June 2002

Adherence to Routine Mammography and Pap Test Screening Guidelines: Results From a Local Health Survey

Diana Mlynarski

ADHERENCE TO ROUTINE MAMMOGRAPHY AND PAP TEST SCREENING GUIDELINES: RESULTS FROM A LOCAL HEALTH SURVEY

Diana Mlynarski

B.A., Providence College, 1997

A Thesis

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Public Health

at the

University of Connecticut

2002

APPROVAL PAGE

Master of Public Health Thesis

ADHERENCE TO ROUTINE MAMMOGRAPHY

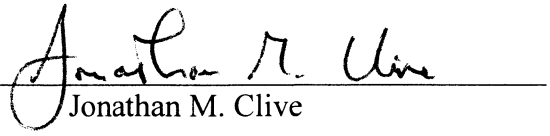
AND PAP TEST SCREENING GUIDELINES:

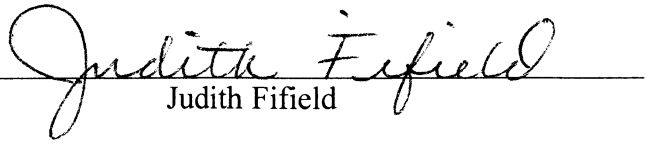
RESULTS FROM A LOCAL HEALTH SURVEY

Presented by

Diana Mlynarski, B.A.

Major Advisor 
Holger Hansen

Associate Advisor 
Jonathan M. Clive

Associate Advisor 
Judith Fifield

University of Connecticut

2002

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my advisors, Holger Hansen, Jonathan Clive and Judith Fifield, for their valuable guidance, infinite patience and unwavering support as I worked toward the completion of this thesis. I must also express my gratitude to Joan Segal, who has demonstrated her enduring kindness and support throughout my graduate education at UConn.

Additionally, I would like to thank my family and friends for all of their encouragement and support, especially in the last few months as I have neared completion of my thesis project.

This thesis is dedicated to the talented staff at the Manchester Health Department, who have come to be more than just work colleagues over the past two years, but great friends as well.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Though the United States is one of the most prosperous nations in the world, many preventable health problems still plague its people. Obesity, AIDS, diabetes, and heart disease affect millions in the U.S., but there seems to be no other affliction that carries with it as much fear and dread as cancer. Breast cancer is the second most prevalent cancer among American women, preceded only by skin cancer, as well as the second most deadly, surpassed only by lung cancer.[1] While not as common, cervical cancer continued to strike and kill thousands of women in the U.S. each year as well. Both of these cancers are greatly feared not only because of their mortality rates, but also because of the personal and intimate nature of the bodily areas they attack. However, both of these cancers are highly treatable and curable when they are discovered in their early stages. Two screening procedures used for early detection of these cancers, mammograms and Papanicolaou smear tests, are revered for their life-saving value and have been in widespread use in America's health care system for decades. But there remain thousands of women who have never received mammograms or Papanicolaou smear tests, and there is an even greater number of women who have had these clinical preventive services at some point in their lives, but do not continue to do so at regular, timely intervals. What differences separate those women who utilize mammography and Pap tests and those who do not? What factors can best be used to predict those women who will not obtain breast and cervical cancer screenings at regular, timely intervals? Many studies have focused on these questions, and specific patterns have emerged from the research. However, we first should examine the background context of such questions by recalling the history of women's health.

BACKGROUND

History of the Women's Health Movement

The term "women's health" has a long and varied history in the health care system of the United States. For some people, whether or not they are trained in the medical sciences, women's health is essentially a synonym for female reproductive health services, revolving around a woman's childbearing capacities and consisting mostly of pelvic examinations and prenatal care. We can see the tying of women's health to reproductive functions as far back as the late 1800s, when partial justifications were made for legislative policies prohibiting abortion and contraception on the basis of the preservation of women's health and their maternal role.[2] The enduring reproduction-centered view of women's health, focusing on women as mothers or potential mothers, is further evidenced by the merging of the areas of obstetrics and gynecology into a single medical specialty in 1930.[3] However, this mainstream view of women's health in the late nineteenth and early twentieth centuries did not go unchallenged for long. In her 1998 book entitled *Women's Health Care: Activist Traditions and Institutional Change*,[4] Carol Weisman describes three major periods of women's health activism that pushed health care professionals and society at large to extend their view of women's health beyond maternal matters. These periods include:

1) **The Progressive Era from 1890 – 1930:** In this period came the increasing demand for expanded maternal and child health services, which became official public policy through the creation of the Children's Bureau at the U.S. Department of Labor in 1912 and the passage of the Sheppard-Towner Maternity and Infancy Act of 1921. Additionally, this era saw the emergence of birth

control advocates, who emphasized the need for married women to exercise control over their reproductive and sexual lives. This notion was met with resistance by medical professionals, laypersons, and maternal and child health advocates as well, causing a rift in the women's health movement of this era.

2) **The Women's Health Movement of the 1960s and 1970s:** Political turmoil and social unrest extended into the realm of health care during this period, and women's health advocates rebuked the male-dominated and medicine-based system that characterized health care and health information services. It was also a time when reproduction-centered women's health was seriously challenged, as women demanded increasingly more control over their maternal status and no longer viewed childbearing and childrearing as essential and integral parts of their lives. Specifically, with the advent of the oral contraceptive pill and the legalization of surgical abortion, women had more viable options for controlling their reproductive functions.

3) **Women's Health Advocacy in the 1990s:** As more women attained positions of influence within the government, educational institutions, the judicial system, and health care organizations, they continued to support the rights of females to control their own reproductive lives by trying to curtail barriers to abortion services and by exposing the need for more effective contraceptive options for women. These advocates also shed light on other women's health concerns, including women's health care within a gender-based social context, the need for a larger number of females to be studied in medical research, and the need for more emphasis on the lifespan view of women's health.

The culmination of these three periods in the women's health movement resulted in the Breast and Cervical Cancer Mortality Prevention Act of 1990, from which emerged the Centers for Disease Control and Prevention's Breast and Cervical Cancer Early Detection Program.[1] This program, which is still ongoing, aims to increase access to mammography and Pap test screenings for underserved women. From the aforementioned periods of women's health activism also came the increase in federal funding for breast cancer research to $500 million in 1995 (up from $90 million in 1991),[4] and the establishment of the Women's Health Initiative, which focuses on midlife and older women's health issues, and is the largest research study ever funded by the National Institutes of Health.[5] Offices of Women's Health were established at the U.S. Department of Health and Human Services (DHHS) and at the Centers for Disease Control and Prevention (CDC), and the Office of Research on Women's Health was formed at the National Institutes of Health (NIH). Furthermore, in an effort to articulate a women's health research agenda, NIH proposed its own definition of women's health, as follows:

> *Diseases or conditions unique to women or some subgroup of women; diseases or conditions more prevalent in women; diseases or conditions more serious among women ore some subgroup of women; diseases or conditions for which the risk factors are different for women or some subgroup of women; and diseases or conditions for which the interventions are different for women or some subgroup of* women.[6]

While the complete omission of an emphasis (or even mention) of health and wellness is apparent in this definition, it does make clear that today's perception of women's health has evolved beyond the realm of reproduction, at least for many health professionals and health-related organizations. But a more complete and integrated

perspective of women's health involves more than simply extending beyond reproductive matters. Such a perspective must: concede that health is not just a matter of disease absence, but also involves psychological and social well-being; understand gender-based social and class inequalities as precursors for women-specific health issues, as health as a product of biological, cultural, psychological and social factors; acknowledge the multiple roles of women and their diverse health issues during different life stages, all of which involve, but do not revolve around, reproductive matters; and recognize the need for health promotion and disease prevention strategies.[2] Ideally, such a perspective also would recognize access to health care as a fundamental right, and not a privilege of class, gender or race.

Ongoing Issues in Women's Health

One of the greatest concerns in regard to the current state of women's health is the fragmentation of women's health care services. This concern has led American women's health care to be dubbed "a patchwork quilt with gaps," referring to the gaps in health services that have resulted from the separation of women's reproductive health care from all other women's health care.[7] This is evidenced by the multiple sites and sources of health care that women utilize to meet their various needs, such as reproductive health clinics, public health department clinics, hospital emergency departments, and private physician's offices. Such differing sources of health care mean that women risk not only redundancy of services when going from one provider to another, but also gaps in services because of the lack of coordination in their health care.[2,4,7] Varying use of clinical screening procedures has been associated with differing physician specialties. While physicians specializing in three areas (family/general practitioners, internists, and

obstetrician-gynecologists) provide most primary health care services to women, Bartman and Weiss found that generalists and internists were half as likely as obstetrician-gynecologists to perform a pelvic examination, a Papanicolaou smear, and a clinical breast exam during a routine medical examination.[4,8]

The Advent Pap tests and Mammography

There have been great advances in women's health over the past century. Since 1900, the average life span for American women has increased by over 30 years.[5] While there have been many valuable medical and scientific accomplishments that have contributed to the improvements in women's health, two of the most important are the Pap test and mammography.

