximately six months after the *Breast Cancer Screening Practices in Ontario* report was distributed. The interviews took place during the final stage of a regular team meeting, which represented the official decision-making venue for the team. This was significant as a response on behalf of the team corresponded with the group as the unit of analysis. To obtain an aggregate response, an effort was made to bring the group to a consensus if opposing points of view were expressed. Where this was not possible, the a priori decision-rule was to accept the perception of the majority of members at the interview as representative of the group[3].

Interviews with the Healthy Lifestyles teams were conducted with semi-structured questions, and an interview guide with probes was used to solicit responses (Table 1.3). The purpose of this approach was to question respondents systematically. At the same time, respondents were encouraged to answer in great detail (Berg 1998). Before developing the interview guide, key concepts were identified through the literature synthesis (e.g., research involvement, research utilization and related influencing factors). Two pilot interviews were used to develop probes that reflected these concepts (Charmaz 1990).

These pilot interviews were conducted with (involved) Healthy Lifestyles teams. In addition to identifying appropriate probes, the purpose of these pilot interviews was to refine the order of topics discussed, and generally to facilitate a smooth flow of conversation, so as to obtain useful data.

The study interviews were tape recorded and transcribed. The team was unaware that this author was affiliated with the report. If a member of the team was absent, she was contacted individually by email or telephone (the team identified what particular point of interest the absent member would have knowledge about, and the

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[3] The potential problem of differing responses within a team was explored in two pilot interviews. It proved not to be an issue during those interviews, nor was it problematic during the study interviews.

follow-up interview concentrated on this point). The teams were asked to review a summary of the interview approximately six weeks after the first meeting, and they were also asked if the report was used any further.

Key informants were also interviewed in person. The semi-structured interview questions varied from respondent to respondent, depending on the sorts of information that were required. These interviews were also tape recorded and transcribed.

The six Directors of the Healthy Lifestyles Teams participated in an individual ten minute telephone interview. Each was asked about their educational and professional history, if they had seen the report, what the priorities of their department had been over the last year, and about the role research played in decision-making. Their responses contributed to the data related to the contextual circumstances.

Documents were retrieved from the public domain (e.g., from websites), from key informants and from the Healthy Lifestyles teams. For example, if a team revealed that they discussed the *Breast Cancer Screening Practices in Ontario* report at a previous meeting, they were asked for the agenda, minutes or notes from that meeting as corroborating evidence. Documents were reviewed for relevant content and to corroborate information from other sources.

Ethical Concerns

This study was approved by the McMaster University Research Ethics Review Board (application available from the author). To gain entry to the site and access to the Healthy Lifestyle teams, each Director was provided with a description of the study. The author introduced herself as a McMaster University student conducting a doctoral dissertation. Once the Director's permission was secured, communication about the project commenced with the manager of the team.

Informed consent was sought from Healthy Lifestyles team members at the time of the group interview. The script relating to informed consent is in Figure 1.2; it was pre-approved by the McMaster University Research Ethics Review Board. The Healthy Lifestyles teams and key informants were assured of confidentiality in the release of any public material from this research.

Data Coding & Analysis

The multiple sources of data required various means of analysis. Selecting an appropriate technique was dependent on the kinds of questions, spelled out in Table 1.2, that corresponded to each data source. Some questions could be answered with a literal reading of a document or transcript, while other questions required the identification of patterns or themes arising from a set of data.

Data from key informant interviews and documents were used to develop a contextual profile of each of the public health units and its Healthy Lifestyles team. A descriptive analysis was used to carry out this task. That is, documents and transcripts were read and information pertaining to the characteristics of each health region and health unit was extracted. Another motivation for compiling contextual profiles was to determine if there were any systematic differences in organizational or environmental factors between the involved and uninvolved teams that could influence utilization of the research report.

Key informant interviews were also used to analyze the contextual circumstances faced by the public health community. Each key informant provided unique, specific insights related to his or her area of expertise. These insights were extracted from the transcripts directly and were used to understand the current public health and breast screening environment (Note: a qualitative coding procedure was not used because identifying commonalities across key informant responses was not required).

Data from the group interviews required a different analytical procedure in order to synthesize cases and identify common themes and patterns. First, the data in the transcripts were subjected to a qualitative coding procedure (Berg 1998; Corbin & Strauss 1990; Creswell 1998; Eaves 2001; Miles & Huberman 1994). To facilitate this, categories were developed to examine and question the data. Unlike the development of the interview guide, which was based on the research utilization literature, the category development process relied on participants' responses. The main feature of this process was to allow emerging categories to be derived primarily from respondents' experiences (Baxter & Eyles 1997; Creswell 1998).

Category Development Process

Two pilot interviews were used to develop categories (Eaves 2001). To accomplish this, data segments were examined. (To preserve the contextual integrity of the information, data segments were defined here as the segment of conversation between questions or probes.) Data segments were marked with a label in the margin on a hard copy of the transcripts. The label was descriptive in nature, and was based largely on the responses, as well as on the questions asked of respondents at the outset. Similar labels were grouped together to form categories. In some cases, subcategories were created to reflect different aspects of the phenomenon. For example, subcategories of "utilization" emerged as "expecting to use," "barriers to use" and "actual use."

In the next stage, unmarked hard copies of the pilot interviews were analyzed using the initial categories and subcategories. This was done by the author and a second researcher (Miles & Huberman 1994). This ensured that categories were stable before using them to analzye the main study transcripts. Discussions between the author and the second researcher clarified any ambiguities, and resulted in changes to the categories. Namely, the initial categories turned out to be too detailed and numerous. Therefore some categories were grouped together, and in some cases the newer, aggregated category was given a more comprehensive, descriptive label. Categories and subcategories generated by this constant comparison process are outlined in Table 1.4 (Miles & Huberman 1994)[4].

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[4] "Pure" open coding techniques involve initial line-by-line (in-vivo) coding. Code phrases are then reduced to categories (Eaves 2001). This study's variation of the technique used larger data segments to directly generate categories, considered more abstract than code phrases (Eaves 2001). This variation came about as a result of the author's novice position as a qualitative data analyser. To determine the potential impact of the variation, one of the two pilot interviews was randomly selected and subject to pure open coding. This result was compared with the categories used for the analysis in this study. The two sets of categories were essentially identical.

Data Analysis

The main analysis involved reviewing data segments for information relating to the various categories.

A decision was made to analyze the transcripts manually rather than use qualitative data management software for the task. This decision was based on technical and practical grounds. Before describing these, it is important to note that the purpose of such software is to organize the data such that the researcher can search, sort, link and retrieve text segments in an efficient manner. The software does not analyze the data – this function must be carried out by the researcher. Practically speaking, the use of software was associated with time and financial costs. Time costs would have been incurred when trying to choose appropriate software, and once again when learning how to use the system. On the other hand, the transcripts consisted of eight interviews that were each approximately 25 pages in length. This amount of data could be managed manually; the software efficiency advantages, in relation to the time and financial costs, were marginal. From a technical viewpoint, some researchers are of the opinion that computer packages serve to distance the researcher from the data and to decontextualize the data (Richards & Richards 1991). These two potential problems were avoided by manually analyzing the data.

The data segments were coded with one or more categories by the author (i.e., manually labelled in the margin of a hard copy of the transcript). Questions or thoughts about the data were also recorded in the margins as the analysis progressed.

As a result of this process, each category was associated with segments of data from various interviews. Each category was analysed as a collective; a word processing package was used to manage the data under each category. The categories were analysed for themes and patterns relevant to the research questions (Miles & Huberman 1994). First the analysis was conducted on a case-by-case basis, and reoccurring themes among the involved teams, and those among the uninvolved teams, were noted. The analysis then proceeded across the cases.

This analysis was used to develop generalizations about the primary research question. These generalizations were then examined with respect to the research utilization literature (Miles & Huberman 1994).

Increasing Rigour in the Research Process

The quality of this case study – the rigour in design, results and inferences – was enhanced with specific steps during the research process:

1. Comparison groups were incorporated into the design in order to appropriately attribute study outcomes, and to protect against the author's interests or bias in interpreting the outcomes.

2. This case study employed multiple data sources and multiple data collection methods, as described in Table 1. More significantly, multiple cases were used to cultivate greater confidence in findings. Three cases were selected among the uninvolved teams, and three cases were selected among the involved teams. In this way common (e.g., replicated) findings were given prominence in the analysis. Triangulation is a strategy whereby multiple sources of evidence are used to uncover converging findings (Patton 1987). Triangulation may be accomplished by using multiple data sources, multiple researchers, multiple methods and/or multiple theories.

3. Two pilot interviews were conducted to refine the data collection and coding procedure (Patton 1987). This ensured that the subsequent research process was stable and standardized.

4. An independent researcher contributed to the development of the categories for coding the interview transcripts. Specifically, she and the author used the two pilot interviews to identify, and then refine, the categories. The inclusion of an independent researcher protected the development process from any preconceived notions or biases the author might have otherwise contributed (Patton 1987).

5. Additional biases could have been avoided if the interviews or the analysis had been conducted such that the author was unaware which data came from the involved groups and which from the uninvolved groups. In an attempt to do something similar, the transcriber was directed to reference dialogue with an initial (not a first name) within the transcript. Then, the cases were allocated (non-randomly) to unique identifiers, one to six, before the analysis proceeded. Thus, each category in the word processing package was associated with data segments referenced by a number between one and six, and an initial.

6. Each category was defined operationally to promote standardized coding.

7. Research participants (e.g., the Healthy Lifestyles team) were given an opportunity to review a summary of the interview (Baxter & Eyles 1997). Participants were asked to comment on its accuracy[5].

8. The term "research utilization" was made meaningful for the broader scientific community by relying on the research literature to identify the dimensions of its construct. At the same time, utilization was made meaningful for the lay community by allowing study participants to identify instances of utilization in their own terms, related to their own spheres of job responsibility. This was accomplished using semi-structured interview questions to collect data, and using a subset of this data (from the pilot interviews) to define coding categories.

9. A database strategy (Creswell 1998; Patton 1987; Yin 1994) was developed to keep track of the different types of information that were collected and used. The database consisted of two types of materials. *Process notes* included descriptions

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[5] This summary did not include any interpretation of the interview but reflected the main points revealed by the team during the interview.

of meeting times, phone numbers and other administrative details. The *raw data*, which included transcripts and documents used for the analysis, were also retained together. The contents of the database are described in Appendix A. The database kept the process organized over the duration of the project. It also systematically documented and archived research material in the event that other researchers wish to reconstruct the research process and analysis.

10. Maintaining a "chain of evidence," as it is commonly called, involves establishing close links between the evidence and the conclusions (Yin 1994). It requires explicitness about the sources of evidence for claims through *extensive and specific reference to the case study database.* This strategy was incorporated when discussing results.

TABLE 1.2: DATA COLLECTION AND ANALYSIS

TOPIC	GENERAL QUESTION	TYPES OF DATA	DATA COLLECTION SOURCE	DATA COLLECTION METHOD	DATA ANALYSIS
ORGANIZATIONAL CONTEXT	1. What are the characteristics of the six public health units associated with the study?	- current challenges - strategic interests - operating budgets	Healthy Lifestyles Teams	Group Interviews	Open Coding
			Healthy Lifestyles Team Directors	Individual Interview	Descriptive
			Public health documents (e.g., annual reports)	Document Review	Descriptive
ENVIRONMENTAL CONTEXT	1. What are the characteristics of the catchment areas associated with the Healthy Lifestyle teams?	- demographics - local industries - health risks	Healthy Lifestyles Teams	Group Interviews	Open Coding
			Public health documents (e.g., health status reports)	Document Review	Descriptive
	2. What are the characteristics of the political climate?	- relationships among stakeholders - recent political events affecting public health units - funding issues - legislative issues	Healthy Lifestyles Teams	Group Interviews	Open Coding
			Key Informants	Individual Interviews	Descriptive
			Ministry of Health documents (e.g., newsletters)	Document Review	Descriptive

TOPIC	GENERAL QUESTION	TYPES OF DATA	DATA COLLECTION SOURCE	DATA COLLECTION METHOD	DATA ANALYSIS
UTILIZATION	1. To what extent was the report read by the Healthy Lifestyle team?	- recall receiving the report - recall reading the report	Healthy Lifestyles teams	Group Interviews	Open Coding
	2. To what extent was the information in the report processed by the Healthy Lifestyle team?	- comments about appearance, format, length, language - comments about methodological aspects of the report - comments about the research findings (e.g., their relevance)	Healthy Lifestyles teams	Group Interviews	Open Coding
	3. To what extent were the research findings applied?	- research findings used for program planning, evaluation, policy development, professional development, etc. - research findings considered in relation to public health units' breast health program - differences in intent to use and actual use	Healthy Lifestyles teams Public Health Unit Documents (e.g., meeting minutes) Healthy LifestyleTeam Directors	Group Interviews Document Review Telephone Interview	Open Coding Descriptive Descriptive

Table 1.3: Summary of Group Interview Guide

TOPIC	INTERVIEW REMINDERS/PROBES
Introduction	- Project description - Tape recorder - Informed Consent
Team	- Name of team, frequency of meetings, reporting structure - Kinds of activities involved in (current breast health activities)
Current Realities	- Regional amalgamation - Mandatory Core Guidelines - Description of catchment area - Other?
Development of *Breast Cancer Screening Practices in Ontario* report	- Recall report? - Who was a member of the Cancer Prevention Network? - Participation in needs identification? - Provided comments on first draft? - How could the (involvement) process be improved? - Other?
Technical Qualities of Report	- How did team members get the report? - Usefulness: appearance, format, length, language, content - Substance: methodology, validity of key messages - Origin: Central West Health Planning Information Network, relationship with them, prior documents from them - Feasibility: potential utility, political acceptability, met expectations - Other?
Use	- Influence the way you thought about breast health problems? - How did it contribute to your work? Policies, advocacy, programming, education - What would make it more useful? - What would interfere or be a barrier to use? - Other?
Organization	- Strategic interests, mission statement - Relationship with other community partners? - Other?
Closing	- Thanks - Any outstanding questions? - Anyone missing? - Might follow up for clarification - Will send summary of interview in 6 weeks for their review - Provide contact information

Table 1.4: Research Utilization Code Book

CODE	LABEL	OPERATIONAL DEFINITION
Utility - Format/Readability	**UT-FORMAT**	Comments by participants about the layout or language used in the *Breast Health Practices in Ontario* report (aka: the CWHPIN report, the Central West Health Planning Information Network report).
Content - Positive	**CONT-POS**	Comments by participants about the breast health information that they liked in the *Breast Health Practices in Ontario* report.
Content - Negative	**CONT-NEG**	Comments by participants about the breast health information that they disliked, or that they would have liked to seen, in the *Breast Health Practices in Ontario* report.
Content - Neutral	**CONT-NEUT**	General comments by participants about the breast health information in the *Breast Health Practices in Ontario* report.
Truth - Methodological	**TR-METHOD**	Comments by participants about the research questions, sample, analysis, National Population Health Survey database, or other aspects about the way in which the research was carried out in the *Breast Health Practices in Ontario* report. Also, comments about how they evaluated the document.
Process - Involvement	**PRO-INVOLV**	Comments by participants related to their involvement in identifying the need for the report, identifying the research questions, providing feedback on drafts, or other aspects of participating in the Central West Cancer Prevention Network.
Process - Not Involved	**PRO-NOINVOL**	Reasons or comments related to not participating in the development of the *Breast Health Practices in Ontario* report and/or not participating in the Central West Cancer Prevention Network.
Process - Other	**PRO-OTHER**	Comments by participants related to their involvement with other research networks, committees or groups.

Dissemination - Path	**DISS-PATH**	Comments by participants about how they came to know about or received the *Breast Health Practices in Ontario* report.
Utilization - Expectations	**UTIL-EXPECT**	Comments by participants about how they plan or expect to use the *Breast Health Practices in Ontario* report in the future.
Utilization - Barriers	**UTIL-BARR**	Comments by participants about barriers which prevent them from using the *Breast Health Practices in Ontario* report.
Utilization - Actual Use	**UTIL-USE**	Comments by participants about reading or using the information in the *Breast Health Practices in Ontario* report.

Figure 1.2

INFORMED CONSENT

The following will be repeated at the beginning of the group interview with Public Health Unit staff; it and the ensuing discussion will be tape recorded:

> "Hi, my name is Anita Kothari and I am a doctoral student in the Health Research Methodology program at McMaster University in Hamilton. [contact person's name] has graciously arranged for me to attend this meeting in order to ask you some questions. Before I tell you about the research I'm conducting, I want to point out that the tape recorder is on.
>
> My research interests revolve around the interface between research and decision-making. That is, I am interested how and when research is useful to you, as well as when research is less useful for carrying out your jobs. I am hoping that the information from my thesis will help those who distribute research documents have a better understanding of your needs from research. I am also hoping that the information from the thesis will help users of research - like yourselves - become more aware of the less obvious ways that you incorporate research into your jobs. Most of the previous work in this area has focused on *clinical* needs from research - like how to best develop clinical practice guidelines - but few people have focused on health program planning and policy needs.
>
> To focus this interview, I will use this document - Breast Cancer Screening Practices in Ontario - as an example of research.
>
> As you can see, I am tape recording this interview but I will not identify your name or this public health unit in my thesis or any publications or presentations. The only people who will have access to the tape and the transcripts are myself and the person who will be transcribing the interview. I also want to send you a summary of this discussion for you to review for accuracy; I 'd like to do that within the next 3 to 4 weeks.
>
> If you are in anyway uncomfortable with continuing this interview, please feel free to leave anytime. I won't be offended. If you stay, I will assume that for the time being I have your consent to conduct the interview and to tape it. After today you still have the opportunity to voice concerns or withdraw from the study. I will leave each of you with my card, and if you turn it over you will see that I have written my supervisor's name and phone number. Feel free to contact him too if you have any concerns.

During the interview, if you would like to say something off the record, please indicate that you would like me to turn the tape recorder off. Does anyone have any questions?

I expect that this interview will last about an hour. I want to emphasize that there are no wrong answers. I'm interested in everyone's point of view, so please don't hesitate to voice your thoughts. Let's begin."

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CHAPTER FIVE: RESULTS AND DISCUSSION

> *"My God when we started, the two of us started in the little village of P, you know nearly 20 years ago and we had no policy and procedures and you did what you felt was good and you did it, you did it. And it was good. We did good work but I remember a new medical officer of health came down and said what are you basing this on and we said...you know..I think it's sometimes hard for us. We struggle to get and to use this evidenced-based practice. It's a bit of a jump because it's not as emotional as being a good nurse and doing good stuff...*
>
> *(3.1)*

The results and discussion of this multiple case study are presented in three sections[1]. The first section consists of a description of the cases and their context. Information about the public health region's local industries, sub-populations, socioeconomic conditions, health risks, local political concerns and organizational features are profiled. In the second section, a summary of the themes emerging from the group interviews is presented in tabular form. These themes are used to reconstruct the involvement and utilization process. As actions (i.e., utilization) are intimately related to the context within which they occur, taking a deeper look at the environmental setting resulted in a fuller appreciation of study findings. The implications of these results are discussed in the last section, where the outcomes are juxtaposed with the contextual

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[1] In this chapter the citations refer to the literature and to the material in the case study database (Chapter Appendix A).

climate associated with the public health system in Ontario.

Result 1: Profiles of Cases

Six Healthy Lifestyles teams were deliberately selected such that they "matched" on certain features. Each case included two to four staff members devoted to breast health issues, which translated into at least one full time equivalent. The teams consisted of a secretarial support person, front-line staff members with university-based Bachelor nursing degrees and a manager with a graduate-level degree. The front-line staff members were responsible for planning and delivering the breast health services, while the manager was accountable (to the team Director) for the services. With the exception of one case, Case 4, all Healthy Lifestyles teams were composed of long-term staff members (more than six months).

The information derived from the Healthy Lifestyles team interviews provided a snapshot of each case's contextual setting, described below. This is supplemented with more comparable data in Table 1.5

Case1

This public health unit serves a large geographic area containing rural spots and clusters of larger populations, including a military base, an Aboriginal population, a Francophone sub-population and an Eastern European community. The area exhibits lower than the provincial average income (1.5)[2], and overall, a lower proportion of residents have post-secondary degrees compared to the rest of the province (1.5). Those

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[2] Citations in this format refer to Chapter Appendix A.

who are employed work primarily in government service and agriculture (1.5). Compared to the rest of Ontario, a higher proportion of the population is married in this region, and there are slightly fewer lone parent families (1.4).

Some of the sub-populations receive health care services through federally-sponsored means, but the public health unit maintains contact with these sub-populations through health promotion activities, or through partnerships with local service providers. Overall, the major causes of death in the area are cardiovascular disease, cancer, respiratory disease and injuries (1.6). The region's mortality rates due to cardiovascular diseases are higher than the rest of the province (1.6).

The team did not identify any notable political events in the area. Regional amalgamation was occurring, but the team indicated that this event was not currently diverting resources from the public health unit.

The unit's budget for 1999 was approximately $6.5 million (1.8). The public health unit is organized into five site offices, and the Division's priorities over the last year included heart and breast health, along with other Mandatory Guideline identified programs (1.11). The catchment population has access to two OBSP screening sites and at least one affiliate site (approval for another affiliate site is pending). Breast health activities have increased significantly over the last year, and include things like display boards, self-help videos at libraries, training of health professionals to reach rural areas, etc. A local breast health coalition, with at least 20 community partners, was initiated and continues to be facilitated by the unit (2.11). The team's breast health programs are supported in part through the Canadian Breast Cancer Foundation, and many of the breast health activities (and funding applications) are implemented in partnership with the coalition.

Case 2

The catchment population in this health region is culturally homogenous, with a high proportion of senior citizens, a local military population and an Aboriginal population (2.11). The population growth rate for the area has been relatively low over the last five years (2.11). The majority of the population lives in the rural areas and subsist on farming, although some factories are located in the one city centre located in the zone. But, overall, the region experiences high levels of unemployment (2.11), and only a small percentage of the population report having any university education (7.1). Residents of this region are more likely to own than rent their living accommodations, and many seniors residing here live alone (2.11). The number of lone parent families is similar to that of the province as a whole (2.11).

The region was currently experiencing regional amalgamation. It had not yet directly had an impact on the public health unit, but it had affected some of their partner agencies (e.g., hospitals, police, schools). The Healthy Lifestyles team voiced concerns about future public health funding at the municipal level.

The health unit is composed of five different offices. Over the past year, priorities for the Division have been primarily heart health activities and the prevention of bicycle-related injuries (2.3).

The unit's breast health promotion initiatives encompass a broader geographic area than is usual for the health unit's other activities, although there is minimal involvement with the local military and Aboriginal populations. The unit's breast health program components include such things as a Bring a Friend campaign, hospital library packages, medical receptionist packages and physician packages. The breast health program components are generally planned and carried out in conjunction with the local breast health committee. For the last four years these activities have been funded by a local hospital.

Case 3

This public health unit is situated in a large region with one city and outlying rural areas. About 60% of the residents live in the rural areas (3.4). The population is culturally homogenous, and residents are, on average, at a lower income level than the rest of Ontario. While most residents work in the farming community, 17% of the work force is associated with the manufacturing industry (3.4). One third of the population has a trade certificate or related qualification (7.1). There exists a low proportion of single parent families in the region, compared to the rest of the province (7.1). There is also a high proportion of home ownership (7.1). The demographics are changing, however, as the population is increasing quickly compared to other regions in the area.

For the majority of standard classifications of disease, this region experiences higher mortality rates than the rest of Ontario (3.4). It also experiences high levels of breast cancer mortality. It was the most frequently diagnosed cancer in women in 1995 (3.4). In the last five years, local physicians have become increasingly supportive of mammography screening, and with their cooperation a new OBSP site opened up recently in the region.

There were no significant local political issues that were affecting the health unit; recent municipal health-related public policy was focussed on alcohol legislation (3.4).