In 1928, a Greek-born cytologist and pathologist named George Nicholas Papanicolaou announced a technique he had discovered to identify precancerous and cancerous cervical cells in women.[9] The technique, which we now call a "Pap smear" or "Pap test", involves gathering cellular material from the vaginal tract and cervix and smearing it on a glass slide, where it is microscopically examined for cellular abnormalities. Abnormal cells found through this test may develop into cervical or uterine cancer, but if detected early and treated promptly, it is now known that cervical cancer is one of the most successfully treated cancers.[10] Though Papanicolaou's discovery was a tremendous medical breakthrough in women's health, it was met with resistance and skepticism by the medical community at large.[9] Not until the 1950s did cervical cancer screening with Pap tests become mainstream in American medicine, and with widespread utilization came a historic drop in the incidence of cervical cancer, since detection of precancerous lesions by the Pap test led to early treatment of the lesions, in

effect preventing the cancer.[1] It follows that mortality due to cervical cancer also has been drastically reduced—by a full 70%—since cervical cancer has a survival rate of almost 100% if it is detected in its earliest stage, treated appropriately, and carefully followed-up.[1,11]

In 1913, a German surgeon, Albert Salomon, announced his attempts to detect cancer of the breast using radiography.[12] This involved taking an x-ray of the breast and examining the x-ray to detect abnormal masses and/or tumors in the breast tissue. Like Papanicolaou, Salomon's discovery of the mammogram was not widely accepted by the general medical community at the time. However, technical improvements in the procedure and the use of lower-dose radiation helped to mainstream mammography into the American health care system in the 1970s.[12]

Even with widespread usage, screening with mammography for the early detection of breast cancer has long been a subject of controversy because of the perceived risks associated with radiation. A recent review of several long-term mammography trials questioned not only the data collection and analysis methods used in these trials, but moreover challenged the efficacy of screening mammograms in decreasing breast cancer mortality rates.[13] Many health agencies, organizations and professionals (such as the American Cancer Society and the National Cancer Institute) have not agreed with the findings of this review, and according to former CDC Director Jeffrey P. Koplan, routine mammography screening remains "the best available method to detect breast cancer in its earliest, most treatable stage—an average of 1.7 years before the woman can feel the lump".[1]

Unlike the Pap test, which can detect precancerous lesions that can be treated to prevent cancer, mammography detects breast cancer itself and not its precursors. It therefore follows that, with the number of new cancer cases being found through the widespread use of mammography, breast cancer incidence rates have increased—by over 40% between 1973 and 1998.[14] However, as mammography is able to detect the disease in its earlier stages, mortality rates have decreased; when breast cancer is diagnosed at a local stage, its victims have a five-year survival rate of 96%.[1]

Mammography and Pap test Screening Guidelines

Recognizing the value that both mammograms and Pap tests have in reducing morbidity and mortality, several health agencies and organizations have produced specific guidelines for frequency schedules of routine mammography and Pap tests. These guidelines have been continuously revised as scientific knowledge accumulates over time, in order to reflect the optimal screening schedule through an analysis of the benefits and risks associated with these screening procedures.

While there is mostly general agreement in regard to Pap test screenings, an optimal mammography screening schedule is still a matter of debate. Recommendations for mammography for women aged 50 years and older are basically similar; most of the controversy surrounds women age 40 - 49, for whom "the evidence that screening mammography reduces mortality from breast cancer is weaker, and the absolute benefit of mammography is smaller, than it is for older women," notes the U.S. Preventive Services Task Force (USPSTF).[15] Recommendations for mammography screening of several health promotion and health care entities include:

- **U.S. Preventive Services Task Force:** The USPSTF recommends screening mammography with or without clinical breast examination every 1 – 2 years for females aged 40 and older.[15] The U.S. Department of Health and Human Services (DHHS) endorses the recommendation of the USPSTF.[16]
- **American Cancer Society:** ACS recommends annual mammography screening for women beginning at age 40.[17] The American Medical Association and the American College of Radiology support the same guideline.[18,19]
- **American College of Obstetricians and Gynecologists:** ACOG recommends screening with mammography every 1 – 2 years for women aged 40 – 49, and annually for women aged 50 and older.[20]
- **American Academy of Family Physicians:** AAFP recommends mammography every 1 – 2 years beginning at age 40 for high-risk women, and beginning at age 50 for average-risk women.[21] The American College of Preventive Medicine recommends this guideline as well.[22]

Guidelines recommended for the commencement and timing schedule of Pap tests are not nearly as numerous or varied as those for mammography. The guidelines for cervical cancer screening are as follows:

- **United States Preventive Services Task Force:** The USPSTF recommends beginning Pap tests when a female first becomes sexually active, and assumes sexual activity by the age of 18.[23] Therefore, it is recommended that Pap testing begin at age 18 or at onset of sexual activity, if earlier than age 18, and should be repeated at least every three years. Pap testing is not

believed to be necessary for women who have had a complete hysterectomy, in which the entire cervix was removed, unless the procedure was performed because of cervical cancer or precancerous cells of the cervix.[23,24] The USPSTF also acknowledges that there is insufficient evidence to make a recommendation about the age at which to discontinue Pap testing. Recommendations for cervical cancer screening disseminated by the Institute for Clinical Systems Improvement concur with the guidelines promulgated by the USPSTF.[24]

- **American Cancer Society:** ACS released new cervical cancer early detection guidelines in November 2002. The organization recommends that Pap testing begin three years after a woman becomes sexually active, but no later than 21 years old, and that Pap tests should be continued yearly (for traditional Pap tests) or every other year (for the newer, liquid-based tests) until age 30. Women who reach the age of 30 and have had three consecutive normal Pap tests may choose to be screened every 2 to 3 years, and women 70 and older who have had three consecutive normal Pap tests, with no abnormal tests in the past decade, may choose to terminate screening. Pap testing after a complete hysterectomy is recommended only if the surgery was necessary because of cervical cancer or pre-cancer. These recommendations are intended for women with no increased risk of cervical cancer, and not for those who are at higher risk, who may need to be screened more frequently.[25]

Utilization Rates of Mammography and Pap tests

Despite continuous scientific research and technological advancement, breast and cervical cancers continue to affect thousands of U.S. women each year. Over 99% of the estimated 193,700 new cases of breast cancer that emerged in American in 2001 were found in females—evidence that breast cancer remains a very prominent women's health issue.[26] Over 40,000 women are estimated to have died from breast cancer in the same year. Almost 13,000 U.S. women were diagnosed with cervical cancer in 2001, and it was the cause of 4,400 deaths. [26]

The above morbidity and mortality numbers demonstrate that even with the proven life-saving benefits of mammography and Pap tests, and with programs such as the CDC's National Breast and Cervical Cancer Early Detection Program (NBCCEDP) that aim to increase access for underserved women, there are still women who do not receive these screening procedures at regular, timely intervals. While no screening test has complete efficacy as to detect all early stage cancers (or precancerous lesions), the mortality and morbidity rates for breast and cervical cancers seem to indicate not a lack of sensitivity of the screening procedures, but rather underutilization of these services.

It should not be assumed, however, that underutilization of mammography and Pap tests reflects the desire or intent of women who are not receiving these screenings at the optimal recommended time schedules. Indeed, the role of practitioners who provide primary care services to women must be taken into account when examining mammography and Pap test utilization rates. While individuals may have every intention of obtaining these screenings at optimal time intervals, many times the ultimate decision lies with the health care provider, as it is the provider who must order and/or perform

such screening tests. Some women may not be aware of breast and cervical cancer screening guidelines, and therefore may rely on their physician (or other medical care provider) to be aware of and follow recommended guidelines for preventive screening procedures. And as noted previously, physicians in some specialties are less likely to perform preventive screening tests during routine medical examinations than others. So when studying the factors that affect utilization patterns of breast and cervical cancer screenings, it cannot be overlooked that physician behaviors can be equally as influential, or perhaps even more so, as a woman's individual intentions, characteristics and circumstances.

Research has identified several subgroups of women that have been associated with underutilization of mammography and Pap testing. Older age has been shown to have a negative association with mammogram usage,[27-32] which is quite disconcerting, given that breast cancer risk increases with age: 77% of new breast cancer cases and 84% of deaths from the disease occur in women age 50 and older.[33] Pap test usage has also been shown to decrease as a woman's age increases,[27,30-31,34-36] even though incidence of invasive cervical cancer augments with age.[31] When looking at race and ethnicity, studies show that Hispanic/Latina women underutilize both mammography[00,32,36] and Pap tests.[27,30,31] Studies also show that Black/African American women utilize Pap tests more than any other racial or ethnic group,[27,32,34,35,37] and recent data show that there is little to no significant difference in rates of mammography usage for Black/African American women when compared to mammography rates of White/Caucasian women.[32,36] A small number of studies have suggested that women who are not married are at increased risk for underutilizing Pap tests.[30,34]

Socioeconomic factors also have historically played a role in the use of these preventive screening measures. Lower income and less education have been highly correlated with decreased rates of mammogram and Pap test utilization.[27,30,31,33,34] Less research has investigated the influence of employment status on preventive screening utilization, and there are conflicting results between those that do. In 1988, Rodney Hayward and his colleagues found that women not participating in the labor force were slightly more likely to have had a recent Pap test,[27] but in 1993 a modest association was found between employment and increased use of mammography and Pap tests by Eugenia Calle and her fellow researchers.[30]

When looking at variables that deal with health and health care issues, a clearer picture emerges. Poor health status, lack of a usual doctor or medical care provider, and lack of health care coverage have consistently been associated with underutilization of both mammography and Pap tests.[27,31,32,34,35,38] Of all influencing variables, health insurance coverage seems to be one of the strongest predictors of clinical preventive service utilization.

The CDC's National Breast and Cervical Cancer Early Detection Program (NBCCEDP) was established to help underserved women gain access to mammography and Pap tests.[1] By offering these screenings to low income, older, racial/ethnic minority and uninsured females at little to no cost, the NBCCEDP has provided services to almost 1.5 million women in the United States. But as evidenced by the research, a large proportion of underserved women remain unscreened. In fact, the CDC acknowledges that the NBCCEDP reaches only 15% to 20% of the population eligible for this program.[38]

Aside from the demographic, socioeconomic, and health-related variables listed above, there are numerous other factors that can influence a woman's use of mammograms and Pap tests. Type of residence area (i.e., rural versus urban), transportation issues, time constraints and the social influence of others are just a few of the possible mitigating factors that have been explored in past studies, or are being examined in current research.

Improving Utilization Rates: Healthy People 2010

The medical and public health professions have long been concerned about the underutilization of mammography and Pap tests by certain subgroups of women. This concern prompted the inclusion of objectives focused on increasing mammogram and Pap test usage by U.S. women in Healthy People 2000, the national health promotion and disease prevention initiative founded in 1990. Healthy People 2000 emphasized disease prevention and early detection, and outlined a "10-year strategy for improving the Nation's health by the end of the 20th century".[40] The desire to increase mammogram and Pap test usage continues with Healthy People 2010, Healthy People 2000's successor, which contains the following objectives:

- **Objective 3-11a:** Increase the proportion of women aged 18 years and older who have ever received a Pap test from the baseline rate of 92% in 1998 to the target rate of 97% by 2010;
- **Objective 3-11b:** Increase the proportion of women aged 18 years and older who received a Pap test within the preceding 3 years from the baseline rate of 79% in 1998 to the target rate of 90% by 2010; and

- **Objective 3.13:** Increase the proportion of women aged 40 years and older who have received a mammogram within the preceding 2 years from the baseline rate of 68% in 1998 to the target rate of 70% by 2010.

These objectives reflect the federal government's acceptance of the USPSTF's guidelines for mammography and Pap tests. They are also measures that states and localities can compare with their own statistics, and thereby gauge the success of current health promotion and disease prevention efforts aimed at increasing breast and cervical cancer screening in their areas.

STUDY GOAL AND OBJECTIVES

The overall goal of this study is to identify individual demographic, socioeconomic, and health-related factors that are associated with differing utilization rates of mammograms and Pap tests for female respondents of the Manchester Health Survey 2001. Characteristics and circumstances of the respondents as consumers of health care services are focused on in this analysis, even though physician behaviors and practices are acknowledged to influence utilization outcomes as well. The analysis further seeks to identify the main predictors of the underutilization of mammograms and Pap tests while controlling for other influencing variables, such as age and income, by simultaneously examining demographic, socioeconomic, and health-related variables that may lead to differing outcomes (i.e., appropriate utilization in accordance with recommended guidelines as opposed to underutilization). The guidelines promulgated by the USPSTF for breast and cervical cancer screening are used for this analysis. Overall mammography and Pap test utilization rates for the Manchester population are compared with the Healthy People 2010 target rates to ascertain the progress in local preventive health screening behaviors. Thus, the specific research questions for this analysis are:

1) Which demographic, socioeconomic and health-related factors affect mammography and Pap test utilization rates of adult Manchester female respondents?
2) Which demographic, socioeconomic and health-related variables can be used to best predict underutilization of mammography and Pap testing in adult Manchester female respondents?

3) Are the routine breast and cervical cancer screenings utilization rates of adult Manchester female respondents similar to the Healthy People 2010 target rates?

The findings of this study may not only be applicable to the town of Manchester, Connecticut, but perhaps also to other towns with similar demographic profiles. Implications from this analysis may be used to evaluate current health promotion and disease prevention programs aimed at increasing mammography and Pap test utilization rates.

METHODS

Data from the Manchester Health Survey 2001 are used in this analysis of factors influencing utilization of breast and cervical cancer screenings. This standardized, structured telephone survey was conducted from March through May 2001 by the Manchester Health Department in Manchester, Connecticut, as part of the town's Community Health Needs Assessment process.

Manchester Community Health Needs Assessment

One of the essential services of public health is to monitor the health status of the community. Such monitoring aims to identify community health problems, information that is necessary for effective health planning. During the mid-1990s, the town of Manchester, Connecticut recognized this need and began establishing an ongoing process to monitor the community's health.[41] The process commenced by acknowledging the importance of assessing the health needs of the town's residents, as well as the need to increase awareness about health behaviors and concerns. The assessment effort officially began in January 1998 with the creation of the Manchester Community Health Needs Assessment Committee, which was composed of community residents, business leaders and town department officials. Committee membership was broadly based to represent the diverse interests and population of Manchester.[41]

The committee selected 21 priority health concerns, defined measures for each of those concerns, and designed a report card format for reporting on them.[42] The report card format included a discussion of each indicator and its meaning and value to the community; available and statistically reliable data for measuring each indicator; and interventions available which produce measurable results.[42]

Need for a Survey

Much of the existing data collected on the Manchester Community Health Needs Assessment indicators had been obtained through reliable secondary sources, such as the State of Connecticut Department of Public Health's Division of Vital Statistics.[42] While this information was very useful, most of it was not reported specifically for the town of Manchester, as most data was categorized on a regional, multi-town basis. Therefore, the health department decided to administer an anonymous population survey of Manchester residents by telephone in order to gather additional, first-hand information on a number of health issues and concerns.[43]

Survey Instrument

While some of the questions included in the Manchester Health Survey 2001 specifically dealt with issues particular to the town of Manchester, many were adopted from other surveys, such as the CDC's Behavioral Risk Factor Surveillance Survey (BRFSS) and the National Center for Health Statistics' National Health Interview Survey (NHIS).[45] These surveys are administered nationally on an continual basis, and have demonstrated validity and reliability. The survey questionnaire created by the Manchester Health Department (hereafter referred to as the health department) was developed over a period of approximately two years, with several pilot tests and revisions taking place in the process. In all, the survey instrument was a lengthy 27 pages long and took 15 to 45 minutes to complete over the telephone; only persons who stated they were 18 years and older were asked to participate.[45] While both males and females were asked to participate in the survey for an accurate assessment of the town's health needs, all male respondents were excluded for the present analysis.

While there are drawbacks to conducting surveys over the telephone (such as non-coverage, non-response and total survey error), the advantages of using telephone surveys for cross-sectional population studies are numerous. Advantages include wide coverage of a geographic area due to the amount of people that can be reached by telephone; the relative completeness of household telephone coverage, especially in the Northeast; the opportunity for quality control over the data collection process; cost efficiency; and the speed with which data can be gathered.[46] Additionally, when organized and administered carefully and correctly, telephone interviews can achieve standardized results relatively free of bias and error, as is the goal of any good survey.[47] The CDC's protocol for administering the BRFSS was adapted for use with the Manchester Health Survey 2001, and provided organized guidelines for training interviewers, setting up the calling facility, adhering to a calling schedule and the replacement of telephone numbers.

Sampling Method & Frame

The target population for the survey consisted of the adult, civilian, non-institutionalized population of Manchester, Connecticut. Using a directory of telephone numbers was judged to be insufficient for compiling a sample for the survey, because of the need to sample households with unlisted telephone numbers as well as those with listed numbers.[45] Instead, a list of random telephone numbers with Manchester prefixes was purchased from a commercial list vendor, Survey Sampling, Inc., based in Fairfield, Connecticut. The list consisted of approximately 9000 telephone numbers, randomly generated by a computer and screened by the vendor for non-working and known business numbers, as the health department sought to survey only household residences. The sample frame (i.e., the list of active, non-business Manchester telephone numbers

randomly generated by Survey Sampling, Inc.) was stratified according to the prefix of the telephone number. Telephone numbers from each stratum were selected from the sample frame in proportion to the rate of telephone numbers in Manchester with that specific prefix, resulting in a list of telephone numbers with prefixes at a rate proportional to the frequency of the prefix in the entire sample frame.[48] In other words, there was a higher proportion of telephone numbers in the sample list that had prefixes that occur more frequently in Manchester (such as "645" or "646"). This type of sampling, called *proportionate stratified random sampling*, was chosen over simple random sampling because, in theory, it reduces sampling error by more accurately reflecting the entire sample frame of active Manchester telephone numbers.[43] In effect, the sample becomes more representative of non-institutionalized, adult Manchester residents living in households with a telephone.

In order to further randomize the sample, the health department decided to employ a strategy for within-household random selection of respondents. This was done to protect against selection bias in the survey, by which those respondents who were available at the time of the call (typically females and older adults) or who were more willing to be interviewed (usually younger and well-educated persons) would be overrepresented in the survey.[46] The *last/most recent birthday method* of respondent selection was used, in which the interviewers asked to speak with the Manchester resident living in the household who was 18 or over and had the last (or most recent) birthday.[45] This selection procedure was used to avoid bias that could occur from respondent selection being left to the interviewer and the individual who answered the telephone;

research shows that this method of respondent selection yields the requested respondent being interviewed most (75% to 80%) of the time.[46]

Survey Implementation

The survey field period took place from mid-March until early May 2001, with calls taking place seven days a week.[45] As noted above, BRFSS protocol was followed by interviewers and supervisors, which specified the calling hours (1:00 pm – 9:00 pm Sunday – Friday, 10:-00 am – 2:00 pm Saturday) and the procedures for repeated calling of telephone numbers (telephone numbers were called up to 15 times if interviewers continuously received a busy signal or ring with no answer).[49] The survey was administered with paper and pencil, and answers were checked, coded and entered into a computer data base. Selected interviewers performed these data entry activities following the survey field period, entering information from the paper surveys into the CDC's EpiInfo Version 6.04 software program. Each survey was entered twice to ensure the entered data was correct. The survey coordinator and supervisors reviewed each worker's data entry accuracy to further ensure quality control.[45]

Manchester, Connecticut is a town with a population of approximately 55,000 residents. Of the total population, 42,401 are adults age 18 and over, of which 53.6% (n=22,727) are female.[44] Approximately 5000 telephone numbers were called for the Manchester Health Survey 2001, and interviewers attempted to speak with the adult Manchester resident living in the household who had the last (or most recent) birthday (see Sampling Method & Frame section above for details). However, many of these telephone numbers were out of service or fax lines (20%) or were business numbers (11.1%), even though the telephone number sample was prescreened for business and

nonworking numbers by the sample vendor.[45] Some of the telephone numbers called were constantly busy or rang without ever being answered after 15 calling attempts (16.6%), reached residences outside of Manchester (15.3%), or reached a residence in which language differences or physical/mental impairment were barriers to selecting the eligible respondent and completing the survey (1.1%). Excluding these telephone numbers and using only those numbers in which an eligible respondent was reached through the random respondent selection process, a total of 1614 numbers were called and yielded 1004 completed surveys. By excluding nonworking, business, fax, out-of-town, and never-answered telephone numbers, as well as telephone numbers that reached residences with language, physical, or mental barriers, the overall response rate for individuals eligible to participate in the survey was 62.2%.[45] The percentage of missing data for each of the survey questions used in this study ranges from 0% (for the question "Is there someone that you think of as your personal doctor or medical care provider?") to 16.2% (n = 94) for the question "What is your total annual household income from all sources?"). Missing data were excluded from the analysis, and only data from female respondents were used in this study.