The public health unit in the area is organized into five satellite offices. In 1996, the unit's total expenditures were approximately $22.5 million (3.5). Staff does not have access to the internet (nor access to research from the internet). The priorities of the Division over the last year were injury prevention, heart health activities and tobacco use (3.3).

The Healthy Lifestyles team was not aware of the local Health Intelligence Unit or its role in the Ontario health system. Much of their breast health information comes from the Ontario Breast Screening Program and the Canadian Cancer Society. The breast health program components include activities such as workshops, presentations and physician newsletters.

Case 4

Case 4 is set in a region with rural and urban areas. In the last decade the region has experienced economic growth which surpassed the provincial average, attributed to the multiple industries in the region (4.5). The region's cultural make-up has been diversifying over the last decade (4.5). A traditional, pacifist Protestant group lives in the region alongside the mainstream population. Owing to the number of post-secondary institutions in the area, the region is also home to a large number of nonpermanent residents (4.5). Across the region, however, a high proportion of the population lacks university degrees or trade qualifications (4.5). Nevertheless, average household income distribution in the region is similar to the provincial distribution (4.5). In terms of social indicators, there are more married people in the region compared to the rest of the province, although the incidence of single-parent families is on the rise (4.5).

There is a shortage of family physicians in the area, and a few community health centres also serve the population. Approximately three OBSP sites are expected to open in the region over the next couple of years.

The public health unit was affected by a few major external and internal events over the last couple of years. A major community-wide public health initiative was established within municipal legislation, an accomplishment which required extensive education, lobbying and consultative efforts by the public health unit. The bylaw serves as a model for the rest of Ontario, if not Canada. As well, the identification of the deadly West Nile virus in neighbouring regions, and the discovery and aftermath of contaminated drinking water in another nearby region, represented two major recent public health incidents in the last year. As a result, the unit was involved in heightened risk monitoring and education campaigns around these topics.

Organizationally speaking, a new Medical Officer of Health and Assistant

Medical Officer of Health were hired within the last few years. The organizational model was restructured with the addition of a new planning and evaluation division. As a result, a physical relocation was occurring to accommodate the restructuring. The unit is composed of two branch offices, and has an annual budget of approximately $ 16 million. The priorities of the Division over the last year included tobacco activities, breast cancer screening and prostate cancer screening activities (4.3).

Breast health program components include information campaigns, media campaigns and presentations; most program components are planned and carried out in collaboration with another local breast health coalition. Many program activities are implemented within workplace settings (7.2). One team member went on maternity leave (June 2000 - Jan 2001) during the study period, resulting in a gap in staffing between June - August 2000 (after which a maternity leave replacement was hired).

Case 5

This public health unit serves both urban and rural areas. The urban areas are home to various industrial plants (auto, paper, nickel), educational institutions, government offices and call centres, while outside of the city, tourism, agriculture and the wine industry dominate. Overall, manufacturing is an important feature of the economy. The proportion of lone parent families has remained fairly stable over the last five years (5.4). Approximately a third of the working age population has a college or university degree (5.4).

There is a high proportion of senior citizens in the area, which translates into high rates of related illnesses, such as cancers and heart disease, and a need for related support services. In general, population growth is slow. Other health concerns include the high incidence of smoking; the leading causes of death in the region are heart disease and cancer (5.4). For younger people, suicide and motor vehicle injuries contribute significantly to mortality rates (5.4).

External issues indirectly affecting the health unit include the discovery of the West Nile virus and a contaminated water supply in neighbouring regions. Internally, the organization faces the problem of inadequate space for staff, who are organized into a main office with three satellite branches. In 1998, the health unit's budget was reported as approximately $20.5 million (5.6).

The priorities of the Division over the last year have been tobacco campaigns and general chronic disease prevention activities (especially heart health activities) (5.3). In 1997, the public health unit introduced the Family Physician Model of mammography recruitment in this region (7.2). In addition, they facilitated community mobilization strategies to encourage screening uptake (7.2). The current breast health program components include such things as: communication strategies (posters, Public Service Announcements, tear-offs, decals), women's health days, workplace wellness presentations and culturally sensitive outreach projects.

Case 6

Case 6 is situated in an affluent catchment area, where about a third of the population has had some university education (6.9). There are high levels of employment in the area, and less than 10% of the households have incomes less than $20,000 (6.9). Local industries include manufacturing, administrative head offices and agriculture. Although there is currently only a small non-English speaking population, that population is growing rapidly and it is expected that the current demographic profile will change to a more multicultural one. Currently, less than 10% of all families are headed by a single parent (6.9).

Parts of the region are experiencing shortages of family physicians. There is only one active Ontario Breast Screening Program site in the region.

One challenge for the health unit is that geographically it straddles two Cancer Care Ontario boundaries (but only one health planning region boundary). This results in duplication of resources at meetings, on committees, etc. Another concern was the discovery of a contaminated water supply in a nearby region, and more locally, the identification of the West Nile virus. These kinds of issues, especially with respect to the virus, required that staff time be diverted to health promotion educational activities. They also limited staff accessibility to the unit's Medical Officer of Health as he was otherwise occupied with risk management tasks (6.3).

The public health unit includes one main office and four branches. The Division earmarked healthy babies and mental health issues as priority programs last year

(6.3).

A new staff member joined the breast health team in the summer of 2000, and the organization has applied to hire another staff person. The breast health program includes such components as breast cancer information nights, work site information and the distribution of educational stickers. The health unit actively facilitates a local coalition of breast health community partners, with the objective of providing consistent educational messages to women in the area (7.2). There is only one active OBSP site in the region, and as result women are encouraged to seek screening referrals from their physicians.

Result 2: Involvement and Utilization Outcomes

Table 1.6 is a summary of the issues and themes that emerged from the interviews with public health staff. The purpose of the Table is to demonstrate the breadth of research utilization issues, and their occurrence in the study sample. This simple tabulation does not reflect the intensity or importance of the issue to the Healthy Lifestyles team(s). The results of the involvement process, and the utilization outcomes, are presented next.

Details of the Involvement Process

The events related to the generation of the *Breast Cancer Screening Practices in Ontario* report are reviewed briefly. Through the Central West Cancer Prevention Network ("the Network"), these Cases met in November 1998 and discussed the need for regional-level breast health information. At a meeting in December 1998 the group outlined their data requirements to Tom Abernathy, the Director of the Central West Health Planning Information Network. He coordinated the analysis, and mailed the first draft of the report to the members of Central West Cancer Prevention Network in October 1999. In December 1999 Abernathy presented and discussed the first draft with the Network. He indicated that feedback was welcome, either there or later through email or telephone. Case 5 coordinated the feedback on behalf of the Network, and later met with Abernathy in March 2000 to discuss the desired changes. The final report was completed by April 2000. It was presented that month at a Network meeting, at which time Abernathy also asked the group's permission to circulate the report widely (7.2). Shortly after, a copy of the report was mailed to each public health unit in Central West by Abernathy's organization (and then mailed to all Ontario public health units in June 2000).

So described, these events do not reveal the nuances of the involvement process. To fully understand the nature of involvement in this study, it was essential to determine two things. First, were the same staff person(s) involved throughout the events? The influence of this person on the eventual utilization of the report might be key – in effect, she acts as a champion for the report. Second, it was essential to determine the level of support for the involvement process. A process that was perceived as faulty or unsatisfactory might, by association, undermine the value of the report.

A review of the Central West Cancer Prevention Network meeting minutes and agenda items from July 1996 to April 2000 confirmed that the same three public health staff members from Cases 4 - 6 attended all the meetings. But, follow-up inquiries with the Case 4 representative revealed that she did not fully participate in the involvement process; at the feedback stage she was preparing for a maternity leave and was therefore too busy to provide comments (4.2). Lack of involvement at this stage of the process did not seem, however, to deter her team from utilizing (e.g., sharing) the report with their local breast health committee (4.2).

Comments about the draft were made with respect to the research literature, the analysis, the framing of the issues and final (text) presentation. The requested changes, and the response, are described in Table 1.7. On the whole, the final document reflected the Network's desired preferences. Thus, lack of attention to the feedback was not a significant issue in this involvement process. Nor did it arise during the interviews with the Cases.

Further discussion with Case 5, the coordinator of the feedback, indicated that this process of involvement had been used for other documents also developed by the Central West Health Planning Information Network. The problem with this approach was the dependence upon consistency of staff,

> "We've been relatively stable and X has been stable and up until this year, Y has been stable . . . The other four units have not been stable and consequently you always have someone new to the table and looking at this again and you're bringing them up to speed on what's going on. So I can't really say that we have strong input from the group as a whole. Interesting results but not strong input

because of the staff turnover." (5.1)

The strength of this approach, as reported in the interview with Case 5, was: 1) the ability to provide input about the study questions, 2) the gain in understanding of the research process, and 3) the management of group expectations around the research outcomes. However, the inevitability of new staff appearing during the involvement process implied that someone needed to take the lead in seeing the process through, as happened in Central West.

Further indications about support for the involvement process might have been reflected in different levels of satisfaction with the report between involved and uninvolved Healthy Lifestyles teams. In fact, all Cases, whether they were involved or not, had positive things to say about the length of the report, its readability, the format of the report, the ease of accessing information in the report and about the content matter. As one Case put it, "it organized a lot of information in a readable way" (3.1).

Negative things about the report were also mentioned, such as a request for a one page summary of the report. But on the whole these comments did not demonstrate any kind of distinct pattern between the two types of public health units, nor were they strongly voiced. There was one exception, however. Cases 1 and 3 made several comments about the report being less useful because study findings were presented at the level of the region, instead of the geographically smaller county level. They felt that this aggregation made the report less useful for local planning. It would seem that these Cases were not sensitive to sample size reliability issues related to smaller units of analysis at the county level.

Further exploration of this issue in the data revealed that those Cases involved in the research seem to have a better understanding of the restrictions associated with a secondary analysis. In contrast, uninvolved Cases found fault with the original wording of NPHS questions (1.1, 2.1, 3.1), expressed qualms about the methodology of the secondary analysis ("If the information is correct now it does leave me to wonder in the end about the survey and the questions and answers in the analysis, for example.", 3.1), and had difficulty understanding why the data was not broken down at the county level. Similar comments were not prevalent among the involved cases, suggesting that involvement in the research process helped the Cases understand the report they commissioned, and gave them a better understanding of the NPHS. For example, "And getting any kind of information that you can actually rely on because as your numerator shrinks..." (5.1) was voiced from an involved Case. The Network meeting minutes of April 5, 2000 indicated that Abernathy's presentation of the report included: an explanation of the limitations associated with the NPHS (e.g., sample size issues, diagnostic versus screening mammograms, etc.,), a discussion of the report findings and how one might proceed with the report findings (7.2). The uninvolved cases were not exposed to this experience.

There were no indications that the involvement process was dissatisfying, which sets the stage for utilization of the report. As well, this process of interaction had been used before between Central West Health Planning Information Network and public health units. As Abernathy remarked, “Yeah, it [the process] usually works well because we design the report along with the ultimate end users, so that we know that the content is aimed at what it is that they need.” (7.3). Thus, the motivation for producing a useful document was also in place.

An interesting sidenote is that there were no indications that the process was enormously gratifying. There was no mention of increased feelings of personal worth or empowerment by those who had the opportunity to be involved in the generation of the research report. This might suggest that the type of interaction that occurred represented more of a partnership than a redistribution of power between the disseminator and the user.

To summarize, the results did not suggest dissatisfaction with the involvement process – feedback was incorporated into the final document, and respondents did not identify major weaknesses with this manner of generating a document. A comparison of the comments made by the groups suggested that the process educated the involved Cases about the limitations and analytical process associated with the *Breast Cancer Screening Practices in Ontario* report. And in doing so, as Case 5 pointed out, this managed expectations with respect to the research findings.

Utilization Outcomes

It was expected that utilization would differ between the two Cases. Those involved in generating the research report would be more likely to utilize it. In this study utilization was conceptualized as a three-stage process: receiving, information processing and applying research findings.

The **Receiving Stage** of utilization was defined as receiving and reading the research report. In some sense this stage is related to the extent of successful dissemination of the report from Central West Health Planning Information Network (CWHPIN) to the health units. Cases 4, 5 and 6 received the report through their involvement in its production. In addition, CWHPIN mailed the final copy to all the public health units in Central West, addressing the report to the public health unit's epidemiologist. To illustrate, Case 4 brought multiple (original) copies of the report to the interview, including first and final drafts (4.1).

The Central West Health Planning Information Network also mailed a copy of the report to all public health units in Ontario (i.e., including the uninvolved Cases), addressed to the Cancer Prevention Program Director. When questioned, at least two uninvolved Cases seemed a bit perplexed about how the report got to their organization, or why it was sent to them (despite the accompanying cover letter from Abernathy),

> "It came in the mail from Tom Abernathy and I think, I don't know why it came other than to share with health units the information so I presume he sent it to all the health units and I don't know how long ago that it arrived at the health unit that I would have received it ..." (1.1)

> [... you hadn't seen this document which had supposedly been disseminated four or five months ago.]
> "To who? Well, this is the mystery..." (3.1)

Although the Cases were unsure about the origins of the report, two of them knew Abernathy (e.g., had heard him speak previously), and admitted that it was usual to receive reports from the Central West Health Planning Information Network[3] (2.1). All three uninvolved Cases read or reviewed the report when the interview was being arranged for this study.

There were some challenges with respect to internal circulation of the report as well, for both the involved and uninvolved Cases. Case 1 used a folder to disseminate documents between five offices, but the folder often got "stuck" at someone's desk (1.1). At Case 2, documents generally are sent to the unit's library and put into a box of materials related to the early detection of breast cancer, so staff is required to take the initiative in signing out materials when needed (2.1). Cases 3 and 6 indicated that the staff epidemiologist would be responsible for circulating the report internally (3.1, 6.1). These different pathways underline the importance of devoting more attention to the internal dissemination of documents if they are to be read, and then utilized.

The **information processing stage** is related to assessing the merit or utility of the research report. This may rest in its physical characteristics, the usefulness of the specific research findings or the perceived validity of findings. The question here is whether there was a difference in information processing between the two groups of Cases.

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[3] There were no criticisms, by any Case, about the disseminating organization or Abernathy.

Involved and uninvolved Cases had some positive and negative things to say about the physical characteristics of the report. Positive comments ranged from "It was nicely laid out and easy to read. You could get a sense of what was in there very quickly..." (1.1) to "In terms of length, seems appropriate to me" (4.1). Negative comments about the format included, "If they had a one page, two-sided summary..." (1.1), and "I like it bound" (5.1). But these comments were not extreme in either direction. Nor did they reveal any clear pattern.

Questions about the perceived validity of findings, which are related to understanding the methodology of the research, were discussed earlier. Involved cases had a better sense of what it was possible to accomplish using the NPHS, and were less critical of the data and findings.

Comments about the utility of the report are related to its contents. The report provided descriptive information about the breast health practices of women in Ontario. The unique aspect of the report were findings it presented at the level of the health region: "...the value of this kind of thing is that we have something on [the health region]" (5.1). In general, respondents said that the report did not provide new information, and that they had seen most of it before. For example, Case 2 said, "...so the material isn't new but in a new format." This reflects the fact that the report did not describe any innovative approaches to breast health that might be directly applicable to breast health programs.

Still, there were specific findings that provoked phrases such as "that's interesting" (2.1), "surprised to see" (3.1), "element of disappointment" (5.1). In these conversations, Cases identified, described and then discussed a particular finding in the report at the interview, suggesting that some information processing had occurred across Cases.

But the involved Cases were more articulate about the value of the report, despite the overall lack of novelty. That is, although all Cases were positive about the format, and admitted to being surprised about some findings in the report, Cases 4, 5 and 6 extended the discussion by identifying the merit of the report. The report was perceived as useful because it synthesized previous research (4.1, 5.1), it provided local, not provincial, information (4.1, 5.1), it described the NPHS (5.1), and it provided an opportunity to compare experiential knowledge with research (6.1). These Cases seemed to be saying, "So it's definitely a good thing to have" (4.1). It was felt by one Case that this would be an *ever more* valuable report for those who were not as involved in its production (5.1).

There was also a marked difference between the involved and uninvolved Cases with respect to *expectations for using* the report in the future. All Healthy Lifestyles teams who were involved in the generation of the report discussed the value of the report as a reference for future activities (5.1, 6.1). They expected to use the local data contained in the report for presentations (4.1), for media communications (4.1), for the original citations (4.1), for developing new educational material (4.1, 5.1, 6.1), and for strategic or program planning (4.1, 6.1). The uninvolved cases gave little emphasis to expectations around future use of the report.

In the final stage of utilization, the user **applies** the research findings by *relating* them to the problem, decision or program at hand. For example, Case 1 discussed the findings in relation to the regulatory public health guidelines (1.1). Another Case provided an explanation of their regional results by describing, in detail, aspects of the catchment area and population (2.1).

Some of the Cases mentioned that they had used the report for information sharing. That is, they were part of a local breast health coalition or initiative, and had taken the report to that group for circulation (2.2, 4.1). The interviews revealed that most breast health activities were carried out in conjunction with local coalitions, so sharing the report in this way was not surprising. One Case used the report as background material in their strategic planning exercise (6.1).

There was an application of the research findings, that surfaced here, that is not prevalent in the utilization literature: confirmation activities, of two sorts. First, all those involved in the research process stressed that the report was valuable for confirming what they were already doing with respect to breast health (4.1, 5.1, 6.1). It was used to "justify what we are doing and to help us decide what we should be doing" (5.1). One team mentioned that they checked their current print material against the information in the report (4.1). Another said that the report confirmed focus group and survey research they had previously conducted (2.1). It was also used to confirm their field or experiential knowledge of breast health practices (2.1, 6.1). The report was used to get a sense of where their activities stood against current evidence.

This kind of confirmation might be related to Weiss' notion of political use, where research findings are used to support a position already taken by the user (Weiss 1979). The use of research to justify decisions might not be seen favourably by some researchers. Weiss maintains, however, that as long as the findings are not distorted or misrepresented, the use of research findings for political purposes is legitimate (Weiss 1979). Here, the political motivation behind this kind of confirmation was not explicitly expressed in the interviews, and the tone of confirmation was less deliberate and less conscious than the tone of political use. Consequently, confirmation was not seen as exactly the same as Weiss' political use.

The second way in which the report was used to confirm was through regional comparisons. Some units used the report to compare breast health activities in their region with how other regions were doing: "I was quite surprised with the statistics by reading this. We are doing much better" (3.5). They were reassured that they were on track, and not an outlier among their peers. As Case 5 put it,

> "Well one thing we noticed pretty fast is that boy we're not much different from the rest of the province, and I mean in fact we were doing well, I think, isn't that what it says to us? We're doing not badly?" (5.1)

Overall, the Cases applied the *Breast Cancer Screening Practices in Ontario* report in a variety of ways, most notably to confirm their program activities and their ranking with respect to breast health outcomes. There was no strong indication, however, that being involved in the research process was associated with a greater extent of application use.

Contextual Differences and Research Utilization

A contextual description of each public health unit and region was presented earlier, supplemented by Table 1.5. These profiles provided a backdrop for the study outcomes associated with each Healthy Lifestyles Team. The profiles were also used to determine if contextual differences could account for, or could have influenced, the research utilization outcomes. It appeared, however, that the organizational and environmental differences between the involved and the uninvolved teams were more random than systematic. This implied that the contextual variables were not associated with the differences in outcomes between the two types of teams.

A Deeper Look at a Contextual Issue

The interviews demonstrated that public health staff were familiar with evidenced-based jargon (e.g., "best practices"), and they were quick to point out past instances of research utilization. Their directors were also eager to display their knowledge about the importance of research for program planning and policy making. Furthermore, the directors' and the managers' educational backgrounds implied exposure to research literature. These motivations and experiences, however, did not match the (expected) level of utilization that resulted from the circulation, or from involvement with, the *Breast Cancer Screening Practices in Ontario* report.

The contextual circumstances provided a deeper understanding of these results. Originally it was expected that *differences* in contextual circumstances between involved and uninvolved Cases would be helpful in this respect. Instead, it was more informative to understand the overall context of breast cancer screening in Ontario, and the challenges that public health units face in the current climate.

This aspect of the analysis was stimulated by the interview results and by a comment from a key informant, who said,

> "They've spent so much time on restructuring that it made it difficult for them to concentrate on programming and policy development. So there's been a heightened political awareness among them because their political environment has been changing so...the politics of survival and restructuring..."

This contextual analysis will focus on the stakeholders in Ontario associated with breast cancer screening. Unless otherwise noted, the information source is the interviews with key informants, who are listed in the Case Material Data Set (Chapter Appendix A). The comments are not specifically attributed to specific informants here, as per confidentiality agreements.

The discussion begins with the Public Health Branch at the Ontario Ministry of Health. In 1983, the Health Protection and Promotion Act was passed, along with a number of other measures to improve the quality of public health practice in Ontario. These measures included an accreditation program for public health units, a movement to develop guidelines for public health practice, and a change in the funding formula such that 75% of the public health units' budget would be provincially funded (with only the remainder, 25%, being left to the municipalities, who had proven to be reluctant to allocate money to public health programs). Thus, the public health system in Ontario experienced "revolutionary changes" during the 1980s.

A first draft of the public health Mandatory Health Programs and Service Guidelines, in effect regulations under the 1983 Act, had been written by the mid-eighties. The Guidelines were subject to revisions as the years progressed. These guidelines are used by approximately 5,000 public health workers in 43 health units across Ontario. They provide "guidelines on how they [public health workers] spend their time on a day to day basis." Over the years, revisions were done to make the guidelines more reader- friendly, to accommodate a guideline development process that was inclusive of public health practitioners, and to make the process more systematic. More importantly, there was a push for increased explicit reference to research evidence. Currently, sections of the 1998 version are under review[4]. The current round of revisions reflects the first time that the Public Health Branch has officially required that a PHRED program representative be a member of each review committee – "...first explicit recognition by the process that there would be some benefit, possibly, by plugging into the research field."

In 1995, the Ontario government changed the public health funding formula.

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[4] Incidently, the *Breast Cancer Screening Practices in Ontario* report was used as one source of research information by the committee responsible for reviewing the screening guidelines.

The province became responsible for only 50% of the public health budget and the municipality was responsible for the remaining 50%. Then in January 1998, the funding source shifted once more, in the name of better local service integration and delivery, to 100% municipal funding. The total value of the municipal tax base, however, varies from city to city. In March 1999, in the face of an oncoming election and pressure from the public health community for a more equitable financing solution, the provincial government agreed to a 50-50 shared funding arrangement with the municipalities for public health services. During this period public health units were often operating without knowing what their funding would amount to that year. As a result of these experiences, public health officials came to believe that municipalities would focus excessively on short-term health outcomes (and numbers of public health staff), without understanding the long-term nature of health promotion and risk protection activities. As a result, the 1997 Mandatory Guidelines were written in such a way as to change the focus from outcomes to the minimum number of activities required to have an impact on outcomes (i.e., process focussed).

In short, grassroots public health workers were in the midst of change. On the one hand they were experiencing continuous financial and organizational restructuring within their organizations ("So they were essentially non-operational almost, for a short time."). To add to these pressures, a top-down push for evidenced-based approaches was evolving in the Public Health Branch, and its influence was filtered through the Mandatory Guidelines. These elements contributed to the contextual climate faced by public health workers.

A grassroots response to the use of research in program planning and decision-making was however expressed very strongly by Case 3. They discussed the need to balance research findings with local conditions. And other reactions were also clear. Using research to make programming decisions was perceived as less "emotional than being a good nurse and doing good stuff." (3.1). The loss of planning flexibility that accompanied the use of guidelines was perceived by the Case in question as being less responsive to community needs, and therefore decreased the public health nurse's credibility in the community: "So that the community very much valued us [in the past]...So a lot of it was community driven. Those years were good years..." (3.1). Overall, the use of research findings for public health practice, and the use of guidelines, was seen to be in competition with their professional standing. The Case ended this part of the discussion with the following comment, "There will be a certain pushing and pulling to see what the community perceives as their needs and what the evidence-based research show what the needs are."(3.1).