Analysis of Utilization Patterns

While the health department did not conduct this survey specifically for the purpose of determining utilization rates of routine mammography and Pap test screening by the town's adult female residents, the information gathered from the survey provides a significant amount of data on the subject, therefore lending itself for analysis in this study. It must be noted, however, that the data gathered by the survey is the result of an observational study, and may not be readily generalizable to other populations.

Independent and Dependent Variables

Nine dichotomous demographic, socioeconomic, and health-related variables were examined to determine their influence on mammography and Pap test utilization. Variables were dichotomized to avoid small numbers in each variable subgroup; explorations of the data using independent variables with multiple levels reduced the number of cases in each subgroup because of the relatively small sample size (data not shown).

Demographic variables used in this analysis include: Age (40 to 49 years versus 50+ years for mammography, and 18 to 49 years versus 50+ years for Pap test); Race/Ethnicity (White/Caucasian versus Other, which includes Black/African American, Hispanic/Latina, multiracial and any other race, including Asian/Pacific Islander and American Indian/Alaska Native); and Marital Status (Married versus Not Married, which includes separated or divorced, widowed and single). Socioeconomic-related independent variables used in this analysis consist of: Education Level (Did not complete high school or general equivalency diploma (GED) versus Completed high school or GED or more); Employment Status (Employed versus Not Employed, which includes disabled and retired); and Annual Household Income (Under $50,000 versus At or Above $50,000). Finally, the three health-related independent variables include: Self-Reported General Health Status (Excellent, Very Good or Good versus Fair or Poor); Health Care Coverage Status (Has some form of health care coverage versus Does not have health care coverage); and Usual Doctor or Medical Care Provider (Has usual doctor or medical care provider versus Does not have usual doctor or medical care provider).

Three outcome measurements (dependent variables) for mammography utilization were used in the univariate analysis portion of this study: ever had a mammogram, had a mammogram during the past 12 months, and overall utilization of routine mammography screenings (using the current USPSTF screening guidelines recommending that women age 40 years and older have a mammogram every one to two years). The three outcome measurements for Pap test utilization employed in the univariate analysis include: had a Pap test screening during last routine medical examination (RME), had a routine Pap test in the past 12 months, and overall utilization of routine Pap test screenings (using the current USPSTF guidelines recommending that women who have an intact cervix and who are sexually active and/or age 18 and older obtain a Pap test at least every three years).

While the health department survey contained questions with numerous answers for respondents to choose from, some adjustments needed to be made for the purposes of data analysis in this study. Among categorical and ordinal variables with a number of choice levels that survey participants were provided to answer questions, such levels were collapsed and made bivariate in order to increase the number of respondents in each of the subgroups. The categories of each subgroup within the variables were selected in large part for their compatibility with previous studies pertaining to mammography and Pap test utilization, and do not necessarily reflect an optimally balanced distribution of subjects in each subgroup.

In regard to the annual household income, this variable was split into subgroups with income boundaries that differ from the more commonly used parameters of annual household income below $25,000 versus annual household income of $25,000 or more.

No significant differences in utilization of breast and cervical cancer screening were found when comparing respondents with incomes below versus above the $25,000 income figure (data not shown). In order to investigate any differences that may occur outside these standard income limits, the variable was then recategorized to compare utilization rates of lower- and middle-income respondents (with annual household incomes less than $50,000) to utilization rates of respondents at higher income levels (with annual household incomes of $50,000 or more).

The measurements of Pap test usage differ from the mammography usage measurements due to the context in which Pap test information was elicited by the survey. Respondents were asked about Pap tests as a part of clinical preventive services obtained during routine medical examinations. Specifically, respondents were asked when they had their last RME, and whether or not their last RME included a Pap test. These questions are structured differently from the mammography questions on the survey, which asked if the respondent ever had a mammogram, and if so, the length of time since the respondent's last mammogram. Please note that the information collected on Pap test utilization was asked within the context of a routine medical examination and the information on mammography utilization was not. The variation in survey questions regarding mammography and Pap test utilization was caused by the differing sources of the questions: mammography questions were identical to those used on the BRFSS, and the Pap test questions were designed by the health department to elicit information on screening procedures performed during RMEs. Although the survey interviewers did explain to respondents that routine gynecological exams were considered RMEs, a number of respondents may have distinguished between routine examinations by a

gynecologist and routine examinations by an internist or family physician, thereby separating reproductive health care from all other health care. This is related to the fragmentation of women's health care, noted in an earlier section of this paper, and possibly could have affected the results of the Pap test questions. One should also take notice that questions were asked specifically about routine screening Pap tests during routine medical examinations, and not about diagnostic Pap tests performed because of a problem or abnormality, as the survey was primarily concerned with routine clinical preventive services and not diagnostic tests and services.

Sample Characteristics

A total of 579 adult female Manchester residents participated in the Manchester Health Survey 2001, ranging in age from 18 to 89 years. Proportions for demographic, socioeconomic, and health-related characteristics for the entire sample are presented in Table 1.

Only those women who identified themselves as 40 years of age and older (n = 351) were included in the sample for the mammography analyses. Respondents stating they were under age 40 at the time of the survey (n = 208) and respondents refusing to provide their age (n = 20) were excluded from mammography analyses. This was done so the sample would reflect utilization rates of women who have reached the age at which most health agencies and organizations recommend routine mammography screenings should commence for individuals without elevated risk. Demographic, socioeconomic, and health-related data for respondents used in the mammography analyses are presented in Table 2.

TABLE 1: Demographic, Socioeconomic, and Health-Related Characteristics of All 579 Females in the Study Sample, Manchester Health Survey 2001

Selected Characteristics	Levels of Characteristics	Percent of Sample
Age in Years		
n = 559	18 – 39 years old	37.2
*(20 missing)**	40 – 49 years old	20.8
	50 – 64 years old	24.3
	65+ years old	17.7
Race/Ethnicity		
n = 572	White/Caucasian	83.6
(7 missing)	Black/African American	7.9
	Hispanic/Latino	5.9
	Other	2.6
Marital Status		
n = 576	Married	43.6
(3 missing)	Divorced or Separated	19.6
	Single	24.5
	Widowed	12.3
Education Level		
n = 577	Less than HS diploma or GED	6.4
(2 missing)	Completed HS diploma or GED	32.4
	Some college or technical school	31.0
	Four or more years of college	30.2
Employment Status		
n = 575	Employed Full Time	56.7
(4 missing)	Employed Part Time	12.9
	Retired or Disabled (Not Working)	10.3
	Not Employed	20.2
Annual Household Income		
n = 485	$0 - $24,000	24.9
(94 missing)	$25,000 - $49,000	34.8
	$50,000 - $74,000	20.4
	$75,000 - $100,000+	19.8
General Health Status		
n = 578	Excellent, Very Good or Good	89.3
(1 missing)	Fair or Poor	10.7
Health Care Coverage		
n = 573	Has health care coverage	94.4
(6 missing)	Does not have health care coverage	5.6
Usual Medical Care Provider		
n = 579	Has usual medical care provider	93.1
(0 missing)	Does not have usual medical care provider	6.9

* Missing data includes "Don't know" and "Refuse to answer" responses, as well as data missing due to human error. Note that percentages may not sum to exactly 100% due to rounding.

TABLE 2: Demographic, Socioeconomic, and Health-Related Characteristics of 351 Age 40+ Females in the Study Sample, Manchester Health Survey 2001

Selected Characteristics	Levels of Characteristics	Percent of Sample
Age in Years		
n = 351	40 – 49 years old	33.0
	50 – 64 years old	38.8
	65+ years old	28.2
Race/Ethnicity		
n = 348	White/Caucasian	92.0
(3 missing)	Black/African American	4.7
	Hispanic/Latino	2.3
	Other	1.0
Marital Status		
n = 350	Married	44.6
(1 missing)	Divorced or Separated	23.4
	Single	13.0
	Widowed	19.0
Education Level		
n = 350	Less than HS diploma or GED	8.0
(1 missing)	Completed HS diploma or GED	33.7
	Some college or technical school	32.0
	Four or more years of college	26.3
Employment Status		
n = 348	Employed Full Time	49.1
(3 missing)	Employed Part Time	12.9
	Retired or Disabled (Not Working)	6.6
	Not Employed	31.4
Annual Household Income		
n = 286	$0 - $24,000	26.2
(65 missing)	$25,000 - $49,000	35.0
	$50,000 - $74,000	19.9
	$75,000 - $100,000+	18.9
General Health Status		
n = 350	Excellent, Very Good or Good	85.7
(1 missing)	Fair or Poor	14.3
Health Care Coverage		
n = 349	Has health care coverage	96.3
(2 missing)	Does not have health care coverage	3.7
Usual Medical Care Provider		
n = 351	Has usual medical care provider	94.6
(0 missing)	Does not have usual medical care provider	5.4

* Missing data includes "Don't know" and "Refuse to answer" responses, as well as data missing due to human error. Note that percentages may not sum to exactly 100% due to rounding.