There were hints that similar sentiments were shared by some of the other Cases. Case 1 mentioned, "... so the Ministry is driving what we are doing. We say what are our priorities of the Provincial priorities." (1.1). Case 2 expressed their feelings as,

> "Well the fact that the Province mandates programs in a great deal of detail ...yet that we can't get adequate funding to do that either from the Province or the Municipality is a constant frustration for the staff." (2.1)

The pressures of uncertain financing within the public health units, combined with a strong desire for research-based activities from upper-level public health officials, might have been amplified by another factor related to organized breast screening services in the province.

The Ontario Breast Screening Program (OBSP) was initiated in 1990 (Central West Health Planning Information Network 1999) and is operated by Cancer Care Ontario. This unique situation – a similar provincial program does not exist for cervical screening, for example – is reflected in the way that the public health guidelines are written with respect to breast cancer screening. Specifically, public health units are required to encourage women to attend mammography screening *through OBSP*. Public health units use different strategies to achieve this objective, often depending on whether an OBSP site or affiliate screening centre is within the region.

Regional OBSP offices also use different strategies to recruit women. In particular, the Hamilton-Wentworth regional experience with the Family Physician Model of recruitment has demonstrated success in mammography screening uptake (McAuley, Rand, et al. 1997). This model depends on collaboration with local physicians, beginning with education about the benefits of organized screening programs. Once physicians agree to join the recruitment efforts, they review a list of potential women from their patient population to confirm eligibility. A personalized letter, on the physician's letterhead, along with educational material, is sent to targeted recipients. A follow-up letter is sent to women who have not arranged for a mammography appointment within a certain period of time. As a result of the success with this approach, some public health workers and administrators identify it as a model of choice for recruiting women to participate in screening programs.

Currently, this model essentially involves a three-way partnership between the family physician, his or her patient and the OBSP. There is no direct role for public health workers in this model, other than perhaps indicating to the community, and to physicians, that the public health community supports the approach. Within this model, public health workers contribute in a passive manner. There are women who are not served by this model – namely, those who do not have a family physician. The public health unit's role then becomes focussed on recruiting women who are not associated with a regular physician for care ("... that group that doesn't come and that's the hardest nut to crack."). How the outcomes from of either these two roles – the passive role, or focussing on the hard-to-reach population – can be measured against the Mandatory Guidelines requirements for public health units is unclear.

Implications of Results

Over the last few years, public health workers' realities have included organizational change and an underdeveloped role with respect to breast cancer screening recruitment. As organizational changes tend to occur in predictable cycles, it is reasonable to expect that the public health climate will become more stable in the near future. If the Family Physician Model of screening recruitment is implemented across the province, then a more meaningful partnership between public health workers and physicians needs to be articulated and nurtured within this Model. In this way the provincial Mandatory Guidelines for breast cancer screening can be met by public health workers and OBSP in a coordinated fashion.

Public health workers have also been experiencing a push, from public health officials, for increased evidenced-based practices – a direction that is perceived to be in some conflict with responding to community-based priorities. Both perspectives, however, are valuable for carrying out public health activities. The Public Health Branch of the Ministry, Medical Officers of Health and other senior administrators acquire a political orientation that is sensitive to public health's standing in the health system. These officials can thus encourage uniformity of services across the province. Front-line workers, on the other hand, have unique knowledge of local issues and concerns, and are in a position to deliver services in a flexible manner. Their professional reputations are closely tied with their relationships with the community.

Interaction between the user and the disseminator in the research process is one way to reconcile these points of view – local needs can be used to frame research questions, lending assurances that eventual courses of action (e.g., public health activities) are grounded in current research findings and are community-relevant. Huberman (Huberman & Cox 1990) favours this course of action,

> "... it is the sustained interactivity that allows for the process of mutual education,

> by which users render evaluators progressively wiser in relation to the workings of the local context that actually account for the observed outcomes, and heighten the awareness of users by feeding back this information to users in ways which are locally recognizable yet framed in such a way as to deepen or sharpen local understandings." (p.168)

In this study, the research question of interest was "is user involvement in the research process associated with greater research utilization than lack of involvement?" Research utilization was conceptualized as a three-stage process of reading, information processing and application; this approach does not represent a hierarchy of outcomes but, instead, recognizes that the outcomes sit on a continuum. The results, then, provide the "degree of utilization" between the two types of groups.

This study demonstrated some benefits to involving users in the production of research. Being involved meant that the report was read earlier, in draft form. Although there was less "novelty value" attached to the report, the involved parties were more accepting of its limitations and more generous in their assessment of its utility, as demonstrated by their expectations to use the report in the future.

Being involved in the research, however, did not have a large impact on the application of the research. There were minor applications, in both cases, such as information-sharing. Furthermore there was a major application that was unique to this study: Healthy Lifestyles teams used the findings to confirm their current breast health programs, and to confirm their population's relative position with respect to breast health activities. These activities did not differ, however, by involvement.

The conceptual framework used in this study suggested that involvement would lead to utilization, as indicated by the research utilization literature. It is possible, however, that those involved in the research are more understanding of its limitations and therefore are *less* likely to utilize the findings. That is, involvement might not lead to greater utilization. This alternate hypothesis might be appropriate for other utilization situations. Given, however, that the involved teams voiced expectations for future use, and that there was little difference in the ways in which the two kinds of teams applied the findings, this alternative hypothesis may not be fitting for the current study situation.

The literature synthesis in Chapter 1 suggested three models of interaction that emerged from the few studies which focussed on interaction. The first model, the least resource intensive, was concerned with interaction for the purposes of helping users understand the research. The second model revolved around the aim of exchanging knowledge between the users and the disseminators. The purpose of the third model was to make the research more responsive to users' needs. These models represent at least three ways that interaction can be manifested. The type of interaction in this study, "involvement," overlaps between models 1 and 3. As a by-product of the involvement process, users were familiar with the limitations of the research findings (model 1). More directly, the involvement process was initiated by the user, and research questions identified by them, to meet their needs (model 3).

The process did not result in a greater extent of applied utilization, and the simple categorization above does not reveal how to make the process "better." The idea of interaction is in its infancy, borne of the need to fill a gap in practice, and perhaps as a result, the idea lacks a theoretical basis to explain why and how the interaction process might operate. The categorization above underlines the importance of articulating the aims of an interactive process. In parallel, this study uncovered both process outcomes (e.g., by-products) and research utilization outcomes of an interactive process.

Some possible objectives of an interactive process, in terms of process and utilization outcomes, are identified. Hopefully this discussion will stimulate empirical work that could contribute to a theoretical basis for the interaction concept. For example, one process objective that arose in a previous study (Cousins & Leithwood 1993) was that of self-worth, or *empowerment*, which predominates in the participatory or action research paradigms. Such paradigms are characterized by: the acknowledgement of lay knowledge and experiences as a source of valuable information, a focus on power imbalances, political action, the education of participants, and raising awareness of local issues through participation (Labonte 1990). Collective actions and experiences are paramount in this process (Labonte 1990). The current study found that the objective of empowerment was not an issue between these particular users and the disseminator. But other users, such as patient-based community advisory groups, might benefit from empowerment-related interactions. Thus, if an objective of an interactive process is to empower and to utilize, then researchers might look to associated theoretical works.

An objective of the interactive process might be *to teach* users about research methods, as occurred in this and other studies (Cousins & Leithwood 1993; Forss, Crackness, et al. 1994; Patton 1988). If so, then adult learning theory might be useful, where new knowledge is not seen to be decontextualized from previous experiences, beliefs and other sources of information. For new concepts to be learned, they must be related to the user's current world view (Davis, Thomson, et al. 1995; Dunn 1983; National Center for the Dissemination of Disability Research 1996). The passive absorption of material is not effective; rather, collaboration and active learning, between a disseminator (the teacher) and the user (the apprentice) need to occur (Abott & Ryan 1998).

Perhaps an objective is simply to *facilitate group processes* between the disseminator(s) and users for increased "linkages and exchanges" (Tyden 1996). Social processing, as it is called, focuses on collegial relationships and verbal exchanges such that disseminators can determine the relevancy of research findings within users' professional activities (Cousins & Leithwood 1993). Such activities are also expected to increase users' understanding of the research, as in model 2 described earlier.

These possible by-products of an involvement process – empowerment, learning, effective group processes or another desired outcome – might be the means by which to achieve the ultimate end state: the utilization of research findings. The way in which this can happen effectively deserves more theoretical attention within a research utilization framework.

Personal Reflection on Multiple Roles

A comment is required about my multiple roles throughout this study. First, I wrote the *Breast Cancer Screening Practices in Ontario* report. Then, for this thesis study, I collected data from users about this report, and subsequently analyzed the data. Some personal reflections are offered about how these roles might have contributed to the way in which knowledge was produced.

The first consideration is whether my role as author of the report interfered with my ability, as interviewer, to develop rapport with, and collect rich information from, users. I would suggest that there was very little interference between my two roles here because I was not identified as the author of the report, either in writing, or in any communication between myself and users (i.e., before the interview took place). Responsibility for the report was placed with the coordinating agency, the Central West Health Planning Information Network.

I did have to learn how to handle questions during the interview about the contents, or technical details of the report. It became clear from the pilot interviews that questions about the contents or methodology were inevitable; and as I had detailed knowledge of these issues, I felt obliged to help users sort through their questions. I knew, however, that this could influence the responses during the interview. After discussions with other qualitative researchers, I resolved this dilemma by remaining distant or neutral about these sorts of questions during the interview process. Once the interview was over, I answered their questions. At this time I disclosed my authorship if I was asked directly about my greater-than-average knowledge about the report. By using this approach I was able to focus on my role as a data collector during the group interview.

The second consideration is the overlap in roles as data collector and data analyzer. In an ideal situation, at least two independent researchers would have generated the categories and coded all the interviews. This process can protect against any premature inferences that might have developed during data collection. Financial constraints precluded this course of action. What was possible, however, was the inclusion of an independent researcher at the pilot stage. To guard against biases that I might have brought to the analysis, another researcher and I used two pilot interviews to independently develop categories and code these interviews. In this way I tried to maximize the opportunities for themes to emerge from the data rather than being constrained by any preconceived ideas.

Limitations to Research Study

The major limitations related to the data sources, analysis, conceptual framework and generalization of results are addressed.

Critics might argue that defining the unit of analysis as the group might have forced a compromised position during the Healthy Lifestyles team interviews. (Note: the a priori decision rule was to use the comments from the majority of respondents in the case of a dispute). The potential for dispute was, in the end, a nonissue. Differences of opinion did not arise in the two pilot interviews, nor did they arise during the subsequent interviews.

In terms of the analysis, two pilot interviews and a constant comparative method (e.g., an iterative process) were used to develop categories. In contrast, the literature prescribes using the entire set of data to refine categories. The key question is whether different data would have been uncovered had the analytical process been conceptually perfect. One of the pilot interviews was revisited and used to develop categories using the pure open coding process; the resulting categories were essentially similar to the set used in this analysis. Therefore it is suggested that, on the whole, the process carried out here did not greatly alter the findings and interpretation of events. It is maintained that the categories used, or slightly different ones, would have uncovered similar dominant themes and patterns.

One of the assumptions of this study was that a reasonable amount of time elapsed for utilization to occur. Research findings must compete with other information for the user's initial attention. Then, opportunities to apply the research findings must present themselves; these opportunities include an appropriate "problem" to solve, and an "acceptable" solution to implement. The current finding of minimal applied research utilization might be associated with this assumption: perhaps not enough time passed for utilization to materialize. An alternate study, designed such that "time" was an explicit contextual variable, could explore this assumption. Such a study, however, would have been difficult to achieve within the time frame of a doctoral dissertation.

Research findings, whether qualitative or quantitative, can be interpreted in more than one way. It remains the researcher's responsibility to provide evidence, based on the findings, for his or her ultimate conclusions. In some situations the evidence for alternative interpretations is equally compelling. In this study it was concluded that involvement led to greater understanding and acceptance of the breast cancer practices report; this conclusion was based on many of the respondents' comments. The *same* comments could be used to support the position that respondents were expressing a defensive attitude based on their involvement and associated ownership of the report. What these two interpretations highlight is a limitation of this and other research utilization studies – that verbal accounts of utilization ought to be supported by more objective measures, such as measures of utilization behaviour, for stronger inferences.

The conceptual framework used for this study described a direct connection between involvement and increased utilization of research. There might have been, however, a third variable related to involvement and utilization. For example, a high degree of "readiness for research" might have confounded the relationship between involvement and utilization. A "research ready" Team might already be retrieving and using research. Such a Team might eagerly agree to participate in an involvement process, and subsequently utilize research from a variety of sources. In this situation the relationship between involvement and utilization is less direct. To rule out this possibility, it would have been helpful to measure the extent of "readiness for research" exhibited by each Team before the involvement process occurred.

The conceptual framework was developed before the study was underway, and as such reflected a basic understanding of the process. In retrospect, the involvement process revealed that 1) dissemination occurred much earlier than depicted as the involved teams received draft versions of the report, and 2) the input from involved teams influenced the findings. An improvement on the framework would be to incorporate a more explicit and reciprocally active link between "involvement" and research generation, dissemination and the research findings.

The conclusions were arrived at through a case study design, implying that the generalizability of these findings is limited to the literature (e.g., research utilization conceptual framework). Although the inferences are not generalizable to the entire population of public health units in Ontario (or elsewhere), researchers may generalize the results to similar settings. Key features between two settings pertaining to research transfer include the: kinds of users and their spheres of responsibility, the specific interaction processes, the kinds of information in a research report (e.g., revolutionary or incremental findings?) or the nature of the relationship between the disseminator and user. The use of the case study design was advantageous in that it facilitated a richer understanding of results through the attention to contextual details.

Table 1.5: Characteristics of Six Study Cases

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Life expectancy at birth, 1996 (years)	78	77.4	77.2	78.9	78.3	80.2
Total mortality, age standardized, 1996 (rate per 100,000)	701.2	719.9	744	653.6	683.1	585.8
Breast cancer deaths, age standardized, 1996 (rate per 100,000)	29.2	26.4	32.5	27.1	32.7	35.8
Proportion of high school graduates, (25-29) 1996 (%)	71.9	69.8	75.2	72.8	76.8	81
Proportion of low income of total population in private households, 1995 (%)	13.6	15.8	12.1	14.3	15.6	9.3
Unemployment rate (labour force age 15 and over), 1996 (%)	10.5	12.8	9.7	8	8.9	5.3
Proportion of population 65 years or older, 1996 (%)	14.6	15.7	15.1	10.7	15.7	10.9
Proportion of urban population, 1996 (%)	51.5	52.4	42.5	93.1	87.4	92.7
Proportion of Aboriginal population, 1996 (%)	1.9	1.8	0.7	0.6	1	0.4
Proportion of immigrants arriving from 1981 to 1996 (%)	22.3	19.6	15.3	37.5	19.8	26

Source: Statistics Canada, Health Indicators (82-221-XIE): Volume 2000, No. 1 (December 2000)

Table 1.6: Summary of Research Utilization Issues for Public Health Units

Issue or Theme	**Case**					
	1	**2**	**3**	**4**	**5**	**6**
Interview prompted reading of report	x	x	x			
Questioning validity of NPHS survey questions or design	x	x	x			
Unhappy about analysis at regional, not county, level	x		x			
Have conducted in-house research	x	x			x	
Apply for external funding for breast health programs	x	x			x	x
Pointed out that their programs are evidenced-based	x	x				x
Talked about why some decisions not based on evidence			x			
Facing information overload	x					
Program staff is overworked	x	x	x			
Tension between local needs and Core Guidelines	x		x			
Tension between availability of OBSP sites, physicians and Core Guidelines					x	x
Tension between split in public health funding between province and municipality		x				
Work with other local health breast coalitions	x	x	x	x	x	x
See the report as a useful resource for local data (for future presentations, media communications, strategic planning)			x	x	x	x
Expected to use the report for information sharing with other breast health groups		x		x		
(Neutral) Comments about findings in the report	x	x	x	x	x	x
Positive comments about report		x	x	x	x	x

Negative comments about report	x	x	x		x	
Report did not provide a lot of new information		x	x		x	
Comments about format	x			x	x	x
Report used to confirm current materials and activities		x	x	x	x	x
Report discussed by breast health team					x	

Table 1.7: Feedback on *Breast Cancer Screening Practices in Ontario* draft report

No.	COMMENT	RESULT IN FINAL DRAFT
1	Research Literature: -needle aspirate instead of nipple aspirate?	- changed to needle
2	Research Literature: -having a mother or sister with a history of breast cancer is cited as both a risk factor and having a moderate association. Does it depend on woman's age?	- change not made
3	Research Literature: - re: a 40% drop in mortality due to breast cancer after a 5 year period – shouldn't it be a 30% in mortality?	- changed to 20-40% drop in mortality due to regular screening over a five year period
4	Analysis: - currently regular drinker is defined by NPHS as one drink per month - re-run analysis using 15+ drinks per month as cut off	- change made
5	Framing: - change title from "Breast Cancer Prevention Practices in Ontario" to "Breast Cancer Early Detection Practices in Ontario"	- change made
6	Framing: -move screening issue in preamble	- change made
7	Framing: -change screening guideline reference from Canadian Task Force to the Canadian Cancer Society & OBSP	- change made
8	Editing (in background): - p. 1, "increasing" age - p. 2, add "at this time" - p. 2, change to "early detection is the best defence against breast cancer" - p. 2, change to "regular" - p. 3, has "50" screening cites - p. 2, add "quality assurance" - p. 3, change to "mammogram"	- changes made
9	Editing (in background): - p. 1, underline established and moderate	- change not made
10	Framing: - p. 2, wording of referral to OBSP site versus referral by a physician	- change made

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CHAPTER APPENDIX A

CASE MATERIAL DATA SET

	Reference
Case 1	
Group Interview	1.1
Summary of Main Points	1.2
Community Health Status Report, Dec. 1994	1.3
Community Health Status Report, July 1996	1.4
Community Health Status Report, Feb. 1999	1.5
Community Health Status Report, Dec. 2000	1.6
Annual Report, 1998	1.7
Annual Report, 1999	1.8
Correspondence Notes	1.9
Sampling Survey	1.10
Interview with Director	1.11
Case 2	
Interview Transcript	2.1
Summary of Main Points	2.2
Interview with Director	2.3
Update for Physicians Newsletter, Sept. 2000	2.4
Health Unit Bulletin, Sept. 2000	2.5
Health Unit Bulletin, Winter 1999	2.6
Health Unit Bulletin, Summer/Fall 1999	2.7
Health Unit Bulletin, Fall 1998	2.8
Health Unit Bulletin, June 1998	2.9
Information Pamphlet	2.10
Demographic Profile, 1996	2.11
Organizational Chart, Feb 1999	2.12
Correspondence Notes	2.13
Sampling Survey	2.14

Case 3

Case 4

Case 5

Case 6

Other Material

CHAPTER SIX: CONCLUSIONS

The research transfer field has accumulated a mass of knowledge about effective ways to disseminate research findings. Recently there has been an interest in "interactive processes" as a research implementation strategy. To pursue this line of inquiry, this study asked whether user involvement in the research process lead to greater research utilization within public health units. The data generated from this multiple case study demonstrated that involvement was advantageous on certain fronts, but less helpful for other desired outcomes. Specifically:

1) Involved Healthy Lifestyles teams gained a better understanding of the research process than did uninvolved teams.

2) As a result, involved Healthy Lifestyles teams were more aware of the limitations associated with the research findings.

3) Involved Healthy Lifestyles teams were more likely to have received and read the research report than uninvolved teams.

4) Involved Healthy Lifestyles teams attached greater value to the research report than did the uninvolved teams.

5) Greater information processing, by way of voicing expectations for future use, occurred among the involved Healthy Lifestyles teams in comparison with the uninvolved teams.

6) There was little difference in the ways in which the two teams applied the research report to their professional activities.

With respect to the last conclusion, the Cases used the research in a way that was not described elsewhere in the literature. They used the report for *confirmation purposes* – to confirm that their breast health program activities were in-line with current research findings, and to confirm that their community's breast health practices (e.g., clinical breast examinations, breast self-examinations and mammography screening uptake) were comparable with other health regions.

This study also demonstrated that involvement was associated with two kinds of outcomes: those associated with the process of being involved, and those associated with the actual utilization of the research report.

These results were situated in a contextual setting which had included organizational and financial uncertainty and change over the previous few years. Within these circumstances, public health officials slowly have been introducing the concept of research-based public health practices through province-wide guidelines for service delivery. At the grassroots level, public health workers, through their roles as community-based nurses, identified a tension between local needs and provincially-mandated services. In the case of breast cancer detection, guidelines encourage public health workers to recruit women to Ontario Breast Screening Program screening sites. The favoured OBSP recruitment strategy, the Family Physician Model, requires further modification in order for public health units to more effectively contribute to the reduction in breast cancer mortality rates.

Summary of Original Contributions

The **existing knowledge base** on research utilization will benefit from this study. In particular,

> A) This study demonstrated that involvement, as one kind of interaction, increased some aspects of research utilization among selected public health staff teams in Ontario.

Furthermore, this study uncovered a new kind of research utilization that had not been described in the literature,

> B) This study revealed that research findings were used by Healthy Lifestyles teams in a "confirmation" fashion.
>
> B1) Research findings were used to confirm breast health program activities.
>
> B2) Research findings were used to confirm that breast health practices in the region were in-line with other regions' practices.

There were a number of **methodological advances** associated with this study. The case study design allowed the research question to be investigated in the foreground, whilst organizational and environmental elements remained visible in the background (i.e., they were not perceived as "noises" that interfered with the primary investigation). Thus,

> C) This study demonstrated that supporting a contextual perspective in a research transfer study led to a deeper appreciation of study insights.

Another methodological contribution of the current approach, to the study of research utilization, was the inclusion of Cases that were not involved in the production of research:

> D) Through the use of comparison groups, study outcomes were appropriately attributed within a case study design.

This research was designed to allow new kinds of research utilization to emerge, such as "confirmation." At the same time, research utilization was conceptualized in a way that allowed operational definitions to be used during the analysis:

> E) In this study, novel instances of research utilization were identified by users through an open-ended questioning process. These instances were analyzed systematically by conceptualizing research utilization as a three-stage process (reading, information processing and applying).

Future Research

Many issues were uncovered in this study that did not receive systematic attention. They represent areas of future investigation. For example, it was suggested that the interaction strategy might be effective in reconciling "top-down" and "bottom-up" differences in the planning and delivery of public health activities. The extent to which this is achievable, or whether grassroots concerns need to be incorporated by alternative means in research-based public health practices, requires further attention.

The interaction strategy explored here, involvement, represented current practice in the field. The study demonstrated that there was room for improvement for increased research transfer within public health. Future strategies could involve major changes within public health units, such as the incorporation of a "knowledge broker" in the working environment (the role of a knowledge broker would be to help public health workers locate and apply relevant research findings to their professional activities). Or again, more incremental research implementation strategies could be used. The identification and effectiveness of future strategies require systematic evaluation.

A related line of inquiry would involve defining the twofold goals of an interactive process for research utilization. These include process goals, as well as outcomes related to the uptake of research findings. This inquiry needs to be supported by corresponding theoretical works.

The role of the disseminator needs to be better understood. This role could be taken on by many: the researcher, the user or a third party. Disseminators bring unique motivations and goals, which might affect the way in which research findings are communicated and utilized. Previous work has focussed on issues of credibility, commitment, scope of authority, attitudes and beliefs related to the researcher (see Table 1.1). Similar issues apply to the disseminator, with a particular emphasis required on understanding how the motivations of the disseminator might affect interactive processes.

REGIONAL AND INDIVIDUAL EXPLANATIONS OF MAMMOGRAPHY UPTAKE

CHAPTER SEVEN: INTRODUCTION

The knowledge gained from health research might be richer, or more informative, if a contextual perspective were incorporated into the research design. In this second dissertation study, the case of mammography uptake was used to explore the ways in which contextual characteristics influence individual outcomes. This line of inquiry is rarely pursued in the mammography screening literature, perhaps owing to the methodological challenges it presents: an appropriate context must be decided upon, information from the context needs to be collected, corresponding information from women must also be collected, and the data analyzed – such that proper inferences can be made at both the contextual and individual levels. These challenges were met in this study, resulting in research findings that were especially policy-relevant for jurisdictions, like Ontario, with organized breast cancer screening programs.

Development of The Research Problem

Breast Cancer and Early Detection

Cancer continues to be the leading cause of death in Canadian women, followed closely by diseases of the heart (Statistics Canada 2000). Among the cancers, breast cancer is the second largest cause of mortality; the age-standardized mortality rates for 1997 reveal that 28 deaths per 100,000 were due to breast cancer. In comparison, lung cancer, the leading cause of cancer mortality, was attributed to 33 deaths per 100,000 females (Statistics Canada 2000). Overall, mortality due to breast cancer has been slowly decreasing throughout North America (Health Canada 1999), a direction that might be attributable to improved early detection methods and subsequent treatment. Within this trend, incidence rates for women over 50 years have been increasing (Health Canada 1999). It was estimated that 18,700 new cases of breast cancer would be diagnosed in 1999, and in the same year 5,400 women would die of the disease (Health Canada 1999).

Earlier diagnosis may promote a survival advantage by affecting the history of the disease and consequently postponing death due to breast cancer (Tubiana & Koscielny 1999). There is strong evidence from seven randomized controlled trials that mammography screening reduces mortality from breast cancer in women aged 50 - 69 years (Fletcher, Black, et al. 1993). It has been estimated that a 15 to 30% drop in mortality from breast cancer can be attributed to periodic mammography screening (Harris & Leininger 1995), although the value of screening for women less than 50 years and more than 69 years old has not yet been firmly established (Kelsey & Bernstein 1996). The effectiveness of breast self-examination and physical examination in reducing mortality has also not been conclusively determined (Kelsey & Bernstein 1996).

Underutilization of Screening Programs

At least twenty-two countries have established mass breast cancer screening programs to systematically recruit women and monitor outcomes (Paquette, Snider, et al. 2000). In Ontario, women can obtain a mammogram through a physician referral to a privately-managed screening site, or through self-referral to the Ontario Breast Screening Program. The OBSP has approximately 50 screening centres throughout the province and provides screening for women between 50 - 74 years of age (Cancer Care Ontario 1998). In addition to screening, the OBSP provides recruitment, clinical breast examination, instruction on breast self-examination, quality monitoring, two-year recall and follow-up services. The Program was established in 1990 (Cancer Care Ontario 1998).

It has been reported that the Ontario Breast Screening Program needs to screen 70% of women older than 50 years of age to achieve a 40% reduction in breast cancer mortality (McAuley, Rand, et al. 1997). The 1998/99 OBSP Annual Report describes the screening participation rate for Ontario women between 50 - 69 as 12% for the period between 1996 and 1997 (Cancer Care Ontario 1998). This rate varies, across the province, from 5.6% to 30%. It would seem that not enough women are being screened through the OBSP to achieve the desired levels of reduction in breast cancer mortality (Miller 2000). In all fairness, it may be too early to claim that reductions in breast cancer mortality will not be achieved, given that the program has only been in operation for about ten years (and participation data at the six years mark) (Paquette, Snider, et al. 2000). However, interim performance indicators have not been entirely convincing of future success (Miller 2000; Paquette, Snider, et al. 2000).

Who Does Not Attend Screening

Researchers have tried to understand why women do not attend screening, and studies have identified factors associated with greater mammography uptake. In a review of mammography utilization in the United States, Vernon and colleagues (Vernon, Laville, et al. 1990) reported that women with the risk factors of increased age, family history or personal history of breast cancer were not more likely to attend mammography screening than other women. Across studies, women who engaged in other preventive health behaviors were likely to attend mammography screening. Socioeconomic status was also associated with screening participation. Other reviews and studies concurred with these results (Potter, Mauldin, et al. 1996; Segnan 1997; Zapka, Stoddard, et al. 1989). In addition, they demonstrated underutilization by women who were either under-insured, from certain ethnic groups, or who lived in a rural area. Recent Canadian studies conformed with these U.S. trends (Gentleman & Lee 1997; Maxwell, Kozak, et al. 1997; Mercer & Goel 1997; Potvin, Camirand, et al. 1995; Snider, Beauvais, et al. 1996).

In turn, interventions to increase mammography screening have focussed on encouraging hard-to-reach women to participate. Interventions include such things as the provision of transportation to screening sties or language translation of educational material. To date, however, no "magic bullet" has proven to be substantially effective, i.e., achieving a 70% compliance rate. To illustrate, the Family Physician Model strategy (McAuley, Rand, et al. 1997) of recruiting women is gaining favour in Ontario. Findings from a pilot study, based in Central West Ontario, indicated however, that only that 54% of eligible women obtained a mammogram as a result of the strategy (McAuley, Rand, et al. 1997).

Addressing the Problem: The Research Questions

The explanations for screening underutilization can be characterized as correlates at the individual level. What is missing in the literature, however, is a research perspective that considers contextual influences on mammography utilization. Ureda (1993) argues that future success in cancer prevention will depend on changing behaviors, and "behavior must be explained in ecological terms. Methods must be used that capture and describe the richness of the community setting, not ones that strip it bare" (p.1126). A few studies have incorporated breast cancer incidence and/or mortality outcomes with contextual information (Dayal, Chiu, et al. 1984; Hakama, Hakulinen, et al. 1982; Selvin, Merrill, et al. 1998), but none take a contextual approach in understanding screening utilization.

The overall aim of this study was to bring a contextual perspective to understanding mammography utilization. One motivation for such an approach was outlined in the preface of this thesis: that health problems sometimes may be inadequately understood when they are reduced to subproblems isolated from contextual circumstances. A second motivation came from recent empirical works in other areas which have incorporated this contextualist perspective. These include studies on smoking (Duncan, Jones, et al. 1993; Duncan, Jones, et al. 1999), drinking (Duncan, Jones, et al. 1993), low birth weight (O'Campo, Xue, et al. 1997), cardiovascular disease (Diez-Roux, Nieto, et al. 1997; Diez-Roux, Link, et al. 2000), and health status (Robert 1998), to name a few.

In general, influences on outcomes are of interest when exposure to the influence differs among individuals. This leads to the presupposition that outcomes might also differ among individuals. For example, researchers are interested in *differences* in physical fitness among individuals, and how these differences lead to cardiovascular diseases. This line of reasoning can be extended to the interest in contextual influences on mammography uptake: that differences in contextual settings may have an influence on screening history. More formally stated, the first research question for this study is: **1) Does the lifetime prevalence of mammography utilization vary systematically by region of residence?** This question seeks to establish differences in the outcome. The second question is concerned with characterizing these differences: **2) To what extent do individual and contextual level variables explain regional variation in the utilization of mammography screening?**

The Multilevel Nature of the Problem

The desire to bring a contextual perspective to the issue of mammography screening required different levels of data. The dependent variable, mammography screening, was measured at the individual level. Previous research about mammography uptake mostly focussed on individual level variables; these needed to be incorporated into this study as well. Contextual level variables, as an aggregate measure or a broad-based characteristic, represented a different level of data. They are also referred to as macro properties, aggregate level variables, ecological level variables, community-level variables or group-level variables (Diez-Roux 1998; Firebaugh 1978).

The inclusion of both individual and contextual levels of data provided a more comprehensive understanding of mammography uptake. In addition to this substantive benefit, the use of both levels of data offered significant conceptual advantages for inference-making based on the study findings. These advantages include, in particular, guarding against the ecological and atomistic fallacies (Diez-Roux 1998).

Instead of including both levels of data, some studies are carried out at the ecological level. That is, contextual level data is used exclusively in the analysis. If the authors of such studies draw inferences from their findings to the same level from which the data was derived (i.e., the contextual level), they are safeguarded from the ecological fallacy. The fallacy, which was first demonstrated by the calculation of correlation coefficients at both levels, occurs when aggregate level relationships are assumed to hold true at the individual level (Dayal, Power, et al. 1982). In addition to mathematical explorations of the fallacy, others have argued that measurement at the individual-level is conceptually different than measurement at the aggregate level (Firebaugh 1978). Furthermore, by ignoring the effects of individual level predictors on contexts (i.e., assuming homogeneity among individuals (Sloggert & Joshi 1994)), some of these studies are also criticized on the grounds of committing the "sociologistic fallacy" (Diez-Roux 1998).

In contrast, interpretations of studies which focus exclusively on individual level independent and dependent variables are open to the atomistic fallacy (Diez-Roux 1998), which occurs when inferences from individual level data are generalized to the contextual level. Conceptually such studies are criticized for the "psychological fallacy" (Diez-Roux 1998) by ignoring the effect of context on individual level relationships.

These fallacies were avoided in the current study through the inclusion of multiple levels of data. The challenge to doing so, however, was using an appropriate analytical technique with which to handle the data.

Presentation of the Study

The next chapter, the Literature Synthesis, discusses the ways in which context has been incorporated in previous studies. In doing so, related conceptual and measurement issues are explored, as are the analytical techniques that have been used by other researchers. This synthesis served to inform the design of the current study.

Two frameworks are developed in the chapter that follows the Literature Synthesis. A conceptual framework integrated the individual and contextual level pathways to mammography uptake using Andersen and Newmans' model of health care utilization. An analytical framework is also presented, in which five steps and associated secondary research questions are specified to guide the detailed examination of the data.

The Methods chapter describes the particulars related to the analysis and data. This includes such things as a description of the data sources, the variables used, sampling issues and the hierarchical multilevel modelling technique. The choices within the study design were made in conjunction with the conceptual and analytical frameworks.

The findings from the five analytical steps are presented in the Results chapter. The implications of these findings are explored in the Discussion chapter; limitations to the study are also addressed at this point. A summary of the findings, directions for future research and original contributions of this study can be found in the Conclusions chapter.

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CHAPTER EIGHT: SYNTHESIS OF CONTEXT-SENSITIVE STUDIES

The goal of this study was to apply a contextual perspective to the problem of mammography screening underutilization. To accomplish this, it was necessary to understand the various techniques available to analyze multilevel problems, as well as the unique measurement concerns related to contextual variables. As Jones and colleague describe (Jones, Moon, et al. 1991), at least three types of effects can be attributed to the contextual level: effects arising from the characteristics of the context, effects arising from the social profile related to the people in the context, and effects due to the interaction among people and contextual characteristics. These issues are highlighted in the following synthesis of the literature.

Search Strategy and Selection

Four keywords were used to conduct a text word search of computerized bibliographic databases (Medline (1975-2000), HealthStar (1975-2000), Dissertation Abstracts (1996-2000), Sociofile (1975-2000)): "contextual" or "ecological" or "aggregate" or "multilevel modeling." This strategy proved to be limited. Personal files and files of other researchers, a more fruitful strategy, resulted in an initial collection of approximately eighty articles.

Articles were included in the synthesis if they conformed with the following selection criteria: 1) the dependent variable referred to a health-related outcome or behavior, 2) the dependent variable was measured at the level of the individual, and 3) the independent variables included a combination of individual and contextual level variables. The references of all selected articles were reviewed for additional articles.

The Ways in Which Context Is Incorporated Into Health-Related Studies

Defining and Measuring Context

A common thread among all the studies was the use of a geographic area as the contextual unit. Most studies use national census data to define contextual areas and/or characteristics of the context (e.g., Kleinschmidt, Hills, et al. 1995; Waitzman & Smith 1998). As Duncan, Connell and Klebanov discuss (quoted in Robert 1998), census data are associated with minor sampling errors and are therefore attractive as a source of contextual level information. Census data also represent a reliable and feasible method of obtaining contextual information.

Other researchers, especially those who define context as a neighborhood, developed their own instruments to collect information. Aneshensel and Sucoff (1996), for example, used cluster analysis to define neighborhoods based on socioeconomic status and race/ethnicity. They conducted in-depth interviews with selected respondents to obtain perceptions about the ambient hazards and social cohesion in the neighborhood. Collecting valid information directly from members of a context like this requires an enormous amount of resources. On the other hand, some researchers suggest that more meaningful constructs of context are obtained, where individual norms and behaviors can be more confidently attributed to social cultures (MacIntyre, MacIver, et al. 1993; Robert 1998). Furthermore, the target for subsequent interventions is more clearly pinpointed than from study findings based on census boundaries.

Diehr and colleagues (Diehr, Koepsell, et al. 1993) took an interesting approach when defining contextual characteristics. They presupposed that individual health behavior (i.e., smoking, drinking alcohol, wearing seatbelts and fat consumption) is affected by the number of community members engaging in similar behavior. Consequently, they used the community mean of each of these behaviors as an independent variable. To illustrate, they used the average value of alcohol intake in the community to explain individual alcohol intake behavior; the authors found that these variables had highly significant explanatory power (as did other community level variables). While theoretically interesting, generally this approach would result in spurious correlations among the independent and dependent variables (in this study the authors split the sample in half, and used half the data to calculate the mean value, thereby avoiding the artefactual correlation problem) (Diehr, Koepsell, et al. 1993).

In general, however, there is little known about the actual mechanisms relating individuals' interactions with their communities – that a better description of place, rather than space, is required (Mitchell, Gleave, et al. 2000). Mitchell et al (Mitchell, Gleave, et al. 2000) note that people have different "propensities to draw influence from their area" (p.67). They attempt to advance this idea of differing meanings of a place for people by studying attitudes around membership in the community (individual level variable), and the extent of deindustrialization of an area (contextual level variable) on health. They found that deindustrialization had an independent influence on physical health, as did attitude. In contrast to what was expected, one's attitude toward the community did not modify the influence of deindustrialization on health. Further studies are required to explain people and place interactions.

One of the current issues of interest in the multilevel research literature is the extent to which the estimated effects on outcomes are dependent upon the level at which context is defined. For example, Blaxter (1990) found that the characteristics of the neighborhood had stronger associations with health than did larger regional characteristics. Some researchers maintain that most contextual effects can be explained by individual level correlates because contextual effects are simply a result of model misspecification (Robert 1998). Others warn against "explaining away" contextual effects with too many individual level variables (Robert 1998).

Soobader and LeClere (1999) confronted the issue when they suggested a priori that income inequality had different effects on health outcomes depending on the level of context. At the county level, their conceptual framework suggested that the role of income inequality was to segregate people, and related public goods and services (e.g., "places and people"). At the smaller, census tract level, however, they predicted that income inequality was manifested *through* individual social class (e.g., "people"). This suggested that at the census level, income inequality would be absorbed by individual socioeconomic status and not demonstrate a strong, independent contextual effect on outcomes. On the other hand, differences in morbidity due to income inequality would be more significant using counties as the contextual level. Their empirical findings supported their premises and they concluded that the level of aggregation reflects the mechanisms by which income inequality is manifested.

Some studies appear to focus on individual and contextual level influences but closer inspection reveals that contextual level variables were used as a substitute for individual level data. For instance, Smith and colleagues (Davey Smith, Neaton, et al. 1996; Davey Smith, Wentworth, et al. 1996) analyzed socioeconomic differences in mortality among the Multiple Risk Factor Intervention Trial (MRFIT) participants. Because individual level income information was unavailable, the researchers used median family income of the zip code area along with various individually-measured health characteristics (e.g., blood pressure) to explain mortality. They were not clear, however, about how they conceptualized median family income as they discuss its benefits both as an individual and contextual level measure. The authors risk the atomistic fallacy if they conceptualize the data as from the individual level but then generalize their study findings as a characteristic of the community.

Geronimus (1996), on the other hand, used an individual level measure of maternal age to represent a contextual characteristic. Specifically, she theorized that social inequality and racial discrimination are manifested through maternal age in the

African American population. Instead of using a contextual measure, maternal age was used as an indicator of social and environmental conditions.

These latter two studies illustrate the heightened tension between theoretical interest and data availability in multilevel research. Individual and contextual level pathways to the health outcome need to be identified, and data corresponding to these pathways need to be secured. Furthermore, the two levels of data need to be related to each other, temporally and spatially. Often data are unavailable at one level and a substitution is used. In doing so, the researcher needs to consider if this substitution results in a confounding effect. Confounding effects are usually ruled out by comparing statistical models with and without the suspect variable (Firebaugh 1978). In the case of data unavailability, the potentially biased effect estimate must be evaluated through other means (e.g., on theoretical grounds).

Analytical Approaches

Tabulation Approaches

The tabulation or stratifying approach is one technique that has been used to explore multilevel relationships (Birch, Jerret, et al. 1997; Blaxter 1990; Hayward, Pienta, et al. 1997). It requires that the researcher conduct separate analyses (e.g., individual level regression models) for each context, and then compare results across contexts. This can be used as a preliminary technique for understanding one's data set and to establish variations by context. Handling the levels of data this way helps guard against committing the ecological and atomistic fallacies.

Blaxter (1990), for example, used a national survey to compare standardized ratios of various health conditions (i.e., illness, psychosocial health, fitness, disease/disability) for different social classes across Britain. Overall, she confirmed the finding that people in lower social classes experience poorer health. More significantly, she concluded that health and healthy lifestyles were associated with higher socioeconomic areas. Conceptually, Blaxter deliberately took a contextual perspective to understanding health.

Contexts can be defined on the basis of natural geographical boundaries. Doing so in a tabulation analysis, however, can miss the heterogenities associated with people and health. Blaxter's study was criticized on this account. To achieve reliable cell sizes she analyzed the data using (large) standard reporting regions. For increased sensitivity using tabulation techniques, researchers need to redefine contexts to represent types of contexts (e.g., upper class, racially mixed area versus upper class, racially homogeneous area). Fox and colleagues (Fox, Jones, et al. 1984) were interested in the influence of socioeconomic characteristics of areas, and that of individual characteristics, on mortality. They derived 36 clusters of wards based on 40 socioeconomic indicators, such as age of settlement and number of rooming houses. By creating more meaningful contextual areas their tabulation analysis provided a more detailed description of area differences on mortality.

As a general rule of thumb, the tabulation approach is only feasible when there are a manageable number of contexts (e.g., a reasonable number of communities). The approach can demonstrate differences among contexts, and then the significance of these differences can be tested empirically. The approach does not reveal whether an effect *due* to context is present, nor the strength of this effect. The approach also neglects the hierarchical nature of the data (more on this later).

Despite these problems, establishing variations by context is a useful first step in analyzing multilevel data. It can provide the impetus to seek explanations for any observed variations. Also, it also provides some insight about the appropriate specification of level of context. Contextual influences may be acting on health, but detrimental outcomes might be seemingly negated when aggregated to broader contextual levels (e.g., a region versus a province).

Single Level Regression Models

Single level regression modelling, in the form of ordinary least squares models, is the most common technique for analyzing multilevel data. To accomplish this, researchers run a series of models and compare the results. Usually the first model considers individual level variables; some are included as controls (e.g., age, sex) and others as variables of interest. Subsequent models may include dummy variables to represent various contexts (Diehr, Koepsell, et al. 1993), or may include variables that measure specific features of the context.

The Alameda County Study (Haan, Kaplan, et al. 1987), by Haan and colleagues, was one of the earliest studies to incorporate data from individual and contextual levels. The researchers examined effects on mortality after considering age, sex, race, physical health status, socioeconomic factors, health practices, social networks and psychologic factors. The contextual level variable was a binary measure reflecting whether the area qualified as a "poverty area residence" or not. Poverty areas were based on federal criteria, which included social and environmental characteristics. Possible confounding effects from individual level factors were ruled out after comparing results among different regression models (e.g., those with and without the individual level factors). The study found a higher risk of mortality associated with living in a poverty area compared to those in non-poverty areas.

Researchers may also seek to determine whether contextual variables modify the influence of individual level variables on outcomes (interaction effects) using single level regression models (Brooks-Gunn, Duncan, et al. 1993; Turner 1995). Turner (1995) did this when studying the effects of employment status, education and community level of unemployment on depression and physical health status. He found evidence of interaction effects between level of area unemployment and personal employment status on health outcomes.

One of the most noteworthy limitations of conducting an analysis of multilevel data with a single level regression model is the effect of clustering. People residing within a contextual area are more likely to demonstrate similar outcomes than their counterparts in another area. This clustering effect results in a loss of independence among measurements, thereby violating an assumption of regression modelling. If ignored, variance calculations can be underestimated, possibly leading to a Type I error (incorrectly rejecting the null hypothesis) when examining the regression results.

Some researchers using single level regression models explicitly mention and attempt to handle the clustering problem (Anderson, Sorlie, et al. 1996; O'Campo, Gielen, et al. 1995). Researchers have used statistical programs like SUDAAN to adjust for clustering in their data (Robert 1998; Soobader & LeClere 1999). Programs such as these estimate the amount of correlation within each cluster – within each contextual unit – and adjust the variances accordingly. Another way to address the clustering issue is to examine the intra-class correlation post-hoc (Kleinschmidt, Hills, et al. 1995). By doing so the extent of within-cluster homogeneity, and its possible effect on the results, can be assessed.

As another example, O'Campo and colleagues (O'Campo, Gielen, et al. 1995) used both a standard logistic regression model and a model that used estimation methods of the generalized estimating equation to examine the determinants of male-initiated domestic violence. The latter model was used to compensate for clustering. Differences between the two models lend further support for using a more robust technique.

In addition to clustering, combining contextual and individual level information in a single regression model can lead to problems of multicollinearity, or linear relationships among variables. Consequently the affected variables are accompanied by inflated variances. Using an index (e.g., a deprivation index) to measure contextual characteristics avoids this problem (see Haan, Kaplan, et al. 1987; Sloggert & Joshi 1994; Waitzman & Smith 1998), but such composite measures make it difficult to untangle the effect of specific mechanisms on outcomes.

Cox Proportional Hazards Models

Some authors have used Cox proportional hazards models to study mortality outcomes using individual and contextual levels of data (Anderson, Sorlie, et al. 1996; Hayward, Pienta, et al. 1997; LeClere, Rogers, et al. 1997). Hayward et al (Hayward, Pienta, et al. 1997) chose to supplement their hazards model of individual socioeconomic status and urban/rural contexts with a tabulation analysis. They reexamined their models using urban, suburban and rural strata, underlining the point that traditional analyses provide limited information about the heterogeneity of outcomes within the study population.

Two-Level Regression Models

Other researchers have used two-step regression models to examine individual and community level data (O'Campo, Xue, et al. 1997). To accomplish this, an individual level model for each context is produced in the first step. The intercepts and coefficients from this step are then regressed on contextual level variables in the next step. This technique allows the researcher to determine the overall significance of the two levels, and allows individual and contextual correlates to be considered in the analysis.

For example, O'Campo and colleagues (O'Campo, Xue, et al. 1997) studied the influence of individual and neighborhood factors on low birth weight. They found that all of the individual level variables, in their relationship with the outcome, were differentially affected by type of neighborhood (e.g., cross-level interactions). In this type of situation, the benefits of individually-focused interventions might be overstated unless neighborhoods are taken into account.

The issue with this method is that the assumptions for the first analytical step do not hold for the second (Hox & Kreft 1994). In the first step, the beta coefficients are considered fixed, which means that inferences can only be made to the context included in each separate analysis. In the second step, however, the coefficients are considered random variables. This means that now the contexts comprise a sample from the populations of contexts and inferences are made about this population. The assumption in each step is different, theoretically leading to different error structures in each case. Consequently results from significance testing based on these standard errors can be upwardly biased (Hox & Kreft 1994).