There were a number of exclusion criteria that reduced the number of respondents eligible for Pap test analyses as well. The responses of all 579 survey participants were used when calculating rates of having a Pap test during last RME, but a number of these women (n=14) stated that the Pap test question was not applicable to them. As this response may have been stated because these respondents did not have a cervix (due to a complete hysterectomy), Pap tests indeed may not have been applicable to these women, and thus they were excluded from the remaining Pap test analyses. An additional, significant number of cases (n = 130) also had to be excluded from the annual Pap test and overall Pap test utilization analyses because respondents stated that they had their last RME within the past one or two years and did not receive a Pap test during the examination. Individuals stating that they had their last RME within the past twelve months, but no Pap test was included, may have had another, previous RME within the past 12 months that may or may not have included a Pap test, and so could not be used in the annual Pap test analysis. In regard to overall utilization rates, respondents stating they did not have Pap test during their last RME within the past one or two years, may have had a RME prior to their most recent one that may have included a Pap test and was within the previous three-year time frame. However, since data was only collected on the most recent RME in this survey, overall utilization rates for this group of women could not be calculated. In reality, these individuals may have had a routine Pap test within the past three years, so rates of utilization in accordance with the USPSTF's guidelines could not be judged in these cases. For simplification purposes, all 130 of these respondents were excluded from annual and overall Pap test utilization analyses. With eight additional respondents excluded because they were unsure of (or unwilling to answer)

when they had their last routine Pap test, the number of women used in the annual Pap test and overall Pap test utilization analyses totaled 427. Table 3 contains demographic, socioeconomic, and health-related data for respondents used in the annual Pap test and overall utilization analyses.

Data Analysis

SPSS Version 11.0.1 for Windows, a statistical analysis and data management software system, was used to calculate frequencies and to perform chi-square tests for the univariate analyses, examining the utilization rates of mammography and Pap test screening by each of the nine independent variables. As noted above, to avoid small cell numbers in variable categories with rare outcomes, categories were collapsed to form dichotomous variables for statistical analysis. SPSS 11.0.1 was also used to calculate the odds ratios and 95% confidence intervals for the univariate analyses. Those variables which obtained a significance level, or p-value, of 0.05 or less for the chi-square tests are listed in Tables 4 and 6.

The SAS System for Windows, Version 8, was used to perform multiple logistic regression analyses on the data. Logistic regression allows for the analysis of the relative contributions of independent variables on the likelihood of underutilizing routine mammography and Pap test screenings. Regression models were tested using both the no selection and the forward stepwise selection methods. Odds ratios (ORs) and 95% confidence intervals (CIs) were also obtained using SAS to estimate the relative risk of overall underutilization according to the screening guidelines. No weighting procedures were used to alter the data in this sample.

TABLE 3: Demographic, Socioeconomic, and Health-Related Characteristics of 427 Females Used in Annual Pap test and Overall Pap test Utilization Analyses, From the Manchester Health Survey 2001 Sample

Selected Characteristics	Levels of Characteristics	Percent of Sample
Age in Years		
n = 414	18 – 39 years old	41.3
(13 missing)	40 – 49 years old	22.2
	50 – 64 years old	23.9
	65+ years old	12.6
Race/Ethnicity		
n = 420	White/Caucasian	82.6
(7 missing)	Black/African American	8.3
	Hispanic/Latino	6.7
	Other	2.4
Marital Status		
n = 425	Married	43.8
(2 missing)	Divorced or Separated	20.5
	Single	26.4
	Widowed	9.4
Education Level		
n = 426	Less than HS diploma or GED	4.2
(1 missing)	Completed HS diploma or GED	31.5
	Some college or technical school	31.2
	Four or more years of college	33.1
Employment Status		
n = 426	Employed Full Time	60.8
(1 missing)	Employed Part Time	12.4
	Retired or Disabled (Not Working)	11.0
	Not Employed	15.7
Annual Household Income		
n = 365	$0 - $24,000	20.0
(62 missing)	$25,000 - $49,000	37.0
	$50,000 - $74,000	21.6
	$75,000 - $100,000+	21.4
General Health Status		
n = 426	Excellent, Very Good or Good	91.8
(1 missing)	Fair or Poor	8.2
Health Care Coverage		
n = 425	Has health care coverage	94.8
(2 missing)	Does not have health care coverage	5.2
Usual Medical Care Provider		
n = 427	Has usual medical care provider	93.9
(0 missing)	Does not have usual medical care provider	6.1

* Missing data includes "Don't know" and "Refuse to answer" responses, as well as data missing due to human error. Note that percentages may not sum to exactly 100% due to rounding.

RESULTS

Mammography Underutilization

Overall, 351 of the 579 women surveyed stated that they were 40 years of age or older, and these women were used in the mammography utilization analysis. Of these respondents, 6.8% (n=24) said they had never had a mammogram, and 26.2% (n=92) said they had not received a mammogram within the past 12 months. When looking at underutilization of routine mammography screening, 14.5% (n=51) of respondents in this sample had not received a mammogram within the past two years, as recommended in the USPSTF's guidelines.

As can be seen in Table 4, the independent variables associated with statistically significant differences in rates of ever having a mammogram are annual household income, general health status, health care coverage status, and usual doctor or medical care provider (MCP). Annual household income (p=0.032) and general health status (p=0.034) seem to have had a considerable effect on lifetime mammography rates. Respondents with annual household incomes under $50,000 were more likely to never have received a mammogram (9.3%) than those with an income of $50,000 or more (2.7%). Of participants reporting excellent, very good or good health status, 5.8% had never been screened with mammography, as opposed to 14% of participants who reported fair or poor health status who have never received this screening procedure.

A marked difference in rates of lifetime mammography use was seen with two variables, health care coverage status and whether or not one has a usual doctor or MCP. Only 6.3% of respondents with some form of health care coverage reported

TABLE 4: Characteristics Associated with Decreased Mammography Utilization* in Women Age 40 and Older, Manchester Health Survey 2001

Variable	Percent Under-Utilizing	Odds Ratio	95% Confidence Interval
Never Had a Mammogram			
Annual Household Income Under $50,000	9.3	3.658	1.040, 12.863
Fair or Poor General Health Status	14.0	2.662	1.043, 6.794
No health care coverage	25.0	4.937	1.243, 19.609
No usual doctor or MCP	25.0	5.167	1.528, 17.476
No Mammogram in Past 12 Months			
Not Married (Divorced/Separated, Widowed or Single)	33.9	2.286	1.374, 3.801
Annual Household Income Under $50,000	32.9	2.082	1.174, 3.693
Fair or Poor General Health Status	39.6	1.983	1.050, 3.747
No health care coverage	66.7	5.833	1.713, 19.868
No usual doctor or MCP	68.8	6.681	2.254, 19.804
No Mammogram in Past 2 Years			
Not Married (Divorced/Separated, Widowed or Single)	19.6	2.417	1.253, 4.666
Annual Household Income Under $50,000	18.8	2.319	1.090, 4.935
No health care coverage	58.3	9.068	2.757, 29.830
No usual doctor or MCP	43.8	5.003	1.773, 14.118

* Only variables associated with significant differences ($p < 0.05$) in mammography utilization are listed in table.

never having a mammogram, as opposed to a full 25% of those who do not have coverage (p=0.013). Approximately these same proportions applied to those who had a usual doctor or MCP versus those who did not, with 6.1% of the former group and 25% of the latter group reporting that they have never had a mammogram (p=0.004).

A number of variables proved to be associated with significant differences in having a mammogram within the past 12 months. Women who were not married had a higher likelihood of not receiving a mammogram during the past year than women who were married (33.9% versus 18.3%, p=0.001). Having a higher annual household income was a factor in annual screening, since 32.9% of survey participants with incomes below $50,000 had not received a mammogram during the past year, and a lesser 19.1% of those with incomes at or above $50,000 had not (p=0.011). Women with fair or poor health were less likely than women reporting excellent, very good or good health to have received an annual mammogram: 39.6% of the former group were not screened during the past year, as opposed to 24.8% of the latter group (p=0.033).

A large difference was also seen between annual mammogram rates of those with and without health care coverage; 25.5% of respondents with coverage failed to be screened in the past year, in contrast with the majority (66.7%) of respondents lacking health care coverage (p=0.002). Annual mammography rates also were found to be associated with the usual doctor or MCP variable, as almost 69% of women lacking a usual doctor or MCP had not had mammogram during the past 12 months, but only 25% of those with a usual doctor MCP had not (p<0.001).

Women in the study 40 years of age and older were considered to be underutilizing mammography if they reported having their last mammogram more than two years ago, as recommended in the USPSTF mammography screening guidelines. Again, as seen with lifetime and annual mammography usage, having some form of health care coverage and having a usual doctor or MCP maintained associations with mammography underutilization. Respondents lacking health care coverage had an

underutilization rate of 58.3%, and those with health care coverage had an underutilization rate of only 13.4% ($p<0.001$). While 13.5% of survey participants with a usual doctor or MCP did not have a mammogram within the past two years, 43.8% of those without a usual MCP did not ($p=0.001$). There were notable discrepancies in rates of underutilization between respondents with annual household incomes at or above $50,000 (9.1%) and those with lower incomes (18.8%, $p=0.026$). And as with having an annual mammogram, women who were single, widowed, separated or divorced were more likely to have had no mammogram in the past two years (19.6%) than those who were married (9.2%, $p=0.007$).

Several other variables also affected utilization rates of mammography, but the effects did not reach statistical significance in the univariate analyses. However, these differences should still be noted. Women ages 40 – 49 were more likely than those 50 years and older to never have had a mammogram (10.5% versus 5.2%, $p=0.065$), as were White/Caucasian women (7.6%) when compared to women included in the Other race/ethnicity category (0%, $p=0.130$). But respondents in the Other race/ethnicity category were more likely to have skipped a mammogram in the past year (37%) than those in the White/Caucasian category (25.9%, $p=0.209$). Survey participants having less than a high school diploma or GED were more likely to have skipped their annual mammogram (37%) than those participants with more education (25.9%, $p=0.212$). As for overall mammography utilization in accordance with recommended guidelines, only 3.7% of females in the Other race/ethnicity group had no mammogram in the past two years, as compared with 16% of females in the White/Caucasian group ($p=0.087$).