Hierarchical Multilevel Modeling

Hierarchical multilevel modelling (MLM) offers several features with which to investigate grouped data, and is the technique used in this thesis study. The approach is an extension of regression modelling, in which two levels of data (or more) are modelled simultaneously but separately. In this way the influences at both levels – individual and contextual – on health outcomes can be compared. In addition, making inferences with the use of a multilevel model avoids the ecological and atomistic fallacies.

The treatment of the residuals, or error terms in MLM provides additional information to the researcher. MLM supports detailed analysis of the heterogeneity or variation among contexts, in contrast to traditional regression techniques which rely on an average measure of the remaining variation for information. For the current thesis study, the extent to which the overall model of mammography uptake is different from region to region can be described.

MLM is similar to the two-step regression technique described in the previous section. Computationally, however, MLM is statistically more efficient in determining regression coefficients. MLM software has only been recently available due to the increased processing capabilities associated with modern personal computers. Thus, the published studies over these last ten years can be considered initial attempts to match research problems involving multilevel data with the advantages of MLM software.

Within the health field, these studies have examined a number of different topic areas. The outcomes of interest range from health status (Duncan, Jones, et al. 1996; Humphreys & Carr-Hill 1991; Mitchell, Gleave, et al. 2000), to cardiovascular disease (Diez-Roux, Nieto, et al. 1997), to risk factors for diseases(Diez-Roux, Link, et al. 2000; Diez-Roux, Nieto, et al. 1997), and to chronic illness (Humphreys & Carr-Hill 1991; Jones & Duncan 1995;). Other researchers were interested in health-related behaviours, such as smoking (Duncan, Jones, et al. 1993; Kleinschmidt, Hills, et al. 1995; Duncan, Jones, et al. 1999; Diez-Roux, Link, et al. 2000; Diez-Roux, Nieto, et al. 1997), or drinking (Duncan, Jones, et al. 1993; Ecob & Macintyre 2000). Health prevention practices, such as immunization (Jones & Moon 1990; Jones, Moon, et al. 1991), have also been investigated, as has utilization of general practitioners (Carr-Hill, Rice, et al. 1996). The majority of these studies employ two level models – individuals at level one, and contexts at level two. Some explore three levels, where individuals might be nested into neighbourhoods which are then nested into larger regions (Duncan, Jones, et al. 1996; Duncan, Jones, et al. 1993; Jones & Duncan 1995; Duncan, Jones, et al. 1999). Other kinds of more complex designs have been discussed in the literature, such as cross-classified designs (where individuals belong to more than one context, such as school and place of worship, where the contexts are not nested), but their empirical application is less common.

To begin, one might ask whether MLM is required for all cases of clustered data. Kleinschmidt and colleagues (Kleinschmidt, Hills, et al. 1995) set out to compare the differences in results on smoking behaviour between a single level regression model and a two-level hierarchical multilevel model. Their results were similar under both models. They concluded that the single level model may be acceptable for their analysis, which employed census tracts. Smaller geographic areas, however, may demonstrate greater homogeneity within areas, therefore necessitating the use of MLM due to the effects of clustering.

MLM allows the modelling of separate and joint effects of individual and contextual pathways. Although the software was developed to handle multilevel problems, the capabilities of the software have also advanced the conceptualization of the problem. Variations in outcomes using traditional analyses suggested that contexts had different effects among populations. But MLM also allows one to determine if contextual effects are different *within* a population in the production of health outcomes. For example, do the wealthy have a health advantage over their poorer neighbours in a rich neighbourhood? Are opportunities and resources presented (or used) differently within the same neighbourhood? In turn, these questions encourage discussion about appropriate policy goals and interventions. Eliminating differences among regions might be achieved at a cost; within a region, only some might benefit.

The measurement of the dependent variable has received attention among MLM researchers. Specifically, researchers have explored whether behaviours measured in a binary fashion – "present" or "absent" – demonstrate different empirical relationships than when measured in terms of intensity or exposure. Multilevel modeling permits the modeling of these two effects separately. To illustrate, Duncan et al (Duncan, Jones, et al. 1996) labeled individuals as either smokers (1) or non-smokers (0), and then assigned each smoker a continuous measure of number of cigarettes per week. Thus, intensity is nested within the presence or absence of a behaviour. After controlling for individual characteristics, the authors found the presence of area variation in the behaviour, but not with respect to intensity. Ecob and Macintyre found similar results in the relationship between smoking and area deprivation (Ecob & Macintyre 2000). On the other hand, they did not find area variations, or relationships with deprivation, in either drinking or amount of drinking. These studies demonstrate that MLM facilitates the modelling of different dimensions of behaviour.

The MLM software is in a state of active development. Consequently, readers of the literature may need to determine if results from studies are comparable or generalizable on technical grounds. For example, improved estimation procedures for multilevel logistic models became available as part of the standard Mln software around 1995. Even at that point, some researchers hesitated to identify particular contexts as "high" or "low" because it was demonstrated that higher level random terms could be seriously underestimated (e.g., see Duncan, Jones, et al. 1999); researchers preferred to confirm between-context variability without naming the most successful or problematic neighbourhood. Updated versions of the software were released periodically, and estimation procedures continued to become more precise and more stable. The most recent versions of MLWin (the Windows version of Mln) now include bootstrapping macros to improve cases with large variance estimates.

MLM can provide a detailed description of the influences on health. Unlike most other quantitative techniques, this analysis can provide information about the heterogeneity of empirical relationships among and within contexts. MLM remains a descriptive technique, however, which means that *explanations* for social behaviours and structures still need to be understood using other methods.

What Context-Sensitive Studies Reveal

Variation versus Effect

There is a body of literature that explores area variations in health status or health outcomes. For example, Lynch and colleagues demonstrated that those US metropolitan areas that have a greater income inequality between the rich and poor are associated with higher mortality rates (Lynch, Kaplan, et al. 1998). In these studies, contextual or ecological measures of an area are used as independent variables. Average measures of health outcomes for an area represent the dependent variable. The findings are limited by the ecological fallacy and can only be generalized to the area as a whole, not the people in the area. These types of studies are useful for identifying potential health-related problems and targets for intervention. They do not, however, represent a multilevel research problem because the dependent variable is an area measure, not an individual level measure. As such, the information about area variation is not related to the individual, making these studies unhelpful for the thesis study research questions.

When confronted with a multilevel research problem, most researchers start their analysis by trying to explain outcomes using contextual variables. Other researchers, in contrast, deliberately establish variations in the health outcomes of interest before moving on to explain this variation (Birch, Stoddart, et al. 1998; Diehr, Koepsell, et al. 1993; Hayward, Pienta, et al. 1997). For example, Diehr and colleagues (Diehr, Koepsell, et al. 1993) first determined whether there were significant differences in average levels of health behaviours by community, and then continued with the main part of their analysis.

By doing this, researchers, like Diehr, highlight the difference between *variations* by area and *effects* by area. These conceptual distinctions are especially important when trying to understand the multilevel pathways to health behaviours, and then appropriately addressing these pathways analytically. The presence of contextual variations *per se* does not in itself establish the presence of contextual effects. Variations in outcomes among communities might depend less on the nature of the community, and more on the concentration of people in the community. Not all researchers make this distinction in the literature.

The Problem of Composition

An analysis may initially reveal an association among contextual characteristics and the outcome under study. This association, however, may be due to the social profile of individuals living in one area rather than an independent effect derived from the area itself. Composition effects, as they are known, are related to individuals and therefore may artificially inflate or deflate the importance of context.

Often studies neglect to consider composition. In some studies, lack of data may restrict this kind of investigation (Kleinschmidt, Hills, et al. 1995; Turner 1995). In contrast, Diehr and colleagues (Diehr, Koepsell, et al. 1993) explicitly took account of the communities' social profile when trying to detect community influences on health behaviours. While they continued to find significant community effects after adjusting for individual characteristics, most of the variation was attributed to composition. Other studies also found small associations among contextual variables and outcomes after considering composition (Brooks-Gunn, Duncan, et al. 1993; Fox, Jones, et al. 1984; LeClere, Rogers, et al. 1997; Sloggert & Joshi 1994).

Compositional effects might be considered a nuisance in multilevel research as they require additional consideration in the analysis. Failure to take composition into account can inflate or deflate the relationship between area effects and outcomes. For example, Robert (1998) examined whether community socioeconomic status influenced three health measures, after controlling for individual and family socioeconomic status. She used a single level regression analysis and Sudaan software to handle the clustering in the data. Various combinations of the three health measures (chronic conditions, self-rated health, functional limitations) and the four measures of community socioeconomic status demonstrated an association with each other. These effects were small, however, and might be still due to the social profile of community members, as only age, sex and race were included in the analysis. Other considerations (related to the outcome) could have included marital status, residence type (urban or rural) or a lifestyle variable such as proportion of smokers.

From a policy perspective, however, the detection of compositional effects is just as valuable as the detection of effects due to the characteristics of the contexts. Such information might be helpful for those decision-makers faced with the problem of allocating resources between individuals or communities. When allocating resources among communities, the influence of composition may actually hide need, or performance. For example, Jones and Moon (1990) compared crude aggregate rates of immunization uptake by general practices with those determined by MLM. They displayed their results by ranking the various practices, thereby demonstrating that the type of people in a practice catchment area influences the immunization outcomes. They argued that in fact many practices might be doing well given their catchment area, despite their seemingly low outcomes. Thus, by adjusting for differences due to populations, multilevel modelling provided more comparable measures of outcomes.

Detecting Contextual and Individual Level Effects

Researchers are starting to move beyond simply detecting overall community effects, as represented by dummy variables in regression equations. Instead, they are trying to identify specific characteristics about the community that might have an influence on community members. Waitzman and Smith (1998), for example, indicated whether study participants lived in poverty areas or not, while conceding that more detailed characteristics would be informative. Furthermore, approaches such as this one (Haan, Kaplan, et al. 1987; Sloggert & Joshi 1994) focus on the extreme end of a continuous measure. Ecob and MacIntyre (2000) investigated whether extreme ends of measures produced different results; they analyzed diet as ‘good’ or ‘bad’, and they analyzed physical activity as ‘good’ or ‘bad’ when examining area deprivation and health behaviours. Their MLM study demonstrated that significant results in terms of overall relationships and area variations differed depending on which measure was used. For example, only ‘bad’, not ‘good’, exercise patterns were related to area deprivation.

Often attempts to determine the effects of the context are data driven rather than theory driven, leading to the testing of numerous variables. For example, a couple of studies tested about 35 characteristics of a neighborhood, without any discussion of implications for Type I errors (Brooks-Gunn, Duncan, et al. 1993; Colby Jr, Linksy, et al. 1994).

Although the studies considered in this literature synthesis vary in subject matter, tentative generalizations about the effects of context on health behaviour are offered as a backdrop for the current study. These generalizations are based on studies using hierarchical multilevel modeling techniques, which are deemed by this author to be more rigorous than other techniques. MLM studies are described in Table 2.1. This set of studies demonstrated that most contextual effects were explained by the social profile of individuals. If significant contextual effects were found after considering composition, they were small in magnitude (i.e., they accounted for less than approximately 10% of the variation in the dependent variable).

Multiple pathways to health outcomes have been suggested at the conceptual level. But analytical techniques which produce only overall average effects, as single level regression does, mask the different ways by which health care or health behaviour is influenced. Contextual effects might arise from the characteristics of the context, the composition of the people in the context, or from the interaction among people and contextual characteristics (Jones, Moon, et al. 1991). Only by using appropriate techniques can each of these types of influences be detected in the case of mammography screening.

Table 2.1: Studies Using Hierarchical Multilevel Modelling

STUDY	INDEPENDENT VARIABLES		DEPENDENT VARIABLES	FINDINGS
	Contextual level	**Individual level**		
Beland et al, 1999	Clusters based on population characteristics (demographics & SES) and boundaries	-sources of stress -social support -psychological factors - socioeconomic status -demographic	-chronic illness -functional disability -perceived health -feeling of well-being	- in general, indicators of stress and health outcomes demonstrated some area variation - variations due to communities were small when compared to variations due to individuals - cross-level interactions between well-being and satisfaction with social relations detected
Beland et al, 2001	Clusters (as above) - level of unemployment - gender distribution - age group distribution - education - proportion of the population that is immigrants - family structure - income - employment status - occupational status	- employment status - sources of stress - socioeconomic status - social support - psychological factors	-perceived health status	- level of unemployment and health relationship did not vary among contexts - stress and health relationship did vary among contexts, and this relationship was influenced by area-level economic well-being

STUDY	INDEPENDENT VARIABLES		DEPENDENT VARIABLES	FINDINGS
	Contextual level	**Individual level**		
Carr-Hill et al, 1996	Ward: -housing tenure -social class -unemployment status -permanent sickness -student status -car ownership -single career households -dependent children -elderly living alone -overcrowding -education -longstanding illness -rural/urban -access to healthcare	-change in employment status -health status -sociodemographic	-consultation rates in general practice	-small contextual effect found -individual effects stronger
Diez-Roux et al, 1997	Census-block groups: -education -income -house value -occupation	-social class	-prevalence and risk factors for coronary heart disease	-small neighbourhood effects, sometimes not significant but consistent across various dependent variables -interaction effect demonstrated only for one neighbourhood (men only)
Diez-Roux et al, 2000	State level: - 3 indices of income inequality	-income	-cardiovascular disease risk factors: BMI, hypertension, sedentarism, smoking	-contextual income inequality associated with three of four dependent variables, especially at low levels of individual income -the remaining variable, smoking, demonstrated an association with income inequality at higher levels of individual income -significant effect found only in women

STUDY	INDEPENDENT VARIABLES		DEPENDENT VARIABLES	FINDINGS
	Contextual level	**Individual level**		
Duncan et al, 1993	Region Ward	-demographic -socioeconomic	-smoking behaviour -alcohol consumption	-very small effects for smoking, a little higher for drinking -contextual effects were mostly compositional
Duncan et al, 1996	Ward Individuals	-demographic -social class	-smoking status -smoking behaviour (consumption rates)	- most variation in consumption due to individuals - after considering composition, smoking status varies by ward - wards with high number of smokers also demonstrate high levels of average consumption
Duncan et al, 1999	Region level Electoral ward level: - index of deprivation	-demographics -social class -housing tenure -employment status -educational status -marital status	-smoking status -smoking behaviour (consumption rates)	-ward deprivation has an independent effect on individual smoking status and behaviour; model suggested that the effect is uniform across all regions -variation among wards could not be fully accounted for by ward level deprivation or composition

STUDY	INDEPENDENT VARIABLES		DEPENDENT VARIABLES	FINDINGS
	Contextual level	**Individual level**		
Ecob et al, 2000	Postcode sectors: - area deprivation	- good exercise habits - bad exercise habits - good diet habits - bad diet habits - occupational social class - education - household material deprivation - marital status - moved in last five years	-smoking status -smoking behaviour (consumption rates) -drinking status -drinking behaviour	- bad diet demonstrated variations by area, even after controlling for area deprivation - good and bad diet demonstrated independent relationship with area deprivation - bad exercise habits demonstrated independent relationship with area deprivation - smoking status demonstrated independent relationship with area deprivation - many cross-level interaction effects identified
Hart et al, 1997	Regional districts	- demographics - social class - housing tenure	- blood pressure - serum cholesterol - alcohol consumption - smoking	- most variation attributed to individuals - significant variation by district for blood pressure, cholesterol and alcohol after considering individual level variables
Humphreys et al, 1991	5 Clusters derived from ward-level information to differentiate rich from poor areas	-socioeconomic -health-related behaviours	-self-assessment of health -reporting of long-standing illness -score from a symptom list -respiratory function	-contextual effect demonstrated, but most of the effect due to individual characteristics -composition effects not examined

STUDY	INDEPENDENT VARIABLES		DEPENDENT VARIABLES	FINDINGS
	Contextual level	**Individual level**		
Jones et al, 1990	General medical practices	- previous death of an infant - mother smokes - housing tenure - stability of family - employment status - mother's age	- childhood immunization	- results demonstrated differences in the ranking of practice rates of immunization when using MLM versus using crude aggregate rates - the ranking of practice rates of immunization changed for some practices when patient composition was taken into account
Jones et al, 1991	General medical practices: - type of practice	-previous infant death in family -smoking mother -tenure -stability of parental relations -employment sector -mother's age	-childhood immunization	- most variation in the outcome attributed to individual level variables - a small amount of variation attributed to type of practice
Jones et al, 1995	Wards: -deprivation index -urban/rural Constituency: -household weekly income	-demographic -socioeconomic -health behaviour	-self-assessment of health -reported symptoms of heart disease, hbp and stroke -forced expiratory volume	- after controlling for individual level factors, places with high deprivation were associated with poorer health outcomes - after controlling for individual level factors, places with low income were associated with poorer health outcomes
Kleinschmidt et al, 1995	Wards: - deprivation index	-demographic	- smoking behaviour	- strong significant association between smoking deprivation of ward - cross-level interaction relationships not detected

STUDY	INDEPENDENT VARIABLES		DEPENDENT VARIABLES	FINDINGS
	Contextual level	**Individual level**		
Malmstrom et al, 2001	Neighbourhoods: -socioeconomic position	- demographic - social network - socioeconomic position	- long term illness - mortality	- long term illness associated with personal social position - long term illness associated with neighbourhood social position - mortality did not demonstrate a significant contextual
McKeehan, 2000	Census areas: - social inequality (income inequality, urban area poverty risks, mean level of alcohol consumption)	- demographics - personal health habits - social cohesion - social support - social networks	- physical health	- after controlling for individual level factors, social inequality demonstrated an effect on health
Mitchell et al, 2000	-Wards: - level of deindustrialization	-demographic -social class -work status -attitude to the community	- index of health derived from perceived symptoms	- deindustrialization had an independent effect on health - attitude to community had an independent effect on health - no interaction effect between the two
Soobader et al, 1999	Census counties: -income inequality -median household income -percent in poverty Census tracts: -income inequality -median household income -percent in poverty	-income-to-needs ratio -education -occupation	-perceived health	-when county level is used as the level of aggregation, contextual effect found -a reduced effect found when tract level is used as the level of aggregation (individual-level effect is dominant)

STUDY	INDEPENDENT VARIABLES		DEPENDENT VARIABLES	FINDINGS
	Contextual level	**Individual level**		
Subramanian et al, 2001	States: - per capita median income - Gini coefficient - mistrust	- demographics - income - health care coverage - smoking habit - marital status - health checkup last year	-health perceived health	- significant variation among states after controlling for individual factors - heterogeneity in health by state for different income groups - mistrust and per-capita income area effects found

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CHAPTER NINE: CONCEPTUAL AND ANALYTICAL FRAMEWORKS

In the introduction to this study it was reported that not enough women were being screened through the Ontario Breast Screening Program to achieve the subsequent desired levels of reduction in breast cancer mortality. As a result of low screening rates here and elsewhere, research has been focussed on uncovering individual level factors associated with mammography screening uptake. Consequently, efforts to recruit women to mammography sites rely mostly on individually based interventions. The traditional narrow focus might miss a potentially important pathway in understanding the determinants of mammography screening. Two frameworks are presented in this chapter. In the first, a conceptual framework describes the multiple pathways by which mammography uptake might be influenced. The second chapter details the analytical framework used to investigate these pathways.

Conceptual Framework for Study

In 1973, Andersen and Newman published a framework describing the utilization of health care services as a function of individual and societal determinants. The major explanatory themes for mammography uptake were selected from the literature and presented within this framework. Specific variables for this study are described in Chapter Ten.

Individual Level Pathway

Andersen and Newmans' (1973) framework suggests that the individual level pathway of mammography utilization is determined by three components: 1) a woman's predisposition to obtaining screening, 2) her ability to secure services (enabling component) and 3) her need level.

Predisposing elements refer to such things as demographics, social structures and beliefs (Andersen & Newman 1973). Those with particular predisposing elements are more likely to use health care services, "even though the characteristics in themselves are not directly responsible for utilization" (p. 108). Social structure variables indicate a woman's position in society, and may reflect particular lifestyle patterns. Beliefs about the health care system, and about health, serve to capture individual values as an influence on utilization.

Previous research about the utilization of mammography services offers numerous predisposing factors associated with greater uptake. These include factors such as: being of higher socioeconomic status as measured by levels of education and type of employment (Mercer & Goel 1997; Potter, Mauldin, et al. 1996; Snider, Beauvais, et al. 1996); speaking English, or being of Caucasian background (Hakama, Hakulinen, et al. 1982; Maxwell, Kozak, et al. 1997); engaging in other preventive health behaviours, such as obtaining Pap smears or conducting breast self-exams (Maxwell, Kozak, et al. 1997; Potter, Mauldin, et al. 1996; Vernon, Laville, et al. 1990)or having had a previous mammogram (Potter, Mauldin, et al. 1996). In terms of barriers to screening, women with low self-esteem (Maxwell, Kozak, et al. 1997), low sense of control (Maxwell, Kozak, et al. 1997), or women who smoke (Potter, Mauldin, et al. 1996) are less likely to obtain screening.

Enabling components are those family or community level conditions which facilitate the use of services. These include factors which affect access to services, financial resources, regular sources of care, or factors reflecting community norms (Andersen & Newman 1973).

In terms of mammography screening, (in the United States) uptake is strongly associated with insurance coverage (Potter, Mauldin, et al. 1996). As is having a higher income (Mercer & Goel 1997; Potter, Mauldin, et al. 1996; Snider, Beauvais, et al. 1996). Having a regular physician (Gentleman & Lee 1997; Potter, Mauldin, et al. 1996) and being involved in social networks (Potter, Mauldin, et al. 1996) are also associated with greater uptake. Women from rural areas demonstrate less mammography screening utilization (Maxwell, Kozak, et al. 1997; Potvin, Camirand, et al. 1995).

The need component of utilization is defined as perceived illness or perceived probability of becoming ill – in this case, with breast cancer. Being between the ages of 50-69 is linked to increased screening (Maxwell, Kozak, et al. 1997), and age is an established risk factor for breast cancer (Kelsey & Bernstein 1996)[1].

Contextual Level Pathway

Andersen and Newman (1973) described societal determinants of utilization as technology and social system norms. In the current study, this aspect of the original framework was modified with the substitution of a more general contextual pathway. More specifically, the way in which the *socioeconomic status* of an area influences utilization was explored. Before doing so, a comment is provided about researchers who frame contextual influences around more tangible resources.

Many researchers choose to focus on specific social, economic or cultural features of an area, and these effects on health and health behaviours. MacIntyre and colleagues (MacIntyre, MacIver, et al. 1993) review such studies (also see Stokols 1992). Independent variables of interest include such things as environmental toxins, quality of housing, recreational facilities, crime levels, etc. A strength of studying tangible features like these is that findings can lead to clear targets for policy interventions. A limitation, however, is that some qualities of an area – or the "feel" of an area – may not be adequately captured.

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[1] Whether women labelled as "overall high risk" are associated with screening is not resolved in the literature (Vernon, Laville, et al. 1990).

To do so, other researchers take a different approach to studying context. Broader-based measures of area, such as deprivation, are used. Measures such as these reflect the contextual circumstances with which residents interact. This line of inquiry is seen as complementary, not competitive, with investigations focussed on specific area features. What is challenging about using such broader measures is detailing their mechanisms on health behaviours. The literature offers various expressions to describe the relationship between contextual circumstances and individuals, such as: creating "socially patterned behaviour" (Davey Smith, Neaton, et al. 1996); "altering the physical and social landscape of individuals" (Soobader & LeClere 1999); "constraining choices people make" (Diez-Roux 1998); and representing "social and cultural factors in community settings that influence personal and collective well-being" (Stokols 1992).

In this thesis study, area socioeconomic status (SES) was used as a broad-based measure of the contextual milieu. Area SES was expected to act through the individual, in this case by limiting or enhancing the choices available to a woman. In other words, area SES shaped a woman's ability to support good health. This conceptualization suggested that better off neighbourhoods would influence women and mammography screening uptake in a different way than poorer ones might. It is also suggested that area SES conveyed more than simply the aggregate of individual measures (e.g., individual social class). It implied something larger, something synergistic – the spirit of the place or the collective well-being – that influenced the individual, and in turn was influenced by individuals.

Together, the individual and contextual determinants were expected to influence mammography screening utilization. Hierarchical multilevel modelling is a technique that facilitated the investigation of both these pathways.

Analytical Framework for Study

Hierarchical multilevel modelling (MLM) is a statistical technique that handles data with a specific structure – units which are nested into groups or clusters. Such is the structure of research problems that consider contextual variables. In the current example, women live in particular regions of the province and so can be grouped or clustered by region (the significance of regions for breast cancer screening is addressed in the next chapter).

This example presents methodological issues that are well managed by MLM. One issue is the levels of data required for the analysis. The interest lies in combining information about women (e.g., age) with information about the region to which a woman belongs (e.g., regional budget for breast health programs). MLM facilitates the incorporation of both levels of data, allowing models which combine contextual and individual level influences on outcomes. By doing so, one avoids committing the ecological and atomistic fallacies when making inferences from findings. Unlike single level analysis, this technique more closely resembles the multiple pathways influencing mammography screening uptake.

The second issue is specific to the clustering of units. It is expected that women within a region will demonstrate more similar outcomes than women from different regions, all else being equal. Women within a region are exposed to similar experiences (e.g., media messages), barriers (e.g., transportation issues), or norms that might influence mammogram utilization in ways that are different from women in other regions. MLM allows one to investigate the effect of this clustering as relevant information about mammogram uptake. In contrast, under single level regression methods, clustering violates the condition of independent residual terms (autocorrelation). The traditional solution is to either ignore the clustering or to include an adjustment in the analysis rather than attempt to understand the clustering.

The third issue is related to the residuals or error terms. A model may demonstrate that screening uptake is dependent upon specified variables, such as age and breast health program budgets, with the remaining variation captured in the residual terms. The particular structure of the residuals in MLM allows one to determine, for example, to what extent the relationship among the individual level variables and mammography uptake varies in each region. In other words, it might be that there are larger fluctuations in mammography screening uptake among individuals in one region, whereas in another region the fluctuations are less pronounced. This heterogeneity can be explored in detail using MLM. In traditional regression modelling, limited information is learned from the residual terms as they are constrained by the assumption of constant variances.

These three main advantages to MLM make it an attractive analytical technique for the problem at hand. A general explanation of MLM is provided in an appendix to this chapter for interested readers. What follows here are the empirical models of interest for this study, accompanied by research questions and hypotheses. Chapter Ten describes the specific implementation details.

Analytical Framework

To answer the research questions for this study, a five-step analytical framework (based on the work of Beland, Birch and Stoddart (Beland, Birch, et al. 1999)) was developed in this section. For discussion purposes the framework employs variables assumed to be continuously distributed.

Step 1: Does mammography screening utilization vary by region?

The first step requires establishing whether regional variation exists in mammogram utilization. Traditional single level modelling regression captures the unexplained variation in the dependent variable in a single term. Instead, MLM separates this unexplained variation from its two sources: differences in utilization due to differences among women, and differences in utilization due to differences among regions. To detect this, a model is estimated as follows:

$$Yij = Bo + (\mu oj + \epsilon oij)$$

Where:

Yij = the utilization of mammograms by a woman (i) in region (j)

Bo = the average utilization of mammograms among all women in Ontario

μoj = the unexplained variation in utilization among regions. These residuals are assumed to be normally distributed with a mean of zero. They are summarized by the variance term $\sigma^2_{\mu o}$

ϵoij = the unexplained variation in utilization within regions. These residuals are assumed to be normally distributed with a mean of zero. They are summarized by the variance term $\sigma^2_{\epsilon o}$

The null hypothesis to be tested is that there is no variation in utilization among regions: Ho: $\sigma^2_{\mu o} = 0$

Step 2: Does the composition of the region contribute to variation in mammography utilization among regions?

Rejection of the null hypothesis in step 1 indicates that there is variation in utilization by region. The subsequent steps in the framework attempt to explore the nature of these variations. One explanation is that the social profile of women, or the composition of the region, might differ among regions, thereby influencing utilization. Thus, the individual level correlates of mammography screening are introduced in this step to explore the influence of composition. Taking account of compositional effects might inflate or deflate the variance estimated in the previous step. So, for example, using women's age as an explanatory variable, the model is as follows:

$$Yij = Bo + B_1X_1ij + (\mu oj + \epsilon oij)$$

Where:
$Bo =$ the average utilization of mammograms among women of mean age in Ontario
$X_1ij =$ a woman's age (centred around the sample mean age)
$B_1 =$ the provincial effect of age
$\mu oj =$ the unexplained variation in utilization among regions after allowing for age composition, summarized by the variance term $\sigma^2_{\mu o}$
$\epsilon oij =$ the unexplained variation in utilization within regions after allowing for age composition, summarized by the variance term $\sigma^2_{\epsilon o}$

After considering the sample's (age) composition in a region, the remaining unexplained regional variation in mammogram uptake is examined. The null hypothesis to be tested in this step is: Ho: $\sigma^2_{\mu o} = 0$

Step 3: Does the individual level pathway associated with mammography screening differ by region?

The empirical model in this step considers whether the association of the individual level variables with mammography uptake varies by region. For example, personal circumstances might differ among regions in ways which have an impact on older women. As a result it might be expected that the association of age and utilization differs among regions. To accommodate this in the model, the individual level relationship is allowed to vary by region;

$$Yij \quad = \quad Bo \quad + \quad B_1X_1ij \ + \quad (\mu oj \quad + \quad \mu_1jX_1ij + \quad \epsilon oij)$$

Where:

μoj = the random intercept, or the unexplained variation in utilization among regions for women of mean age, summarized by the variance term $\sigma^2_{\mu o}$

μ_1j = the random slope, or the unexplained variation in utilization among regions due to age, summarized by the variance term $\sigma^2_{\mu 1}$

These two random terms are not assumed to be independent of each other. Consequently, a covariance term, $\sigma_{\mu o \mu 1}$, is also estimated. If this term were positive, it would reveal that the difference in uptake between older and younger women may be high in regions of high mammography screening utilization.

The null hypothesis to be tested is that there is no variation among health planning regions in the individual level model (e.g., age). Using a joint Wald testing procedure, Ho: $(\sigma^2_{\mu 1} + \sigma_{\mu o \mu 1}) = 0$

Step 4: Does a characteristic of the region contribute to regional variation in mammography screening utilization?

Here the empirical model explores whether the observed regional variation can be explained by characteristics of the region. For example, exploring the influence of regional breast health budgets on utilization of mammograms:

$$Yij = Bo + B_1X_1ij + \alpha_1W_1j + (\mu oj + \epsilon oij)$$

Where:

W_1j = the regional budget for breast health services
α_1 = the effect of the regional budget on mammography utilization
μoj = the unexplained variation in utilization among regions, after controlling for age composition and regional budget, summarized by the variance term $\sigma^2_{\mu o}$

There are two null hypotheses associated with this step. The first is to determine whether the regional characteristic has an influence on utilization: Ho: $\alpha_1 = 0$. The second is to determine whether the unexplained variation in the outcome among regions is the same after the introduction of the contextual variables: Ho: (Step 2 μoj) = (Step 4 μoj). If there is a significant difference in regional variation between step 2 and step 4, this can be interpreted as differences in the extent of regional variable influence from region to region.

Step 5: Does the regional characteristic interact with the individual level pathway in explaining mammography screening utilization?

Step 5 explores whether the relationship between age and mammography screening utilization is conditioned by different regional budgets, for example;

$$Yij = Bo + B_1X_1ij + \alpha_1W_1j + \alpha_2W_1jX_1ij + (\mu oj + \mu_1jX_1ij + \epsilon oij)$$

Where:

W_1jX_1ij =	the interaction or product term of regional budget and age
α_2 =	the effect of the interaction between regional budget and age on mammography utilization

The null hypothesis is concerned with the significance of the interaction term:

Ho: $\alpha_2 = 0$.

Appendix 1: Review of Hierarchical Multilevel Modelling (MLM)

For simplicity, the ensuing discussion will assume that all variables are continuous in nature, and the dependent variable or outcome is “utilization of mammography screening.” “Age” will be used as a variable of interest at the individual level (does age explain utilization of mammography screening?), and “regional budget for breast health programs” is used as the contextual variable (does regional budget explain mammography screening utilization?).

MLM is concerned with modelling the effect of age simultaneously with the effect of regional budget on utilization, representing the two pathways described in the conceptual framework. The first of these two models, the individual level model (i.e., the influence of age), takes the following form:

Utilization of mammograms = Average utilization in each region + Age + Residual

$$Yij = Boj + B_1X_1ij + \in ij \qquad (1)$$

In equation 1, i represents an individual woman and j represents the region in which the woman lives. A woman's utilization of mammograms is explained here by three terms. First, the intercept (Boj), is adjusted for interpretability such that it represents the average utilization of mammograms in a region among women of sample mean age. In the second term, X_1ij is a woman's age centred around the sample mean, and its effect on utilization of mammograms is given by the B_1 coefficient[2].

The last term, the individual level residuals, represents the remaining variation in utilization of mammograms not accounted for by age. These residuals are assumed to be normally distributed with a mean of zero. MLM allows for correlation among these residuals within a region. In practice the residuals are summarized by the variance term $\sigma^2 \in_{0.}$

The individual level model (equation 1) is now supplemented by a model that incorporates regional influences on utilization. This contextual level model takes the form:

Average utilization in each region	=	Average utilization in province	+	Regional budget	+	Residual
Boj	=	Bo	+	$\propto_o$Woj	+	μoj(2)

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[2] Of note is the assumption that the influence of age is constant from region to region. These kinds of MLM models are called Random Intercepts or Variance Components Models, implying that the slope is held constant while the intercept is allowed to vary from region to region. It is possible to relax this assumption and allow age to vary among individuals in each region; such a model is called a Random Coefficients or Fully Complex Model.

In the contextual model, the outcome is the average utilization in each region. Later, the individual level model and the contextual model will be combined to determine an overall model explaining utilization of mammograms. In equation 2 the outcome is explained by three terms. The first term, (Bo), represents the average utilization of mammograms in the province by women of mean age. The second term incorporates a regional characteristic, regional budget, (Woj) into the model. Its effect on the outcome is given by the $\propto_o$ coefficient.

The residual terms are interpreted as the unexplained variation in utilization among regions, after controlling for regional budget. The residuals, which provide information about regional variation, are summarized by the variance term $\sigma^2 u_{0,}$ and are assumed to be normally distributed with a mean of zero.

These variances are assumed to come from a distribution that can be modelled as a function of its individual level variables or regional level variables. Most noteworthy is what this distribution reveals about the heterogeneity of the relationship. It might be expected that age is a better predictor of utilization of mammograms for women between the ages of 50 - 60, but age functions less well as a predictor of mammograms for women between the ages of 40 - 50 years. Because MLM does not assume this relationship is constant it facilitates exploration of this heterogeneity.

Substituting equation 2 into 1 results in an overall MLM model which considers both an individual variable and a regional level variable in explaining a woman's utilization of mammograms:

$$Yij \quad = \quad Bo \quad + \quad B_1X_1ij \; + \quad \propto_0 Woj \; + \quad (\mu oj \quad + \quad \epsilon oij) \qquad (3)$$

Where[3] ,

Yij = the utilization of mammograms by a woman (i) in region (j)

Bo = the average utilization of mammograms among women of mean age in Ontario

X_1ij = a woman's age (centred around the sample mean age)

B_1 = the provincial effect of age

W_1j = the regional budget for breast health services

α_1 = the effect of the regional budget on mammography utilization

μoj = the unexplained variation in utilization among regions, after controlling for age composition and regional budget, summarized by the variance term $\sigma^2_{\mu o}$

ϵoij = the unexplained variation in utilization within regions, after controlling for age composition and regional budget, summarized by the variance term $\sigma^2_{\epsilon o}$

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[3] A simplified model has been presented. A Fully Complex model facilitates the investigation of cross-level interactions: does the regional budget interact with age as it affects utilization of mammograms?

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CHAPTER TEN: METHODS FOR MULTILEVEL STUDY

This chapter describes the execution of the MLM strategy introduced in the last chapter. Five steps were developed to explore the primary research questions for this study. Secondary research questions associated with the five empirical steps are reviewed below:

- Step 1: Does mammography utilization vary from region to region?
- Step 2: Does the composition of the region contribute to variation in mammography uptake among regions?
- Step 3: Does the individual level pathway associated with mammography screening differ by region?
- Step 4: Do characteristics of the region contribute to regional variation in mammography utilization?
- Step 5: Do characteristics of the region condition the individual level pathways associated with mammography utilization?

The previous chapter introduced the analysis using a limited number of continuously-distributed variables. The actual implementation of the analysis, however, was more complex due to the larger number of variables and the categorical nature of the data. These issues, along with a description of the data sets and sampling, are presented in this chapter. It concludes with a discussion about the limitations of the analytical technique.

Data Sets

Statistic Canada's 1996 National Population Health Survey (NPHS) (Statistics Canada 1998) was used to obtain all individual level data of interest.

The NPHS was initiated in 1994 and will be administered every two years in order to derive a longitudinal and cross-sectional profile of the health of Canadians. The NPHS followed a stratified, two-stage design; independent samples of clusters were selected from strata in the first stage, and households within each cluster were selected in the second stage. The sampling frame included all household residents in all provinces with the exception of those on Indian Reserves, Canadian Forces Bases and some remote areas of Ontario and Quebec. In 1994, a randomly selected household member was marked as the longitudinal respondent. For the 1996 cycle, longitudinal respondents were recontacted to provide longitudinal data.

The cross-sectional profile contains core and health information. The selected, longitudinal respondent was asked to provide information about the core component of the survey for all members of the household. Then, one randomly selected household member over the age of 12 years was asked to provide in-depth responses for the health component.

Thus, the cross-sectional profile contains information from the longitudinal respondent and from all household members living with the respondent. In addition, it contains information from the supplementary buy-in sample from particular provinces (the NPHS contained about 4,000 Ontario residents, consequently the Ontario Ministry of

Health arranged to increase the sample size by 30,000 additional residents to achieve reliable statistical calculations at the local planning level).

Including the supplemental participants, the Ontario response rate for the core component of the survey was 78.8% of all contacted households. From these households, 94.4% selected individuals agreed to participate in the health component of the survey. All interviews were conducted by telephone between October 1996 and August 1997. Additional details about the NPHS design and sampling techniques are available elsewhere (Statistics Canada 1998).

The Ontario portion of the NPHS is available as an SPSS system file to health services agencies and researchers. This file is called the 1996 Ontario Health Survey Datafile, or, informally, the Ontario Shareware Version. It contains all the Ontario data from the NPHS minus 5% of respondents who did not wish to share their information with the provinces. The analysis for this study used the Ontario Shareware Version file. Permission to use this file was granted to the author by the Ontario Ministry of Health.

The 1996 Canadian Census was used to obtain regional level independent variables to correspond with responses in the 1996 NPHS. Socioeconomic status information about each census division in Ontario (n = 60) was obtained. However, the geographic areas of interest in the NPHS, the health planning regions (n = 23), were defined on the basis of 1991 census geographies. Statistics Canada provided data to manually link the 1991 census divisions to the health planning regions; census divisions belonged to one and only one health planning region (Geran 2000). Further investigation by Statistics Canada confirmed that "you can assert with a high degree of confidence that, for all intents and purposes, any CD [census division] boundary changes that took place between 1991 and 1996 will have no effect on any Census or NPHS data that you produce" (Gilmore 2000).

Sampling

The Canadian Task Force on the Periodic Health Examination and the Canadian Cancer Society recommend that women between the ages of 50-69 obtain regular mammography screening (annually or biennially, respectively)[1] (Canadian Cancer Society 2001; Morrison 1994). In line with these guidelines, all Ontario women between the ages of 50-69 were selected from the 1996/97 Ontario Health Survey Datafile (unweighted n = 4,773).

Sample size requirements are an issue of current statistical interest in the MLM literature. Data requirements need to be addressed at the individual and regional levels, and the hierarchical nature of the data (i.e., clustering) needs to be considered. In addition to producing precise estimates (e.g., minimizing variances), determining appropriate sample sizes also depends on design efficiency and cost considerations.

Issues around sampling and clusters have been addressed previously (e.g., see

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[1] These guidelines are revised as new findings from on-going breast cancer screening studies become available.

works by A. Donner[2]) and the concept of effective sample size is generally accepted among methodologists.[3] Additional attention to this issue is required, however, because multilevel modelling incorporates random slopes, and consequently variances (and intragroup correlations) are a function of the independent variables (Snijders & Bosker 2000). While no guidance was located for determining appropriate sample sizes for logistic MLM, some recommendations are available for linear MLM.

Paterson and Goldstein (1992) suggested that fewer than 25 groups, with fewer than 25 units within each group, would provide imprecise parameter estimates. They also remarked that using 100 groups could provide "useful insights." Their suggestions are based on experiences with previous studies. The "25 units with 25 groups" suggestion has become the rule of thumb in the multilevel modelling literature.

Another suggestion, based on an empirical analysis, was offered by Mok (1996). She used a hierarchical sample from a population with known parameter estimates. Various MLMs were simulated such that total sample size remained constant while sample sizes between units and groups were systematically varied (e.g., 10 units per 10 groups, five units per 20 groups, etc.). After comparing the results, Mok provided detailed comments about sample size trends for fixed components, group variances, group covariances, and unit variances. Mok determined that estimations were more

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[2] For example: Donner A. Sample size requirements for stratified cluster randomization designs. Stat Med 1992; 11(6): 743-50.

[3] Effective sample size can be calculated as:

$n_{\text{effective}} = n_{\text{units}} / [\, 1 + (N_{\text{groups}} - 1)\, \rho \,]$, where ρ is the correlation within groups.

efficient and less biassed when larger numbers of group level units (N) were used in conjunction with fewer numbers of individual level units (n), rather than vice versa. Mok recommended 400 subjects distributed among 53 groups, given an intra-class correlation of less than 0.15.

In terms of group size, there were twenty-three health planning regions in Ontario. These, and the number of women in each region, are listed in Table 2.2. The regions range from a high of 464 to a low of 143 women per region, with an average of 207 women per region. These numbers are roughly in-line with the recommendations above, although a greater number of groups (e.g., health regions) would have been ideal.

Variables

The <u>dependent variable</u> in this analysis was the dichotomous response[4] to the question: "Have you ever had a mammogram, that is, a breast x-ray?" in the 1996 National Population Health Survey. The survey also contained data about women who have had a mammogram in the last two years, a period of time that reflects screening guidelines. The responses to this question, however, were unreliable for analysis due to small sample sizes in each region. As a result, and for reasons of confidentiality, Ministry of Ontario guidelines for data release would not have permitted the publication of an analysis using this variable.

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[4] Responses for "don't know", "refusal to answer" and "not stated" were included in the "no" category.

The individual level model of ever having had a mammogram was based on the Andersen and Newman framework of health care utilization (Andersen & Newman 1973). The literature offered numerous predisposing, enabling and need variables associated with screening uptake (e.g., Gentleman & Lee 1997; Goel, Iron, et al. 1977; Maxwell, Kozak, et al. 1997; Mercer & Goel 1997; Potvin, Camirand, et al. 1995; Snider, Beauvais, et al. 1996). The following set of variables was used to provide a reasonable individual level model of lifetime mammograms with which to explore regional variation.

The predisposing variables that were selected initially were marital status, birthplace, language, years since immigration and education level. Other predisposing variables included having one's blood pressure taken, frequency of physical activity, smoking, alcohol, having a Pap smear and conducting breast self-examinations.

Enabling variables first were identified as having a regular physician, number of consultations with a health professional in the past year, income and perceived social support. A derived social involvement score was available in the Ontario Health Survey Datafile that reflected frequency of participation in associations and volunteer activities as well as frequency of attendance at religious services. The higher the score, the more socially involved the respondent.

The need variables were self-rated health and age. The latter variable had a dual purpose: to represent an established risk factor for breast cancer, and to adjust for increased opportunities to have had a mammogram due to age (e.g., a 60-year-old woman had the opportunity to have had approximately five more mammograms than a 50-year-old woman).

These initial variables were each evaluated against the following criteria for inclusion in the model: a) the variable demonstrated significant bivariate correlation with the dependent variable (Chi-squared test, $p< 0.05$); b) its valid responses constituted at least 95% of the response rate; c) a multivariable correlation matrix demonstrated correlations less than 0.8; d) the variable's distribution conformed with Ontario Ministry of Health data release guidelines, including appropriate cell sizes in each region; and e) it demonstrated significant effects in a linear logistic regression model.

Exceptions to these criteria were birthplace, language and education level. The first two variables were eliminated on the grounds that they contained too many response categories (years since immigration was retained). Education level was not significant in the linear logistic regression model but was retained as an indicator of individual level socioeconomic status (the response rate to income was only 74% and therefore dropped from the model).

The variables selected for the multilevel analysis are listed in Table 2.3. Responses for "don't know," "refusal to answer" and "not stated" were considered missing responses (and were excluded in the analysis); at the most these constituted 3.2% of a variable's distribution in the study sample, and this exclusion was not perceived to bias the results (see Table 2.4 in the Chapter Eleven). The categorical variables were coded such that the base category – the category with the most frequent response in the study sample – was incorporated into the intercept value for ease of interpretation, and the remaining number of variable categories (e.g., k - 1) were represented as dummy variables (Goldstein 1995).

The regions selected for the analysis reflected the provinces' public health boundaries (n = 23). The public health regulating framework, the Mandatory Health Programs and Services Guidelines, outlines General Standards in which a goal for program planning and evaluation is to "ensure that local programs address the health needs of the community, with cost-effective, efficient, evidence-based approaches" (Ontario Ministry of Health 1997). In 1997, the Early Detection of Cancer Program of the Guidelines set the following objective for public health units: "To increase to 70% the proportion of women aged 50-69 who receive screening mammography through the Ontario Breast Screening Program by the year 2010" (Ontario Ministry of Health 1997). The Guidelines also outline the minimum requirements for conducting group-based and broad education campaigns, for initiating strategies developed in conjunction with community groups and for providing continuing education of health professionals with respect to breast cancer screening. Thus, health planning regions were deliberately selected such that the results might be policy-informing with respect to these activities.

The potential importance of area level socioeconomic status on individual health and health behaviour was discussed in the previous chapter. The 1996 Canadian Census was used to obtain socioeconomic status information about census divisions in Ontario. Indexes or composite measures of socioeconomic status can act to "conceal rather than reveal actual effects" (Folwell 1995; Susser, Watson, et al. 1985, p.205). Instead, three different indicators of area socioeconomic status were used to reflect potentially different dimensions of the construct – employment, education and income (Susser, Watson, et al. 1985). The three regional-level independent variables were: the employment-population ratio, 15 years and above; the percentage of the population without a secondary school graduation certificate (grade 9-13), 15 years and above; and the median family income of all families.

Lynch and Kaplan briefly recount the types of area-based socioeconomic indicators used in previous health studies. These include "median or per capita income, deprivation scores, percent in poverty, unemployment, median level of education, percent white collar occupations, and unemployment rate" (Lynch & Kaplan 2000, p.29). Determining which area socioeconomic indicators have the strongest predictive power for health and health-related behaviours represents a task beyond the scope of the current study. Comparisons of area deprivation and mortality have demonstrated, however, similar major findings with the use of different deprivation measures (Eames, Ben-Shlomo, et al. 1999).