Additionally, those with fair or poor health were more likely to underutilize mammography (22.9%) than those with better health status (13.6%, p=0.093).

Multiple logistic regression was used to identify predictors of mammography underutilization. After simultaneously controlling for all nine variables in the regression model, the analysis using no selection method revealed three variables that had statistically significant likelihood ratio chi-square values when using a 0.10 level of significance (which is customary for this step in the multiple logistic regression procedure): health care coverage, usual doctor or MCP, and race/ethnicity (see Table 5). When considering odds ratio estimates, lack of a usual doctor or MCP seemed to remain predictive of mammography underutilization (OR=6.056, CI=1.549, 23.679), but lack of health care coverage had a wide CI that included the number 1 when following the rules of rounding (OR=5.194, CI=1.046, 25.795). Other race or ethnicity seemed to show a negative relationship with underutilization; in other words, the likelihood of obtaining a mammogram during the past two years seemed to increase with Other race/ethnicity (OR=0.117, CI=0.011, 1.256). But a CI that included the number 1 also limited this finding, and so race/ethnicity, just like health care coverage, may have little predictive value for mammography utilization when controlling for other confounding variables.

Results of the logistic regression model run with forward stepwise selection (data not shown) demonstrated three variables with statistically significant likelihood ratio chi-square values when evaluating predictors of mammography underutilization: lacking a usual doctor or MCP (p=0.0281), lacking health care coverage (p=0.0581), and not being married (p=0.0345). While the usual MCP variable had a wide but acceptable CI for its odds ratio (OR=4.044, CI=1.162, 14.077), and the marital status variable had a more

TABLE 5: Results of Mammography Underutilization Analysis Using Multiple Logistic Regression with No Selection Method, Manchester Health Survey 2001

Variable	Level of Significance*	Odds Ratio	95% Confidence Interval
No usual doctor or MCP	0.0096	6.056	1.549, 23.679
No health care coverage	0.0439	5.194	1.046, 25.795
Race/Ethnicity (Other: Black, Hispanic/Latino, or other)	0.0764	0.117	0.011, 1.256

* Significant at 90%, or 0.10.

narrow CI but nearly included the number 1 (OR=2.321, CI=1.063, 5.065), the CI for the health care coverage variable both was wide and included the number 1 in this model (OR=4.119, CI=0.953, 17.811). Even so, a number of observations keep the health care coverage variable from being excluded as predictive of mammography utilization. These observations include the fact that health care coverage was associated with very significant differences in the univariate analyses, that health care coverage is a suspected predictor in both logistic regression models, and that non-coverage has been shown to reduce mammography usage in other studies. Such findings make it possible to suspect that health care coverage status still may have been a predictor of mammography underutilization in this sample, in spite of the variable's confidence intervals.

Pap test Underutilization

Of the entire sample overall, 73.5% (n=422) of women surveyed stated that their last routine medical examination (RME) included a Pap test; 24% (n=138) of the sample did not have a Pap test at their last RME, and 2.5% (n=14) said the question was not

applicable to them. As noted earlier, these 14 women were excluded from the remaining Pap test analyses, along with another 138 respondents whose routine Pap test utilization could not be judged because of survey limitations (see the Sample Characteristics section of this paper).

Of the 427 remaining survey participants eligible for analysis, 12.9% (n=55) said that they did not have a Pap test during a RME in the past 12 months. The vast majority of respondents proved to be utilizing routine Pap tests according to the USPSTF guidelines, with only 4.7% (n=20) of respondents not receiving a Pap test during a RME in the past three years.

Table 6 shows the five independent variables associated with significant differences in the rates of women having had a Pap test during their last RME. Older age, less education, and not being currently employed were all positively associated with having no Pap test during the last RME with a high degree of statistical significance ($p< 0.001$). Whereas 16.9% of females surveyed under age 50 reported that they did not receive a Pap test at their last RME, 34.8% of women age 50 and older reported the same. Not completing high school or GED greatly decreased the likelihood of having had a Pap test during the last RME, with over half (51.4%) of females with limited education stating they did not have this test performed at their last RME, and only 22.9% of respondents with more education reporting the same—a difference of almost 29%. Twenty percent (20%) of employed women were not screened during their last RME, but 34.3% of women who were not employed went unscreened.

Annual household income was also a notable independent variable, as lack of a Pap test during the last RME was 26.7% for women with a lesser household income

TABLE 6: Characteristics Associated with Decreased Pap Test Utilization* in Women Age 18 and Older, Manchester Health Survey 2001

Variable	Percent Under-Utilizing	Odds Ratio	95% Confidence Interval
No Pap Test during Last RME			
Age 50 Years and Older	34.8	2.629	1.758, 3.930
Did not complete high school or GED	51.4	3.565	1.782, 7.132
Not Employed	34.3	2.088	1.397, 3.121
Annual Household Income Under $50,000	26.7	1.625	1.033, 2.556
Fair or Poor General Health Status	39.7	2.206	1.253, 3.884
No Pap Test in Past 12 Months (during last RME)			
No health care coverage	50	8.159	3.342, 19.917
No usual doctor or MCP	42.3	5.950	2.572, 13.764
Not Adherent to Recommended Pap Test Guidelines			
No health care coverage	22.7	7.608	2.476, 23.378
No usual doctor or MCP	26.9	10.996	3.934, 30.732

* Only variables associated with significant differences ($p \leq 0.05$) in Pap test utilization are listed in table.

(under $50,000 annually), and 18.3% for those in the higher income bracket of $50,000 or more annually (p=0.035). General health status was the fifth independent variable significantly affecting these rates, with 23% of respondents reporting their health was excellent, very good or good going unscreened at their last RME, as opposed to 39.7% of women in fair or poor health (p=0.005). No differences were observed between subgroups with differing health care coverage status, or between subgroups that did and did not have usual doctors or MCPs.

Results for univariate analysis of factors influencing differing rates of annual Pap testing and for overall utilization of routine Pap testing showed only two variables of

significance, which were identical for both outcome measures: health care coverage status and usual doctor or MCP. While 10.9% of respondents with some form of health care coverage had not received a Pap test during a RME in the past twelve months, those without coverage reported not receiving a Pap test at a rate of 50% ($p<0.001$). Those respondents having a usual doctor or MCP were more likely to report a Pap test during the past year than those who did not have a usual doctor or MCP, with only 11% of the former group going unscreened as compared to 42.3% of the latter group ($p<0.001$). Respondents without health care coverage maintained significantly higher rates of underutilization of Pap test screening according to recommended guidelines than those with coverage (22.7% versus 3.7%, $p<0.001$). Also, those respondents lacking a usual doctor or MCP demonstrated higher rates of underutilization than those who had a usual doctor or MCP (26.9% versus 3.2%, $p<0.001$).

As with mammography use, there were some variables associated with smaller differences in Pap test utilization that did not reach statistical significance, but are noteworthy nonetheless. While 34.5% of respondents without health care coverage reported no Pap test during their last RME, a lesser 23.6% of covered respondents reported the same ($p=0.184$). Additionally, women with annual household incomes under $50,000 were slightly more likely to underutilize Pap test screenings when compared with USPSTF guidelines (6.7%) than were women with incomes at or above this figure (2.5%, $p=0.068$).

The multiple logistic regression procedure was used to identify predictors of Pap test underutilization, as it was with mammography utilization. When all nine independent variables were forced into a regression model with no selection method, five

had statistically significant likelihood ratio chi-square values using a 0.10 significance level: usual doctor or MCP, health care coverage, race/ethnicity, employment status, and income level (see Table 7). When considering odds ratios, lack of a usual doctor or MCP remained predictive of Pap test underutilization (OR =12.763, CI = 3.062, 53.194), as did lack of health care coverage (OR=8.919, CI=1.637, 48.601), but both had very wide CIs. Other race/ethnicity showed a negative relationship with underutilization (OR=0.057, CI=0.004, 0.844), indicating that Other race/ethnicity is a predictor of increased utilization of Pap tests. This is consistent with the findings of other studies that look at race/ethnicity and Pap test utilization.[27,32,34,35,37] Finally, while the employment and income variables had statistically significant likelihood ratio chi-square values, their confidence intervals included the number 1 (OR=0.152, CI=0.021, 1.101 for not being employed; OR=0.309, CI=0.075, 1.268 for annual household income less than $50,000). In addition, these variables demonstrated a negative relationship with Pap test underutilization, indicating that not being employed and having a lower annual household income increased utilization. Such findings seem to be counter-intuitive and are not supported by previous research. For these reasons, the employment and income variables were not considered to be predictors of Pap test underutilization.

When analyzing the results of the logistic regression model run with forward stepwise selection (data not shown), the three variables determined to be predictive in the first model—lacking a usual doctor or MCP, lacking health care coverage, and White/Caucasian race/ethnicity— emerged with significant likelihood ratio chi-square values (p=0.0010, p=0.0073, and p=0.0687, respectively). However, the CI for the race/ethnicity variable contained the number 1 (OR=0.125, CI=0.013, 1.173), implying

TABLE 7: Results of Overall Pap test Underutilization Analysis Using Logistic Regression with No Selection Method, Manchester Health Survey 2001

Variable	Level of Significance*	Odds Ratio	95% Confidence Interval
No usual doctor or MCP	0.0005	12.763	3.062, 53.194
No health care coverage	0.0114	8.919	1.637, 48.601
Other Race/Ethnicity (Black/African American, Hispanic/Latino, Multiracial and other)	0.0372	0.057	0.004, 0.844
Not Employed	0.0623	0.152	0.021, 1.101
Annual Household Income < 50K	0.1029	0.309	0.075, 1.268

* Significant at 90%, or 0.10.

that this variable may have less predictive value than originally indicated in the first model, which controlled for the effects of other variables. The CIs for lacking a usual doctor or MCP (OR=8.198, CI=2.336, 28.772) and lacking health care coverage (OR=6.778, CI=1.676, 27.408) were wide but did not contain the number 1, and thus could be considered as predictors of Pap test underutilization for this study.