Data Preparation

The major data preparation step involved collapsing interval categories to ensure adequate sample size per cell, as per Ontario Ministry of Health (MOH) guidelines for data release. Minor steps included renaming variables, recoding variables, centering continuous variables about their mean, etc. A code book was maintained to document changes to the variables.

Analysis

Descriptive Analysis

To begin, the distribution of each variable was examined, followed by cross-tabulation correlations (unweighted and weighted, using MOH analytic weights) with the dependent variable. These steps provided a 'feel for the data', allowed data manipulation errors to be spotted (e.g., in collapsing categories or moving data between statistical programs) and allowed data distributions and coefficients of variations to be checked against MOH guidelines for data release.

Logistic Hierarchical Multilevel Modelling

Until this point, MLM has been described using continuously distributed variables. In this analysis, however, the dependent variable, 'ever had a mammogram', had a binary (no/yes responses) rather than a linear distribution. This implies that predicted outcome probabilities ought to lie between zero and one, a constraint not met in linear MLM. Furthermore, in the case of a binary outcome, the variance among individuals is related to the mean, with the result that the coefficients in the fixed part of the model are related to those in the random part. Binary logistic MLM, in which the logarithm of the odds is modelled using a logit link function, was used to manage these issues (Jones, Moon, et al. 1991; Snijders & Bosker 2000).

The regional level model remains as described in the previous chapter, and a Gaussian (e.g., normal) distribution is assumed for its random terms (Snijders & Bosker 2000).

The individual level model is:

$$Yij = B_{0j} + B_1X_{1ij}$$

As before, the intercept (Boj) represents the average utilization of mammograms among women of mean age in Ontario, X_1ij represents a woman's age (centred around the sample mean age) and B_1 is the effect of age on utilization. The expected response by each woman (i) in region (j) to the question 'have you ever had a mammogram', is yes or no. These responses can also be designated as one or zero, representing probabilities,

$$Pij = B_{0j} + B_1X_{1ij}$$

Turning now to the right side of the individual level model equation, the expression $(B_{0j} + B_1X_{1ij})$ needs to be transformed such that values lie between zero and one. A logistic transformation is used,

$$Pij = \frac{e^{B0j + B1X1ij}}{1 + e^{B0j + B1X1ij}}$$

This expression is rearranged to obtain,

$$Pij + (Pij)(e^{B0j + B1X1ij}) = e^{B0j + B1X1ij}$$

$$Pij = e^{B0j + B1X1ij} - (Pij)(e^{B0j + B1X1ij})$$

$$Pij = e^{B0j + B1X1ij}(1 - Pij)$$

$$\frac{Pij}{1 - Pij} = e^{B0j + B1X1ij}$$

Pij/(1-Pij) represents the probability expressed as odds, the odds of responding yes or the odds of responding no. In order to estimate a linear function, the logarithm of both sides is taken,

$$\log \frac{Pij}{1 - Pij} = B_{0j} + B_1X_{1ij}$$

Thus, the right side of the equation is estimated, and the results, on the left, are provided in log odds.

The model requires constraining the residuals among women in a region to one to conform to a binomial distribution. It is also assumed that the residuals among regions are independent from those among women. The multilevel software used for this analysis was MLWin 1.10. Within this program, the binary logistic MLM relies on a linear approximation based on a Taylor series expansion for an iterative generalised least squares estimation. The reader is directed to other references for more details about the estimation procedure (Goldstein, Rasbash, et al. 1998; Snijders & Bosker 2000).

Limitations

There were some technical limitations associated with the analysis:

1) It is common practice to weight data from surveys designed with different sample selection probabilities (like the NPHS). Weights can be used to incorporate information about the likelihood of an individual being sampled. The program used to carry out the MLM analysis, MLWin 1.10, contained a programming bug which prevented the incorporation of weights into the analysis. Consequently, standard errors may be slightly less conservative than might otherwise be obtained using weights.

2) Methods to estimate multilevel models with discrete responses represent a current area of active development. It has been suggested that a downward bias may result in the random parameter estimates when using the standard estimation procedure (quasi likelihood procedures) (Snijders & Bosker 2000). This bias is associated with a small number of groups. If the bias is severe, it can be corrected using bootstrap estimation, however the User's Guide to MLWin warns (Goldstein, Rasbash, et al. 1998, p.240), "With this release of MLWin there is still relatively little experience of using bootstrap methods with multilevel models. We suggest therefore that this procedure should be used with care." On account of the lack of guidance available in this area, this avenue was not pursued. This warning does imply, however, that parameters that border on significance need not be automatically discarded from further consideration.

Table 2.2: **Number of Women (aged 50-69) in each Health Planning Region from 1996 NPHS Sample**

REGION	NUMBER OF WOMEN
1) Ottawa-Carleton	282
2) Prescott & Russell/Stormont, Dundas & Glengarry/Renfrew	143
3) Lanark/Leeds & Grenville/Hastings/Prince Edward/Frontenac/ Lennox & Addington	283
4) Northumberland/Victoria/Haliburton/Peterborough	202
5) Durham	161
6) Peel	166
7) Metropolitan Toronto	464
8) York	170
9) Simcoe	189
10) Halton	209
11) Niagara	212
12) Hamilton-Wentworth	193
13) Brant/Haldimand-Norfolk	189
14) Wellington-Dufferin	175
15) Waterloo	178
16) Essex	191
17) Lambton/Kent	191
18) Elgin/Middlesex/Oxford	185
19) Bruce/Grey/Perth/Huron	245
20) Algoma/Cochrane	178
21) Manitoulin/Sudbury	208
22) Timiskaming/Muskoka/Parry Sound/North Bay	214
23) Thunder Bay/Kenora/Rainy River	145
TOTAL	4773

Table 2.3: Variables for Multilevel Analysis

DEPENDENT VARIABLE		1. Ever had a mammogram
INDEPENDENT VARIABLES		
Individual Level:		
	Predisposing:	1. Marital Status 2. Years Since Immigration 3. Education Level 4. Smoking 5. Ever Had a Pap Smear 6. Conducted Breast Self-Examination
	Enabling:	7. Has a Regular Physician 8. Derived Social Involvement Score
	Need:	9. Age
Regional Level:		1. Employment-population ratio, 15 years and above 2. Percentage of the population without secondary school graduation certificate (grade 9-13), 15 years and above 3. Median family income of all families

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CHAPTER ELEVEN: MULTILEVEL MODELLING RESULTS

Results from the estimated hierarchical multilevel models are presented in this chapter; they are interpreted in light of the five step analytical model and associated questions. As a whole, the findings were used in the next chapter to explore the study research questions: 1) Does the lifetime prevalence of mammography utilization vary systematically by region of residence?, and 2) To what extent do individual and contextual level variables explain regional variation in the utilization of mammography screening? Thus, the analysis extended previous approaches to understanding mammography screening utilization by examining possible contextual relationships – either directly or through the modification of an individual level relationship – with the outcome.

Sample Characteristics

Table 2.4 presents the distribution of the dependent, the individual and the contextual level variables. Dependent and individual level variables refer to Ontario women between the ages of 50 - 69 years. The first column describes the percentage of the sample in each variable category. As discussed in Chapter Ten, it was not possible to weight the sample, in accordance with the NPHS sampling strategy, during the analysis.

The second column illustrates what the weighted[1] sample distribution would have been (i.e., representative of the 50 - 69-year-old female population in Ontario). Fewer married/common-law/partnered and more single/divorced/separated/widowed women were represented in the study sample, as were higher numbers of non-immigrant women. In general, however, the columns are similar, lending confidence in the ability to generalize the study findings to other Ontario women who are 50 - 69 years old (and who do not live on Indian Reserves, Canadian Forces Bases and in some remote areas of Ontario).

Contextual variable values were census-derived, and based on the health region in which the study individual resided.

Multilevel Modelling

Step 1: Does Lifetime Mammography Screening Utilization Vary by Region?

Table 2.5 presents the results from step 1. Such models are commonly known as "null models" on account of the exclusion of any explanatory variables. Only the intercept coefficient in the fixed part of the model and its associated random term are available for interpretation. These estimates are accompanied by standard errors.

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[1] The weighting factor for each respondent was available in the 1996 Ontario Health Survey data file, based on the 1996 NPHS (variable "wt66_s").

The intercept in this model was significant[2], and it revealed that the estimated average proportion of Ontario women, aged 50 - 69, who reported ever having had a mammogram was 0.79[3]. This is high compared to the data from the Ontario Breast Screening Program, which reported a rate of 12% across Ontario (Cancer Care Ontario 1998). The incongruence between the two figures is due to a number of factors. First, this model pertains to lifetime mammograms while the OBSP rate only refers to the period between 1996 - 1997. Consequently the model estimate captured second (and subsequent mammograms) and will be higher than the OBSP figure. Second, screening mammograms are not separated from diagnostic mammograms in the current data set, providing another explanation for the higher model estimate. Third, the different figures reflect the inability to separate out mammograms obtained through the OBSP from those obtained through a physician's referral to a non-OBSP site in the study data. This means that the number of mammograms from all sources is reflected in the figure 0.79, but only OBSP mammograms are included in the 12% rate. This discussion is meant to underline the fact that the two numbers are not strictly comparable. The OBSP figure indicated that there might be a problem with attracting women to mammography programs. The NPHS

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[2] The significance of fixed terms was determined using the ratio of the estimate to its standard error in comparison to the standard Z distribution. The ratio needs to be greater than 1.96 to be considered significantly greater than zero; readers might notice that this critical value is identified typically as "two" in the multilevel modelling literature (Goldstein 1995).

[3] Log odds are converted to proportions using the formula: $1/(1 + e^{-x})$, where x is the log odds value.

data set facilitated the exploration of this problem.

The second result of interest was the variation in ever having had a mammogram among the regions. As discussed in Chapter Ten, the estimation of logistic multilevel models is an area of current research; the standard estimation procedure is suspect of producing random parameter estimates with a downward bias (Snijders & Bosker 2000) For this reason, an alpha level of $p < 0.10$ was used instead of the conventional alpha level of $p<0.05$ for the hypothesis testing of the random parameters. By doing so a slight accommodation was made for the software while still maintaining a reasonable level of Type 1 error. Formal testing[4] revealed that the regional variation in ever having a mammogram was significant at $p < 0.10$. For interpretation purposes, the variance can be used to calculate the intraclass correlation coefficient[5], which, for this model, was 0.012. This indicated that only a small portion of the unexplained variation in the outcome can be attributed to differences among regions.

The combination of information from the fixed and the random effects can be used to compare specific regions. For example, in the Ontario region with the highest level of screening uptake, region 17, women between 50 - 69 years have an 85% probability of having had a screen. In the region with the lowest level of uptake, region

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[4] The random parameters in a logistic model are tested using a Wald test (Goldstein 1995; Snijders & Bosker 2000).

[5] The intraclass correlation coefficient for a two level logistic random intercept model is calculated as: $\mathrm{var}(\mu_{1j}) / [\,\mathrm{var}(\mu_{1j}) + (\pi^2/3)\,]$ (Snijders & Bosker 2000)

22, women have a 75% probability of having had a screen.

The results of the null model indicated that lifetime mammography utilization varied modestly by region.

Step 2: Does composition account for the variation among regions?

Here, individual level variables were incorporated into the model to determine if the composition (e.g., social profile) of the health region accounted for any of the regional variation in ever having a mammogram (Table 2.6). The composition could act to inflate or deflate the magnitude of the regional variation in the outcome.

In this step the intercept represented lifetime screening uptake by a woman who was 59 years old, married, did not finish secondary school, was not an immigrant, did not smoke, had a regular physician for health care, had a moderate social involvement score (e.g., “2" on a scale of 0 to 4), had a Pap smear and conducted breast self-examination – hereafter called the “stereotypical woman.” The previous chapter described that these categories had the most frequent response, of each variable’s categories, in the study sample. For interpretation purposes they were absorbed into the intercept.

As in the last step, the intercept value was significant; the estimated proportion of (stereotypical) women who reported having had a mammogram in Ontario, across all regions, was 0.86. The inclusion of explanatory variables resulted in an increase in the intercept value when compared to the null model (i.e., from 1.35 to 1.82). The reason for this change is that a portion of the average fixed effect is now being accounted for by the base values associated with stereotypical women, represented in the intercept.

The individual level variables that demonstrated statistical significance are presented in Table 2.6. An exception was age, which failed to demonstrate significance but was retained to adjust for increased opportunities to have a mammogram (e.g., compared to a 55 year old, a 60 year old woman had five additional years within which to have screens). Another exception was having a college or university degree, which was retained to guard against confounding effects later when contextual socioeconomic indicators were included in the model. Without doing so, effects that seem to be derived from contextual SES variables might actually be the result of, or mixed with, individual level SES effects on ever having a mammogram (i.e., this guards against the claim that estimated regional SES effects are the result of a misspecified individual level model).

The overall model was significant using a Wald joint chi-squared testing procedure (Goldstein 1995). The significant variables (as well as age and college) demonstrated associations in directions that were consistent with previous literature. These associations are reported in log odds and are contrasted with the stereotypical woman[6]. A woman who was a daily smoker was significantly less likely to report ever

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[6] The variable categories which failed to achieve significance were not included in the model presented. This meant that the variable category's effect was no different than the variable's base category, which is absorbed into the intercept. Strictly speaking, the stereotypical woman now was: 59 years old, married, did not finish secondary school (*or finish less than secondary school or other post-secondary school besides college/university*), was not an immigrant, did not smoke (*or did not smoke occasionally*), had a regular physician for health care, had a moderate social involvement score (e.g., *"1" or* "2" on a scale of 0 to 4), had a Pap smear and conducted breast self-examination.

having a mammogram (Maxwell, Kozak, et al. 1997; Potter, Mauldin, et al. 1996). As well, a woman without a regular physician was significantly less likely to report ever having had a mammogram (Maxwell, Kozak, et al. 1997; Mercer & Goel 1997; Potter, Mauldin, et al. 1996). To illustrate, the stereotypical woman without a regular physician has a 59% probability of ever having had a mammogram (statistically holding other variables constant). The lack of conducting a breast self-exam was associated significantly with a lower probability of ever having had a mammogram (Potter, Mauldin, et al. 1996; Vernon, Laville, et al. 1990). A woman who never had a Pap smear was significantly less likely to report ever having a mammogram; this was the strongest association, as indicated by the size of regression coefficient (Maxwell, Kozak, et al. 1997; Potter, Mauldin, et al. 1996). And, in general, increased social involvement was associated significantly with an increased probability of reporting a lifetime mammogram (Maxwell, Kozak, et al. 1997; Potter, Mauldin, et al. 1996).

With respect to the random term, variation in ever having a mammogram among regions hardly changed and remained statistically significant at the $p<0.10$ level. This model was concerned with the influence of composition among regions. If the compositional variables were evenly distributed across regions, then they would not contribute to differences in the outcome by region. Conversely, if these individual level variables did differ significantly by region, their influence on ever having a mammogram is reflected in a change in the group level variance (i.e., the intercept variance) (Jones, Moon, et al. 1991). The result of this step indicated that the individual level variables were evenly distributed in the province and therefore could not account for the observed variation among regions in having had a mammogram.

Again, comparing specific regions illustrates the influence of composition on the outcome. In region 17, the estimated proportion of women ever having had a mammogram was 90% after adjusting for the regional social profile. In the region with the lowest lifetime mammography uptake, women have an 83% probability of ever having had a mammogram. Notably, this region is identified as region 18, whereas in the null model it was region 22. After considering composition, therefore, region 22's relative position with respect to lifetime uptake shifted.

In answer to the question posed at the outset of this step, there was no indication that composition accounted for the differences in outcome among the regions. This regional variation was significant at the $p<0.10$ alpha level.

Step 3: Does the influence of the factors associated with mammography screening utilization differ by region?

The model in the previous step restricted the association between each individual level variable and the dependent variable to be the same in each region. This assumption was relaxed here, and the influence of each variable on the dependent variable was explored on a region by region basis. Allowing more than two to three variables to vary across regions can lead to failure of model convergence on account of the estimation algorithms (Snijders & Bosker 2000); the general rule of thumb, then, is to only permit a maximum of two or three random slopes at one time.

Consequently, this step was implemented by taking the estimated model in step 2, and then allowing age, for example, to vary by region, followed by further model estimation and significance testing (e.g., "does the association between age and ever having a mammogram differ by region?"). This procedure was repeated individually for college, smoker, doctor, categories of social involvement, pap smear and breast self-examination variables. This was done individually (i.e., conservatively) because, as indicated in the Note in Table 2.7, evidence of model instability emerged. It was hoped that after this conservative process, variables that were found to vary significantly in the outcome by region could be coaxed into an overall model. This procedure follows the recommendation to build up models of increasing complexity in a cautious, stepwise fashion (Goldstein, Rasbash, et al. 1998; Snijders & Bosker 2000).

The association between each individual level variable and ever having a mammogram failed to be significantly different from region to region. And, in each case, the intercept and its random term remained essentially the same from that estimated in the previous step (data not shown).

Overall, the application of this step failed to detect an association among the individual level variables and ever having a mammogram that differed from region to region. Thus, regional variation in ever having a mammogram cannot be attributed to these individual level relationships.

Step 4: Do characteristics of the region contribute to regional variation in mammography screening utilization?

The regional variation in the outcome, presented earlier in step 2, Table 2.6, was reported to be statistically significant at the $p<0.10$ level. The analysis continued to explore possible reasons for area differences in ever having a mammogram.

The three regional level variables, the employment-population ratio (15 years and above), the percentage of the population without a secondary school graduation certificate (grade 9-13; 15 years and above), and the median family income of all families, were added to the base model in step 2. This was done separately as area income was highly correlated with employment and secondary school certificate. The results for each of these models are presented in Table 2.8. The parameter estimates for the intercept and the independent variables remained essentially the same as estimated previously (data not shown).

Model 4a considered regional level employment-population ratios[7] as an explanation for a woman's utilization of mammography. The fixed effect coefficient, 0.01, did not achieve statistical significance, implying that regional employment does not contribute to ever having had a screen.

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[7] These values have been centred from the sample mean employment-population ratio, which is absorbed into the intercept.

Model 4b considered the region's educational level[8]. The negative sign indicates that regional education is inversely related to ever having a mammogram. The fixed parameter estimate of secondary school diplomas, -0.05, was statistically significant. In step 2 it was estimated that the proportion of stereotypical women who ever had a mammogram was 86%. However, this model revealed that in a region where the number of high school diplomas is just 10% less than the provincial mean, women have a 79% probability of ever having had a mammogram (assuming all other variables held constant).

To guard against the claim that this regional education effect is simply due to misspecified individual level education effects, the parameter estimates for individual college/university are also presented. Major changes in the coefficient of this variable from its previous value in Table 2.6 (log odds 0.18, SE 0.09) might indicate confounding effects. As can be seen in Table 2.8, its estimate remained fairly similar (log odds 0.16, SE 0.10) in this model, implying that two separate educational effects were at play. Both individual level education and regional level education had an association with ever having a mammogram.

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[8] These values have been centred from the sample mean of the education variable, which is absorbed into the intercept.

Similar results were found using regional median family income[9]. The associated beta coefficient was statistically significant, indicating that regional median family income has a positive influence on ever having a mammogram[10]. As indicated earlier, the individual level income variable had too many missing responses to be included in the modelling, so it was not possible to completely rule out the criticism that perhaps these effects were confounded with individual level ones.

Turning to the random effects estimates, the variation in the outcome among regions was not greatly influenced by the inclusion of the contextual variables – employment, education or income – in any of the models. That is, contextual variables did not explain any of the regional variation in ever having had a mammogram. Overall, this step revealed that regional income and regional education had a significant influence on ever having had a mammogram. These effects, however, did not significantly differ by region, implying that they were constant across the province.

Step 5: Do characteristics of the region constrain or facilitate the influence of factors associated with mammography screening utilization?

The two significant regional level variables, percentage without secondary

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[9] These values have been centred from the sample mean median family income, which is absorbed into the intercept.

[10] At this point in the analysis, MLWin crashed repeatedly. The programmers provided a "patch" (i.e., a macro) to help the situation. Consequently, a significant result was generated but its direction of effect was not clear.

school certificate and median family income, were tested for cross-level interaction effects. That is, it was determined if either of these variables modified the relationship of an individual level variable and mammogram uptake. These regional variables were analysed in separate models, and were found to be significantly related to a high level of social participation (i.e., the "4" social involvement score).

The first set of data in Table 2.9 refers to the model using the education variable. The magnitude of the fixed effect of a "4" social involvement score on mammography screening uptake remained as it was in previous models. More interestingly, the fixed effect of percentage without a secondary school certificate changed from -0.05 (Table 2.8) to -0.11. This suggests an even greater influence of regional education on ever having had a mammogram when cross-level interactions are considered. To illustrate, in a region where the number of high school diplomas is just 10% less than the provincial mean, women have a 68% probability of ever having had a mammogram (assuming all other variables held constant).

A significant cross-level interaction effect of high levels of social involvement on education was demonstrated. Furthermore, this effect was in the positive direction. This implies that the effect of a woman's increased participation in volunteer activities, associations and religious services modifies the previously detrimental relationship of living in a less educated region in relation to ever having had a mammogram.

The second set of data in Table 2.9 refers to the model with regional median family income. The parameter value associated with the high social involvement score was unaffected. The fixed effect of regional income had to be constrained to zero to facilitate model convergence; this log odds value was statistically significant. Similarly, the cross-level interaction effect with social involvement had to be treated in the same manner, and it was also significant. The data suggest that regional income and social involvement have a joint influence on ever having had a mammogram.

In both these models, the magnitude of the variance among regions in the outcome remained essentially as that in previous steps. It continued to be statistically significant at the $p<0.10$ alpha level. These results imply that variation among regions in ever having had a mammogram is not explained by the joint individual and contextual level effects explored in this step.

Model Diagnostics

Significant variables from previous steps were combined into one model for the purposes of checking model assumptions. A correlation matrix of independent and dependent variables was used to examine correlation among variables; no problems were detected except for evidence of high correlation among the contextual variables. For this reason they were treated in separate analytical models (steps four and five).

Theoretically, the level one random term was constrained to one[11]. To check for over- or under- dispersion of the binomial distribution, the models were fit with extra-binomial variation. In other words, the models were checked for remaining variation above and beyond that accounted for by the sampling variations of the binomial random term. These results demonstrated no statistically significant departures from the binomial assumption, thus providing no indication of model misspecification.

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[11] Initially, logistic models are estimated as a binomial distribution with a first-order Taylor expansion and marginal quasi-likelihood procedures. Once stable convergence is achieved, further model estimation is carried out by allowing extra-binomial distribution with a second-order Taylor expansion and predictive quasi-likelihood procedures. This second step provides improved estimates of model parameters. This procedure was carried in the current analysis (Duncan, Jones, et al. 1999).

Table 2.4: Distribution of Study Variables

Type of Variable	Variable	% of Study Sample	% of Weighted Study Sample
Dependent	Ever Had a Mammogram		
	Yes	79.2	78.0
	No	20.8	22.0
	Missing Responses	2.5	4.3
Individual	Marital Status		
	Married, Common-law, Partner	61.4	71.4
	Single, Divorced, Separated, Widowed	38.0	28.2
	Missing Responses	0.5	0.4
	Years Since Immigration		
	Recent Immigrant (0-9 yrs)	1.4	3.5
	Established Immigrant (10 years +)	24.8	30.5
	Not an Immigrant	73.6	64.3
	Missing Responses	0.8	1.7
	Education Level		
	Less Than Secondary School	31.6	30.1
	Secondary School	21.0	21.6
	Other Post-Secondary School	17.3	15.7
	College/University	28.6	30.3
	Missing Responses	1.5	2.3
	Smoker		
	Daily	20.4	17.8
	Occasionally	2.3	2.0
	Not at All	77.1	79.8
	Missing Responses	0.2	0.3
	Had a Pap Smear		
	Yes	90.4	88.2
	No	6.4	6.9
	Missing Responses	3.1	4.9
	Conducted Breast Self-Exam		
	Yes	79.8	76.9
	No	16.9	17.9
	Missing Responses	3.2	5.2

	Derived Social Involvement Score		
	0	27.7	27.2
	1	14.9	14.5
	2	29.8	30.1
	3	6.4	6.2
	4 (most social)	18.8	17.9
	Missing Responses	2.5	4.0
	Has a Regular Physician		
	Yes	96.5	96.4
	No	3.5	3.6
	Missing Responses	0	0
	Age	59.00 (mean)	58.6 (mean)
Contextual	Employment-Population Ratio	59.63 (mean)	n/a
	Percentage Without Secondary School Diploma	19.22 (mean)	n/a
	Median Family Income	50,787 (mean)	n/a

Table 2.5

Log-Odds Estimates for Step 1 - Does lifetime mammography screening utilization vary from region to region?