DISCUSSION

Findings of the Analysis

The overall findings of this analysis are quite encouraging for female residents of Manchester, Connecticut. A high percentage, 93.1%, of women age 40 and older reported that they had received a mammogram at some point in their lives, and 73.2% said that their last mammogram occurred within the past year. With 85.1% of respondents age 40 and older having received their last mammogram within the past two years, these women have already exceeded the mammography screening objective of Healthy People 2010, which is to increase the proportion of women 40 and older who have received a mammogram within the preceding two years to 70%.

Overall findings of Pap test utilization in accordance with national guidelines are favorable as well. With over 95% of survey participants having received a Pap test during a routine medical examination within the past three years, female residents of Manchester have also surpassed the Healthy People 2010 objective of at least 90% of women aged 18 years and older having received a Pap test within the preceding three years.

Although the overall mammography and Pap test screening utilization rates of the Manchester adult female population are high, there are still subgroups of the population whose utilization rates are lower, as evidenced by the findings of this study. Those respondents who lack health care coverage and those who lack a usual doctor or medical care provider have the highest rates of overall underutilization for both cancer screening procedures, and these two variables emerged as influential in both the univariate chi-square analysis and the multivariate logistic regression analysis. Survey participants who

had no health care coverage reported the lowest overall utilization of mammography screening, with less than half (41.7%) having received a mammogram in the previous two years, as opposed to 86.6% of participants with health care coverage. This finding is consistent with previous studies that have found lack of health insurance to be a significant predictor of mammography underuse.[27,32,38] A lower rate of utilization can be expected from this subgroup, given the high cost of mammography screening, and those females with no health care coverage may not want to, or be able to, pay for the cost of this procedure out-of-pocket. Lower rates of Pap test utilization also were found in respondents lacking health care coverage, with approximately 77% having had a Pap test during a routine physical exam in the past three years, as compared to 96.3% of respondents with coverage. This finding is also supported by previous studies that have found lower rates of Pap test screening utilization among uninsured individuals.[27,32,35]

Research shows that women are slightly more likely to have health care coverage than men.[4,50] However, it is apparent that women who lack such coverage do not receive life-saving breast and cervical cancer screenings at the optimal time intervals recommended by the U.S. Preventive Services Task Force. In this sample, the overall rate of health care coverage is 94.4%, which leaves 5.6% of respondents without coverage and thus more vulnerable to decreased mammography and Pap test utilization. Health care coverage increases with age in this sample, as 9.3% of women under 40 had no health care coverage and 3.7% of women 40 and over were not covered. This increased coverage among older women can be expected, as they become eligible for Medicare with age. Breast cancer, being the second most common cancer in women, is likely to develop in some of these individuals whether or not they are being screened

according to the guidelines. But the cancer would likely be discovered at a more advanced stage if these women were unable to receive mammograms every one to two years as recommended by the USPSTF. And tragically, with later-stage diagnosis comes a higher mortality rate. The same would be true for the 22.7% of non-insured women in the sample who have not received a routine Pap test in the past three years, as recommended by the USPSTF. If these women were to remain vulnerable to delays in routine Pap testing, they would be at greater risk of later diagnosis if cervical cancer were to develop. And as with breast cancer, later-stage diagnosis of cervical cancer is associated with a higher mortality rate. If we were to extend these findings to the entire adult female Manchester population (and beyond, if appropriate), they would suggest that many cases of illness and death could be prevented by assisting women without healthcare coverage obtain timely routine mammograms and Pap tests. And it is evident, through the findings of this analysis and many others, that increased utilization is associated with by increasing the rate of health care coverage.

Respondents who reported having no usual doctor or medical care provider also fell short of the Healthy People 2010 target rates for both breast and cervical cancer screening utilization. In the entire sample, 6.5% of the respondents lacked a usual doctor or MCP; among those age 40 and older, the rate is 5.4%. Of women 40 years and older with no usual doctor or MCP, 56.2% received a mammogram in the past 24 months, leaving 43.8% who did not. As for Pap testing, about 73% of respondents lacking a regular health care provider had a Pap test within the past three years, but approximately 27% did not. These findings of decreased mammography and Pap test utilization in persons without regular MCPs concur with findings in several published studies.[32,34,35]

The multivariate regression analysis shows that lacking a usual MCP is a predictor of underutilization independent of health care coverage status, and perhaps it is a regular provider's coordination of care, as well as a steady provider's encouragement to maintain one's health, that increases utilization of cancer screening procedures in those who have a usual doctor or MCP.

Although it did not prove to be as strong a predictor of underutilization as having a usual MCP or having health care coverage, not being married seemed to have some association with decreased mammography use in this analysis. This finding concurs with research conducted by Eugenia Calle and her colleagues,[30] as well as Linda Martin and her associates,[34] but such a relationship between mammography use and marital status is not widely recognized. Being unmarried was associated with lower mammography utilization in the univariate and forward stepwise regression analyses, but did not present as a predictor in the regression model where all variables were forced simultaneously to control for confounding. While this does not mean marital status had no influence on mammography utilization, it may signify that there could be some other factor associated with marital status, and not marital status itself, that influenced mammography utilization rates.

Of interest is the finding of race/ethnicity as a predictor in the logistic regression model for underutilization of routine Pap test screenings. In the univariate analysis, the difference between Pap test utilization rates for the race/ethnicity subgroups is small, with 5.5% of White/Caucasian respondents and 1.4% of Other race/ethnicity respondents underutilizing Pap test screenings according to recommended guidelines ($p=0.134$). However, when the race/ethnicity variable is included with all other factors in the logistic

regression model with no selection method, as well as in the forward stepwise selection model, White/Caucasian race/ethnicity emerged as a predictor for Pap test underutilization. Past research has shown that, in general, Black/African American women do utilize Pap testing more appropriately than other races and ethnicities, but research has also demonstrated a higher rate of both mammogram and Pap test underutilization among Hispanic/Latino ethnicity and "other" races.[30,32] Because of the relatively small sample size in this study, the Other category of race/ethnicity includes Black/African American, Hispanic/Latino, multiracial and other race or ethnicity, and this combination may have influenced the findings regarding this variable. In reality, there may be an even greater difference in Pap test utilization between Black/African American females and White/Caucasian females in this study. More in-depth research on race and ethnicity factors should be pursued before stating the degree of predictive value that race/ethnicity has on routine Pap test utilization for adult females in Manchester.

Limitations of the Analysis

The results of this analysis are limited due to a number of factors, and should be interpreted with caution. The data was gathered based on a self-reporting survey, and is therefore subject to recall bias, as certain groups or individuals may have been able to recall the preventive screening procedures they have received more accurately. Because the survey instrument was administered over the telephone, there could be effects of non-coverage error, as 5% of households in the Northeast do not have telephones and thus were not included in the sampling frame.[46] There also was a percentage of eligible respondents who refused to participate in the survey, which may have led to response

bias, as those persons who refused to participate in the survey may have been systematically different than those who completed the survey.

Additionally, the true rate of Pap test utilization may differ from the findings in this analysis. As noted earlier in this paper, the Pap test utilization questions were asked within the context of the respondent's last routine medical examination. Data was not collected on Pap tests obtained outside a RME, since such a test may be more likely to be due to a specific condition or problem, and thus would function not as a screening test but rather a diagnostic test. Since no data was collected on screening procedures obtained outside the respondent's last routine medical examination, it was impossible to conclude yearly Pap test and overall Pap test utilization information. So as to not over- or understate cervical cancer screening utilization, some of these cases had to be excluded from analysis, and it is possible that these exclusions may have affected the Pap test utilization findings for this sample.

CONCLUSIONS

Implications of the Findings

The results of this analysis show that in this random sample of adult women in Manchester, Connecticut, overall utilization rates of routine mammography and Pap test screenings have exceeded the Healthy People 2010 target rates. However, findings also show subgroups of women who remain substantially below the target rates. Women with no health care coverage and women with no usual doctor or medical care provider have the lowest rates of overall utilization for both mammography and Pap test guidelines. These two factors, lack of health care coverage and lack of a usual doctor or medical care provider, seem to consistently and significantly predict underutilization for both screening procedures. Additionally, not being married may increase the risk of receiving mammograms at a less than optimal screening schedule, and White/Caucasian race/ethnicity may contribute to receiving Pap tests at less frequent intervals than recommended.

Having a usual doctor or medical care provider increases a woman's chances of obtaining both breast and cervical cancer screening procedures as recommended in national preventive health service guidelines. Perhaps this increased rate of appropriate utilization is a result of the coordination of care that comes with having a personal physician or other MCP. Such an effect may also be due to an ongoing emphasis on preventive health care by a usual health care provider.

Since income did not demonstrate much strength as an independent predictive factor, women with low breast and cervical cancer screening utilization rates do not necessarily have low household incomes. Therefore, they may not meet the financial

qualifications often required for free or low-cost mammograms and Pap tests through programs such as the CDC's Breast and Cervical Cancer Early Detection Program. This finding reflects the ongoing need for comprehensive health care coverage in the United States, regardless of an individual's age, sex, income or general health status.