Fixed Effect	**Coefficient**	**S.E.**
β_{1j} = Intercept	1.35	0.06
Random Effects	**Variance Components**	**S.E.**
Variance btwn regions:		
$\sigma^2_\mu = \text{var}(\mu_{1j})$	0.04	0.02

Table 2.6

Log-Odds Estimates for Step 2: Does composition account for any of the variation among regions?

Fixed Effect	**Coefficient**	**S.E.**
β_{1j} = Intercept	1.82	0.09
$\beta_{2=}$ Age (Differential)	0.01	0.01
$\beta_{3=}$ College	0.18	0.09
$\beta_{4=}$ Daily smoker	-0.42	0.09
$\beta_{5=}$ No doctor	-1.46	0.18
$\beta_{6=}$ '0' social involvement score	-0.21	0.09
$\beta_{7=}$ '3' social involvement score	0.54	0.20
$\beta_{8=}$ '4' social involvement score	0.46	0.12
$\beta_{9=}$ No pap smear	-1.62	0.13
$\beta_{10=}$ No breast self- exam	-0.54	0.10

Random Effects	**Variance Components**	**S.E.**
Variance btwn regions:		
$\sigma^2_\mu = \text{var}(\mu_{1j})$	0.05	0.03

Note: only significant variables are presented

Table 2.7

Log Odds Estimates for Step 3: Does the influence of the factors associated with mammography screening differ among regions?

Random Effect	Regional Variance (& SE)	Covariance (& SE)
Age (Differential)	0.002 (0.002)	0
College	0	0
Daily smoker	-0.01 (0.03)	-0.05 (0.04)
No doctor	0.01 (0.04)	-0.21 (0.10)
'0' social involvement score	0	0
'3' social involvement score	0.06 (0.06)	0.05 (0.24)
'4' social involvement score	-0.11 (0.06)	0.16 (0.14)
No pap smear	0	0
No self-breast exam	0.03 (0.03)	-0.005 (0.06)

Note: exact values of zero indicate that negative variances for these variables had to be constrained to zero to facilitate model convergence.

Table 2.8

Log Odds Estimates for Step 4: Do characteristics of the region contribute to regional variation in mammography screening utilization?

	Fixed Effect	**Coefficient**	**S.E.**
Model 4A	β_{11}= employment-population ratio	0.01	0.01
	Random Effects	**Variance Components**	**S.E.**
	$\sigma^2_{\mu} = \text{var}(\mu_{1j})$	0.06	0.03

	Fixed Effect	**Coefficient**	**S.E.**
Model 4B	β_{11} = without a secondary school graduation certificate	-0.05	0.02
	$\beta 3$ = college	0.16	0.10
	Random Effects	**Variance Components**	**S.E.**
	$\sigma^2_{\mu} = \text{var}(\mu_{1j})$	0.04	0.02

	Fixed Effect	**Coefficient**	**S.E.**
Model 4C	β_{11} = median family income	0.00	0.00
	Random Effects	**Variance Components**	**S.E.**
	$\sigma^2_{\mu} = \text{var}(\mu_{1j})$	0.04	0.02

Table 2.9

Log Odd Estimates of Step 5: Do characteristics of the region constrain or facilitate the influence of factors associated with mammography screening utilization?

Regional percentage without a secondary school graduation certificate:

Fixed Effect	Coefficient	S.E.
β_7 = '4' social involvement score	0.43	0.13
β_{11} = without graduation certif.	-0.11	0.03
β_{17}= grad x '4' social	0.18	0.05

Random Effects	Variance Components	S.E.
Variance btwn regions:		
σ^2_μ = var (μ_{1j})	0.04	0.02

Regional median family income:

Fixed Effect	Coefficient	S.E.
β_7 = '4' social involvement score	0.44	0.13
β_{11} = regional income	0.00	0.00
β_{17}= income x '4' social	0.00	0.00

Random Effects	Variance Components	S.E.
Variance btwn regions:		
σ^2_μ = var (μ_{1j})	0.04	0.02

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CHAPTER TWELVE: DISCUSSION OF RESULTS

Does the Lifetime Prevalence of Mammography Utilization Vary Systematically by Region of Residence?

The results from this study suggested that the lifetime prevalence of mammography utilization varied systematically by health region. This finding was moderately statistically significant, and the possibility remains that the result might be due to chance.

It was reasonable, however, to carry forth with the analysis on the grounds that the analytical procedure is still under development. The estimation techniques for logistic multilevel modelling are continually being updated within the statistical program, and borderline significant results ought not to be immediately discarded. In this study, regional variation in the outcome was deemed to be significant at the $p < 0.10$ alpha level.

Another reason for carrying forth with the analysis was to determine if *regional effects* were present, above and beyond any (or lack of) regional variation in the outcome. Such effects might not differ from region to region, but they are still important to detect if a comprehensive understanding of mammography uptake is desired.

By way of validation, the study findings conformed with Goel and colleagues' (Goel, Iron, et al. 1997) study based on Ontario Health Insurance Plan fee-for-service data. The authors showed significant variation in mammography utilization across Ontario District Health Council boundaries, which are similar but not exactly the same as public health boundaries. Within the multilevel modelling literature, the results were in accordance with other health-related studies which also demonstrated less variability among contexts and more among individuals (e.g., Beland, Birch, et al. 1999; Carr-Hill, Rice, et al. 1996; Diez-Roux, Nieto, et al. 1997; Humphreys & Carr-Hill 1991).

The analysis established that these variations were not due to the social profile of the women living in the health regions. In other words, the composition of the region did not account for the geographical differences in the outcome. This was an interesting finding given that the population across the province is heterogenous, but, as demonstrated by the analysis, this diverse make-up did not have an influence on mammography uptake. Other researchers have shown that health-related behaviours that seem to differ by contextual settings can in fact be explained by the people in those settings (Brooks-Gunn, Duncan, et al. 1993; Diehr, Koepsell, et al. 1993; Fox, Jones, et al. 1984; LeClere, Rogers, et al. 1997; Sloggert & Joshi 1994). While this was not the case here, it was still theoretically important to rule out influences on mammography uptake due to composition.

Identifying health region variation in ever having had a mammogram was a useful first step to understanding mammography underutilization. From this vantage point, the options for future breast health policymaking are expanded from simply individually based ones to those that also consider the environment within which screening occurs.

2) To What Extent do Individual and Contextual Level Variables Explain Regional Variation in the Utilization of Mammography Screening?

The primary finding from the analysis was that the selected individual and contextual level variables did not explain, or contribute to the differences among regions with respect to lifetime prevalence of screening. In other words, the tendency for health regions to vary in mammography uptake did not change after age, education, smoking status, having a physician for care, social involvement, having a Pap smear, conducting breast self-exams and regional level socioeconomic status were considered. On the other hand, some variables demonstrated significant associations with the outcome. This implies that while individual and contextual level variables had an influence on ever having had a mammogram, this influence did not differ among health regions.

Care was taken to identify a reasonable individual level model of mammography utilization. Appropriate variables were selected based on previous studies of mammography screening, and the corresponding multilevel model was strongly statistically significant. Thus, there was a high degree of confidence in the specification of the individual level processes associated with ever having had a mammogram.

In fact, the majority of the variables demonstrated an association with the outcome that was consistent with previous literature. There were a couple of unexpected findings, however, with respect to the individual level model. For one, age did not demonstrate a statistically significant relationship with the outcome, as was expected. In retrospect, however, the age range was narrowly defined in this study (50 - 69), and has in the past demonstrated the least variability in mammography utilization compared to other age ranges (Goel, Iron, et al. 1997). This has been attributed to the consensus in screening recommendations for this age group compared to other age ranges (Goel, Iron, et al. 1997).

Personal education level did not demonstrate a significant relationship with mammography uptake. It was expected that women with higher education levels would have had more screens (Katz & Hofer 1994). This study suggested a change in the general trend – that less educated women were now obtaining screening like their advantaged counterparts. The possibility for this explanation is supported by the relatively high average proportion of ever having a mammogram across the province. What is not revealed in the data, however, is whether the number of screens differs by education level.

The analysis explored whether the individual associations with mammography uptake might differ by region. For example, the association between not having a physician and ever having a mammogram might play out differently depending on where one lived. This type of relationship was not evident for any of the individual level variables. The majority of multilevel studies do not go so far as to pursue this part of the analysis, but such variable individual level effects have been detected by some researchers (Beland, Birch, et al. 1999; Carr-Hill, Rice, et al. 1996).

Two of the three regional indicators of socioeconomic status demonstrated influences on the outcome, but these influences were not geographically variable. Employment-to-population ratios did not have a significant influence on ever having had a mammogram, while regional education and regional income were positively associated with uptake. The possibility of a synergistic regional socioeconomic effect on uptake still remains, however. Such an effect was not tested here because the regional variables were treated in separate models. The use of a socioeconomic index in a future analysis could shed light on this possibility. Previous studies suggest that area deprivation or disadvantage might explain health or health behaviours (after controlling for individual level factors), but not all studies demonstrate statistically significant effects (Ecob & Macintyre 2000).

Overall, the findings suggested that different dimensions of area socioeconomic status influenced uptake, and they did so in a uniform manner across the province. Earlier it was put forth that regional socioeconomic influences "worked" by limiting or enhancing the choices available for a woman to support good health and health behaviours. The study results support this general concept as advantaged areas positively influenced mammography uptake. Furthermore, in the case of education, the analysis demonstrated two independent, separate effects on ever having a mammogram arising from the individual and the regional level.

In general, the contextual literature has been criticized for not detailing specific mechanisms by which areas might influence the health of their residents (MacIntyre, MacIver, et al. 1993). In this absence, many studies have used contextual boundaries based on census geographies, a tactic that was avoided in this study. Instead, health planning regions were selected such that the results would be policy-informing. Furthermore, it is maintained that the choice of regional socioeconomic variables was not unreasonable, given the well-accepted body of literature that draws a strong association between individual level socioeconomic status and health. At the same time, it is granted that other area variables which were not included in this analysis might also demonstrate an association with mammography uptake and thereby explain the variation in the outcome by region.

The analysis also showed significant joint influences on mammography uptake. Specifically, being socially involved dampened the negative effect of regional education, and involvement also demonstrated an effect with regional income, in association with ever having a mammogram. In this study contextual variables demonstrated a general spatial effect across regions rather than a specific social effect among individuals, within a region.

Policy Implications

There are directives for decision-makers arising from this analysis. Foremost is the point that concern need not necessarily be directed to particular health regions. The lifetime prevalence of mammography screening was uniform across the regions, as were the effects of individual and contextual level variables considered here.

The models suggested that the estimated average proportion of Ontario women, aged 50 -69, who reported ever having a mammogram was 0.86. This figure represented both screening and diagnostic mammograms, as well as mammograms conducted outside of the Ontario Breast Screening Program. The current political push, in contrast, is to encourage women to attend OBSP, where high-quality screening can be provided, and where population breast health statistics are recorded and evaluated periodically. The figure 0.86 cannot, however, be used as an indicator of OBSP outcomes; previous documentation was presented that suggested that OBSP could improve its recruitment efforts.

To accomplish this, the analysis underlined some "pressure points" that could be used to increase levels of screening. These include a focus on the individual and contextual level variables that were discussed above. The key, however, is not an intervention that concentrates on one or two of these variables, but rather an intervention that integrates a synergistic effect to achieve higher levels of screening. This suggestion is based on the finding that at least one of the contextual variables in this study displayed patterns with certain individuals. Thus, future research might do well to focus on interventions that target multiple audiences (e.g., individuals and communities) with multiply-focussed strategies (e.g., healthy public policy and individually targeted behaviour changes) which are informed by the results of this study.

Was a Multilevel Analysis Necessary?

The research problem included data from regional and individual levels, thereby presenting as a multilevel problem. One of the advantages of hierarchical multilevel modelling over other analytical techniques is the appropriate treatment of clusters within the data. Given that the intraclass correlation was low (0.012), and that ultimately it was shown that variation in the outcome by health region could not be explained by the variables considered, one might ask whether a single level regression model might have been sufficient for this study.

For many reasons, ignoring the higher level structure in the data with the use of a single level analysis would have been inappropriate. First, inferences from a single level analysis might fall prey to the ecological or atomistic fallacy if not done properly. In this study there was an upfront interest in the character of regions, as well as the character of individuals, as they related to mammography uptake. A technique that would facilitate interpretations at both levels was required. Second, a related point: multilevel modelling more closely resembles the separate pathways (individual and contextual) that were conceptualized as important to understand. Single level modelling "collapses" these pathways, conceptually speaking. Third, while this study fell short of (significantly) explaining the variation in the outcome among regions, at least the analytical technique facilitated this examination. The structure of the error terms in a single level model would not have permitted this exploration.

Thus, it is strongly suggested that unless one has a priori theoretical grounds for ignoring the higher level structure, appropriate techniques ought to be used to examine the data.

Limitations of the Research

There are limitations to using the National Population Health Survey as a data source. The data are subject to biases common to self-reported surveys, including recall bias and social desirability bias. A previous study reports, however, close association between self-reported mammograms and chart review (Zapka & Bigelow 1996).

Respondents may not have been able to discriminate between a screening versus a diagnostic mammogram. Goel (Goel, Iron, et al. 1997) investigated this problem using hospital and Ontario Health Insurance Plan data for women between the ages of 50 - 69. He estimated that 72 - 89% of the mammograms were for screening purposes, implying that the dependent variable response in this analysis might be slightly inflated.

The inability to separate screening from diagnostic mammograms might have confounded the analysis. That is, the associations between the independent and dependent variables might in fact be due to a third variable. For example, diagnostic mammograms, which might constitute one-quarter of the dependent variable, might be associated with women with higher socioeconomic status. Such women might have better access to primary care, thereby leading to diagnostic mammograms. They might also have diagnostic mammograms because they experience high incidence levels of breast cancer. Such women are also likely to be associated with the independent variables in this analysis (e.g., attended college, had a Pap smear, non-smoking, etc.).

Furthermore, one might argue that the entire data set – screening and diagnostic mammograms – is more likely to be associated with higher socioeconomic status women (SES), as demonstrated by previous research. There are three reasons why the impact of such possible SES confounding was minimal in this study. First, the analysis attempted to control for SES by including personal education level in the analysis. Second, over 95% of respondents had a regular physician for care – a referral source for a diagnostic mammogram (see Table 2.4) (although it is granted that physician referral patterns and patient behaviour with respect to physician recommendations were not examined here). Third, the bivariate analysis of the sample data demonstrated a small difference in educational levels (as a SES indicator) among those who reported having had a mammogram, and among those who did not report one. Of those who had one, 29% had less than a secondary education while 33% had a college/university degree. Of those who had not had a mammogram, 38% had less than a secondary education while 25% had a college/university degree. Thus, in general, women who experience higher incidence levels of breast cancer did not seem to be reporting more mammograms than other respondents. For these three reasons it was felt that the study findings were not greatly affected by individual SES confounding effects.

A better data set would be one that recorded mammography uptake, and type of mammogram, based on administrative records instead of self-reported data (the NPHS is based on self-report). It would also include comprehensive demographic and socioeconomic status information for those researchers interested in contextual influences on health behaviour. To be most useful, however, this better data set would also capture demographic and socioeconomic status information about women who *do not attend* mammography screening. The NPHS provides information about these women, and therefore was an attractive source of data for this study.

The dependent variable in this study was ever having a mammogram in one's lifetime. It might have been more informative to limit the response to those who have had a screen in the last two years, a period which conforms with current guidelines. Different explanations for underutilization might exist between first and subsequent screenings (Zapka, Stoddard, et al. 1991). However, unreliable sample sizes as per Ontario Ministry of Health release guidelines prevented this line of inquiry.

A decision was made to select public health regions as the relevant context. This was done because mammography utilization can be affected by polices and procedures implemented by public health units, and as such, the findings of this study can be policy-informing. Other types of contexts, such as the workplace, are also possible. The selection of smaller geographic areas, such as neighbourhoods, might have been informative but would not have conformed with the Ontario Ministry of Health's guidelines for data release due to unreliable sample sizes.

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CHAPTER THIRTEEN: CONCLUSIONS

This study incorporated data from women and health regions to gain a better understanding of mammography uptake. The two primary research questions were: 1) Does the lifetime prevalence of mammography utilization vary systematically by region of residence?, and 2) To what extent do individual and contextual level variables explain regional variation in the utilization of mammography screening? Logistic hierarchical multilevel modelling was used to analyze the data, and the summarized findings are as follows:

1) In Ontario, there were modest variations among health regions in ever having had a mammogram for women between 50 - 69 years.

2) These variations could not be explained by the individual and regional level variables considered in the study.

> 2a) Regional variations in mammography uptake were not attributed to composition effects (i.e., not due to the social profile of women in each region).
>
> 2b) The individual level variables' relationship with mammography uptake did not vary from region to region, and hence did not explain the regional variations.
>
> 2c) Regional variations in mammography uptake could not be explained by regional level socioeconomic status indicators.
>
> 2d) Effects of cross-level interactions among variables did not explain the regional level variations in mammography uptake. In other words, any effects at the contextual level that constrained or mediated effects at the individual level did not demonstrate geographic variability.

Regional variation in the outcome could not be accounted for by the variables considered here. This implied that either the variables were not associated with ever having had a mammogram, or that these associations were present but did not differ from region to region. The findings demonstrated that the variables did influence the outcome:

3) After accounting for individual and contextual level variables, the estimated average proportion of Ontario women, aged 50 - 69, who reported ever having had a mammogram was 0.86.

4) Having a college degree and high levels of social involvement were positively associated with ever having had a mammogram. Being a daily smoker, not having a regular physician, not having had a Pap smear and not conducting breast self-exams were negatively associated with ever having had a mammogram. The overall individual level model of mammography uptake was statistically significant.

5a) Regional education (i.e., the percentage of those without a high school diploma in a region) was negatively associated with ever having had a mammogram.

5b) Regional median family income influenced mammography uptake.

6a) Having a high degree of social involvement in volunteer activities, associations and religious services dampens the detrimental influence of a less educated region on ever having had a mammogram.

6b) Having a high degree of social involvement in a high income region presents an additional influence on mammography uptake.

Summary of Contributions

A number of original contributions to knowledge were generated from this study. First, many substantive insights about mammography screening were uncovered, as listed above. Both individual and contextual variables demonstrated an effect on ever having had a mammogram. These associations did not, however, contribute to variations in the outcome by region. These insights are important to consider by those decision-makers involved in planning breast health policies and programs.

The line of inquiry pursed here has challenged the current theoretical perspective on mammography uptake. Previously this perspective had been focussed on individual level accounts of uptake. As a result of this study, researchers in the field might be stimulated to broaden the conceptualization of the issue to now include the effects of community level social and political structures on participation in mammography programs.

A step removed from this specific issue is the general idea of context as it influences health and health-related behaviours. Health promotion programs cannot continue to try and change individual behaviours without appreciating the circumstances in which these behaviours take place. To do so might overestimate the success of such programs, perhaps to the detriment of a sub-population's health. The overall goal of this dissertation has been to maintain the contextual integrity in the study of individual level phenomenon; this research contributes to the growing literature in the area.

Methodologically, a new statistical technique – logistic hierarchical multilevel modelling – was applied to the study of mammography utilization. This technique permitted the exploration of separate and joint individual and contextual level effects on a binary outcome. Conducting the analysis with both levels of data guarded against committing the ecological and atomistic fallacies when interpreting findings. Unlike many multilevel studies, policy-relevant geographic boundaries were selected as the contextual level. By doing so, it was hoped that findings would be useful to public health units and other organizations concerned with breast health issues.

Future Research

This study considered the ways in which regional characteristics influenced a particular health behaviour. Indeed, most empirical works and discussions about the role of context tend to concentrate on this direction of the effect: from the community, to the individual. Individuals can also shape communities, however, through establishing social norms, supporting particular political structures or establishing resources. In turn, it is the collective community "spirit" that is thought to influence health. While researchers have started to understand the ways in which health can be influenced by community level factors, little attention has been given to the ways in which the health of individuals influences community social structures. Thus, this study can be extended by more explicitly considering the reciprocal relationship between women, their communities and mammography uptake (or other health-related behaviours).

CONCLUDING REMARKS

The main theme in this dissertation is the idea of incorporating a context-sensitive approach in health research. That is, designing the research such that the relevant circumstances were identified alongside the health-related problem of interest. Of particular interest was understanding *the interplay* between circumstances and the health problem. This theme was integrated into both the studies comprising this thesis.

In the first study, *Research Utilization by Public Health Units in Ontario*, a case study design was used to support a contextual perspective. It was originally thought that *differences* in organizational and environmental circumstances might account for underutilization of the research report. By paying close attention to relevant circumstances, however, it became clear that contextual *similarities* across cases were the key. Looking at contextual similarities added a "richness" to the study results. For example, the tension between senior public health officials' desire for research-based public health guidelines and public health unit nurses' concerns about such guidelines emerged. By ignoring context, one might think the involvement strategy was ineffective. This contextualized study led to the conclusion, in contrast, that the involvement strategy ought not to be abandoned altogether, as it might serve to resolve officials' and nurses' concerns. Thus, the contextual approach proved essential to properly assessing the involvement strategy.

The objective of the second study, *Regional and Individual Explanations for Mammography Uptake*, was to detect possible contextual differences in mammography uptake rates, and to determine if contextual characteristics could account for any such differences. A novel statistical technique was used to focus deliberately and rigourously on effects arising from health regions. The analysis demonstrated that, generally speaking, better-off health regions were associated with increased lifetime mammography uptake, irrespective of individual socioeconomic status. Two points need to be highlighted with respect to this study. First, the empirical results established that "context matters" in the case of mammography screening uptake. Second, the study broadened the conceptualization of the underutilization problem to now consider contextual influences on uptake. Once again the contextual approach proved to be valuable for health research.

To summarize, this thesis incorporated a context-sensitive approach in two very different types of studies. Furthermore, two different methods were used to seek out, and understand, the way in which circumstances influenced particular health-related outcomes.

It is hoped that this thesis might inspire other health researchers to also adopt a context-sensitive frame of reference. By doing so, a number of objectives might be fulfilled. More creative and rigourous ways to study context might be developed. A more meaningful discourse around definitions of context could arise. And perhaps most importantly, the mechanisms by which contextual factors influence individuals could be given greater attention.

It is also suggested that decision-makers need to adopt a similar frame of reference. The results of these studies demonstrated that community characteristics were associated with health-related outcomes. Therefore, program performance ought to be understood in relation to local circumstances. Otherwise, outcomes might be over- or under-estimated. This is especially relevant to public health programs that operate in the community, and which try and deal with health issues that are caught in the "web of causation."

In conclusion, the two studies in this dissertation satisfied the desire to bring newer contextual approaches to health research. By doing so, richer research findings were uncovered, opportunities for multilevel interventions were identified, and social sciences research was more strongly linked with health services research. In other words, the contextual approach improved the research process.