Next Steps

The matter of universal health care coverage for all Americans is fraught with political and social controversy. However, it seems from the findings of this study—as well as many others—that providing comprehensive health care coverage, with a designated primary medical care provider for each individual, may be a significant step in increasing the appropriate utilization of routine mammography and Pap test screenings. Such an increase in utilization may, in effect, reduce morbidity and mortality from breast and cervical cancer, and significantly contribute to the health of American women.

REFERENCES

1. Centers for Disease Control and Prevention. *The National Breast and Cervical Cancer Early Detection Program, At-A-Glance 2001.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, 2001. Available at http://www.cdc.gov/cancer/nbccedp/bccpdfs/bccaag01.pdf

2. Weisman CS. Changing definitions of women's health: Implications for health care policy. *Maternal and Child Health Journal* 1997;1(3):179-89.

3. Speert H. *Obstetrics and Gynecology in America: A History.* Chicago, IL: American College of Obstetrics and Gynecology, 1980.

4. Weisman CS. *Women's Health Care: Activist Traditions and Institutional Change.* Baltimore, MD: The Johns Hopkins University Press, 1998.

5. Department of Health and Human Services, Office of Women's Health. *A Century of Women's Health: 1900 – 2000.* Washington, DC: DHHS, 2001.

6. Kirschstein RL. Research on women's health. *American Journal of Public Health* 1991;81:291-2.

7. Clancy CM, Massion CT. American women's health care: a patchwork quilt with gaps. (Commentary). *Journal of the American Medical Association* 1992; 268(14):1918-20.

8. Bartman BA, Weiss KB. Women's health care in the ambulatory care setting. *Clinical Research* 1991;39:595A.

9. WhoNamedIt.com. *George Nicholas Papanicolaou.* 2001. Available at www.whonamedit.com/doctor.cfm

10. Schiffman MH, Brinton LA, Devesa SS, Fraumeni J, Joseph F. Cervical Cancer. In: Schottenfeld D, Fraumeni J, Joseph F, eds. *Cancer Epidemiology and Prevention.* New York, NY: Oxford University Press, 1996.

11. Gyncancer.com. *All about Pap tests.* 2000. Available at http://www.gyncancer.com/pap-test.html

12. Lerner, BH. To see today with the eyes of tomorrow: a history of screening mammography. 2001. Background paper for the Institute of Medicine report "*Mammography and beyond: Developing technologies for the early detection of breast cancer*". Available at www.iom.edu/iom/iomhome.nsf/WFiles/IOM2/$file/IOM2.pdf

13. Olsen O, Gotzsche P. Cochrane review on screening for breast cancer with mammography. *The Lancet* 2001;358:1340-42.

14. Howe HL, Wingo PA, Thun MJ, et al. Annual report to the nation on the status of cancer (1973 through 1998), featuring cancers with recent increasing trends. *Journal of the National Cancer Institute* 2001;93:824-42.

15. U.S. Preventive Service Task Force. *Screening for breast cancer: recommendations and rationale.* Rockville, MD: Agency for Healthcare Research and Quality, 2002. Available at www.ahrq.gov/clinic/3rduspstf/breastcancer/brcanrr.htm

16. Department of Health and Human Services, HHS Press Office. *HHS affirms value of mammography for detecting breast cancer.* (Press Release). Feb. 21, 2002. Available at http://www.hhs.gov/news/press/2002pres/20020221.html

17. American Cancer Society. ACS guidelines for the early detection of breast cancer: update 1997. *CA: A Cancer Journal for Clinicians* 1997;47(3):150-3.

18. American Medical Association. *Mammographic Screening for Asymptomatic Women.* Report 16 of the Council on Scientific Affairs (A-99). June 1999. Available at http://www.ama-assn.org/ama/pub/article/2036-2346.html

19. Feig SA, D'Orsi CJ, Hendrick RE, et al. American College of Radiology guidelines for breast cancer screening. *American Journal of Roentgenology* 1998;171(1):29-33.

20. American College of Obstetricians and Gynecologists. *Primary and preventive care: periodic assessments.* ACOG Committee Opinion 246. Washington, DC: American College of Obstetricians and Gynecologists, 2000.

21. American Academy of Family Physicians. *Periodic Health Examinations: Summary of AAFP Policy Recommendations & Age Charts.* 2002. Available at www.aafp.org/exam

22. Ferrini R, Mannino E, Ramsdell E, Hill L. Screening mammography for breast cancer: American College of Preventive Medicine practice policy statement. *American Journal of Preventive Medicine* 1996;12(5):340-41.

23. U.S. Preventive Services Task Force. Screening for cervical cancer. *Guide to Clinical Preventive Services.* 2nd ed. Baltimore, MD: Williams & Wilkins, 1996.

24. Institute for Clinical Systems Improvement. *ICSI Health Care Guideline: Cervical Cancer Screening.* Revised 2002. Bloomington, MN: Institute for Clinical Systems Improvement, 2002. Available at http://www.icsi.org/guide/Cervic.pdf

25. American Cancer Society. Patient pages: early detection of cervical cancer. *CA: A Cancer Journal for Clinicians* 2002;52(6):375-6.

26. American Cancer Society. *Cancer Facts & Figures 2001*. Atlanta GA: American Cancer Society, 2001. Available at http://www.cancer.org/downloads/STT/F&F2001.pdf

27. Hayward RA, Shapiro MF, Freeman HE, Corey CR. Who gets screened for cervical and breast cancer? *Archives of Internal Medicine* 1988;148:1177-81.

28. Marchant DJ, Sutton SM. Use of mammography, United States, 1990. *Morbidity and Mortality Weekly Report* 1990;39:621-30.

29. Burg MA, Lane DS, Polednak AP. Age group differences in the use of breast cancer screening tests: the effects of health care utilization and socioeconomic variables. *Journal of Aging and Health* 1990;2:514-30.

30. Calle EE, Flanders WD, Thun MJ, Martin LM. Demographic predictors of mammography and Pap smear screening in US women. *American Journal of Public Health* 1993;83(1):53-60.

31. Wyn R, Brown ER, Hongjian Y. Women's use of preventive health services. In: Falik MM, Collins KS, eds. *Women's Health: The Commonwealth Fund Survey*. Baltimore, MD: The Johns Hopkins University Press, 1996.

32. Blackman DK, Bennett EM, Miller DS. Trends in self-reported use of mammograms (1989-1997) and Papanicolaou tests (1991-1997) – Behavioral Risk Factor Surveillance System. In: *CDC Surveillance Summaries*, October 8, 1999. MMWR 1999;48(No. SS-6):1-22.

33. American Cancer Society. *Breast Cancer Facts & Figures 2001-2002*. Atlanta, GA: American Cancer Society, 2001. Available at http://www.cancer.org/downloads/STT/BrCaFF2001.pdf

34. Martin LM, Calle EE, Wingo PA, Heath CW. Comparison of mammography and Pap test use from the 1987 and 1992 National Health Interview Surveys: are we closing the gaps? *American Journal of Preventive Medicine* 1996;12:82-90.

35. Simoes EJ, Newschaffer CJ, Hagdrup N, et al. Predictors of compliance with recommended cervical cancer screening schedule: a population-based study. *Journal of Community Health* 1999;24(2):115-130.

36. American Cancer Society. *Cancer Prevention & Early Detection: Facts & Figures 2002*. Atlanta, GA: American Cancer Society, 2002. Available at http://www.cancer.org/downloads/STT/CPED2002.pdf

37. Norman SA, Talbott EO, Kuller LH, Krampe BR, Stolley PD. Demographic, psychosocial, and medical correlates of Pap testing: a literature review. *American Journal of Preventive Medicine* 1991;7(4):219-26.

38. Woolhandler S, Himmelstein DU. Reverse targeting of preventive care due to lack of health insurance. *Journal of the American Medical Association* 1988; 259:2872.

39. Centers for Disease Control and Prevention. *The National Breast and Cervical Cancer Early Detection Program.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, 2002. Available at http://www.cdc.gov/cancer/nbccedp/index.htm

40. Department of Health and Human Services. *Healthy People 2010* (Conference Edition, in Two Volumes). Washington, DC: January 2000.

41. Manchester Health Department. *Manchester Spotlight on Health.* (Information Packet). Manchester, CT: Manchester Health Department, 1999.

42. Manchester Health Department. *Manchester Community Health Needs Assessment.* Manchester, CT: Manchester Health Department, 2002. Available at http://humanservices.ci.manchester.ct.us/health/CommunityHealthAssessment.htm

43. Mlynarski D. *Sample design and methodology for a local, population-based health survey.* 2000. Unpublished report for Manchester Health Department, Manchester, CT.

44. Connecticut Department of Economic and Community Development. *Town profiles: Manchester, Connecticut.* Hartford, CT: Connecticut Department of Economic and Community Development, June 2002. Available at http://www.state.ct.us/ecd/research/townprof00/towns/manchester.pdf

45. Mlynarski D. *Process report: the Manchester Health Department Telephone Survey 2001.* 2002. Unpublished report for Manchester Health Department, Manchester, CT.

46. Lavrakas PJ. *Telephone Survey Methods: Sampling, Selection, and Supervision.* 2nd ed. Applied Social Research Methods Series Vol. 7. Newbury Park, CA: Sage Publications, 1993.

47. Fowler FJ Jr., Mangione TW. *Standard Survey Interviewing.* Newbury Park, CA: Sage Publications, 1990.

48. Survey Sampling, Inc. *Summary of Sampling Types.* Fairfield, CT: Survey Sampling, Inc., May 1998. Available at http://www.surveysampling.com/ssi.x2o$ssi_gen.product?id=118

49. Centers for Disease Control and Prevention. *Behavioral Risk Factor Surveillance System User's Guide*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, 1998. Available at http://www.cdc.gov/brfss/pdf/userguide.pdf

50. Horton JA, ed. The Women's Health Data Book: A Profile of Women's Health in the United States. Washington, DC: Jacobs Institute of Women's Health, 1992.