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INFLUENCE OF PUBLIC INSURANCE ON HEALTHCARE ACCESS AND CANCER CARE

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Influence of Public Insurance on Healthcare Access and Cancer Care

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

by

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Abstract

INFLUENCE OF PUBLIC INSURANCE ON HEALTHCARE ACCESS AND CANCER CARE

By Wafa W. Tarazi, Ph.D., MHPA, B.Pharm

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

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Medicaid expansion under the Affordable Care Act (ACA) facilitates access to care among vulnerable populations, but 21 states have not yet expanded the program. Tennessee's Medicaid program experienced a dramatic Medicaid contraction when the program disenrolled approximately 170,000 nonelderly adults in 2005. Pre-ACA expansions were associated with better access to and utilization of healthcare services. However, little is known about the effect of these policy changes on improvement in health outcomes for women diagnosed with breast

cancer, access to care for cancer survivors, and the effect of generosity and duration of expansion on access to care.

This dissertation has three objectives. First, to assess the effects of the Tennesse's Medicaid disenrollment on stage at diagnosis and delay in surgery for breast cancer among nonelderly women. Second, to compare access to care between cancer survivors living in non-expansion states and survivors living in expansion states. Third, to examine the effect of generosity and duration of the pre-ACA Medicaid expansions on access to and utilization of healthcare services.

I use three different types of datasets: the 2002-2008 data from Tennessee Cancer Registry, the 2012 and 2013 Behavioral Risk Factor Surveillance System (BRFSS), and the 2012 Medical Expenditure Panel Survey (MEPS) data. I estimate difference-in-difference models and perform multiple logistic regression models to examine the impact of these policy changes on the different measurement outcomes.

While many states are expanding Medicaid eligibility under the Affordable Care Act, there has been discussion among policymakers in some states about reducing eligibility under the Affordable Care Act once full federal funding expires. This study suggests that Medicaid disenrollment leads to later stage at diagnosis for breast cancer patients, indicating negative health impacts of contractions in Medicaid coverage. Prior to the passage of the Affordable Care Act, cancer survivors living in expansion states had better access to care than survivors living in non-expansion states. Failure to expand Medicaid could potentially leave many cancer survivors without access to routine care. The study informs policy makers that, relative to no expansion,

moderate or generous expansion is associated with improvement in access to and utilization of healthcare services.

Chapter 1: Introduction

Specific Aims

Delay in access to preventive services is a barrier to get early diagnosis and treatment, and it has been shown to be associated with several complications (Weissman, Stern, Fielding, & Epstein, 1991). In contrast, timely access to preventive services improves health outcomes and increases quality of life (Healthy People 2020, 2014).

The U.S. Preventive Services Task Force (USPSTF) guidelines recommend that women, 50 – 74 years old receive biennial mammography screening to help detect breast cancer early and allow for timely treatment. Further, the Institute of Medicine (IOM) and the American Cancer Society (ACS) recommend that cancer survivors receive a survivorship care plan developed by their clinicians to facilitate follow-up care. The goal of these recommendations is to reduce the burden of cancer for patients and society.

This dissertation examines two contradictory changes in the Medicaid program, both of which provide policy implications for Medicaid expansion under the Affordable Care Act and Medicaid policy moving forward. The first change is related to the 2005 Medicaid disenrollment in Tennessee and its impact on stage at diagnosis and treatment of female breast cancer. The second change is related to Medicaid expansion and its potential impact on access to and utilization of healthcare services among low-income people in general and cancer survivors in particular.

In the literature, Medicaid contractions have received less consideration than Medicaid expansions. Examining the effects of these contractions on health outcomes of low-income individuals who lose Medicaid coverage contributes to existing literature and provides evidence on consequences of these contractions. The first study of this dissertation examines the effects of Medicaid contraction in Tennessee on stage at diagnosis and delay in treatment of breast cancer among women living in low-income zip codes and those living in high-income zip codes.

Medicaid expansion under the Affordable Care Act (ACA) aims to reduce the uninsurance rate and improve access to underserved populations (Department of Health and Human Services, 2014). Despite the anticipated benefits and the federal funding of Medicaid expansion, many states have decided not to expand their programs at this time. A baseline comparison between the two groups of states can shed light on the potential effects of state decisions whether to implement the expansion. The second study of this dissertation examines baseline differences in access to healthcare services among cancer survivors living in states that expanded Medicaid, compared to survivors living in states that did not expand Medicaid as of June, 2015.

The literature suggests that Medicaid coverage provides enrollees with better health care access and outcomes (Coughlin, Long, & Shen, 2005; Long, Coughlin, & King, 2005). However, each state has its own rules to regulate and manage the program. Hence, experiences from each state can provide lessons for other states and federal level policies. The third study of this dissertation compares access to and utilization of healthcare services for low-income individuals living in states with generous Medicaid expansion, moderate expansion, and no expansion as of 2012. The study also examines the effect of generosity and duration of expansion on access to and utilization of healthcare services among low-income individuals.

We have the following specific aims:

Aim 1: Examine the effect of Tennessee's Medicaid disenrollment on breast cancer stage at diagnosis and treatment among women living in low-income zip codes and those living in high-income zip codes.

H1: After disenrollment, women living in low-income zip codes who were diagnosed with breast cancer had later stage of disease than women living in high-income zip codes.

H2: After disenrollment, women living in low-income zip codes had greater delays in breast cancer treatment than women living in high-income zip codes.

H3: After disenrollment, women living in Tennessee who were diagnosed with breast cancer had later stage of disease than women living in SEER states.

Aim 2: Examine access to care for cancer survivors living in states that did not expand Medicaid and those living in states that expanded Medicaid.

H1: Cancer survivors living in non-expansion states are more likely to be unable to see a doctor because of cost than survivors living in expansion states.

H2: Cancer survivors living in non-expansion states are less likely to have a personal doctor and receive an annual checkup than survivors living in expansion states.

Aim 3: Examine the effect of generosity and duration of Medicaid expansions on access to and utilization of preventive services among low-income adults

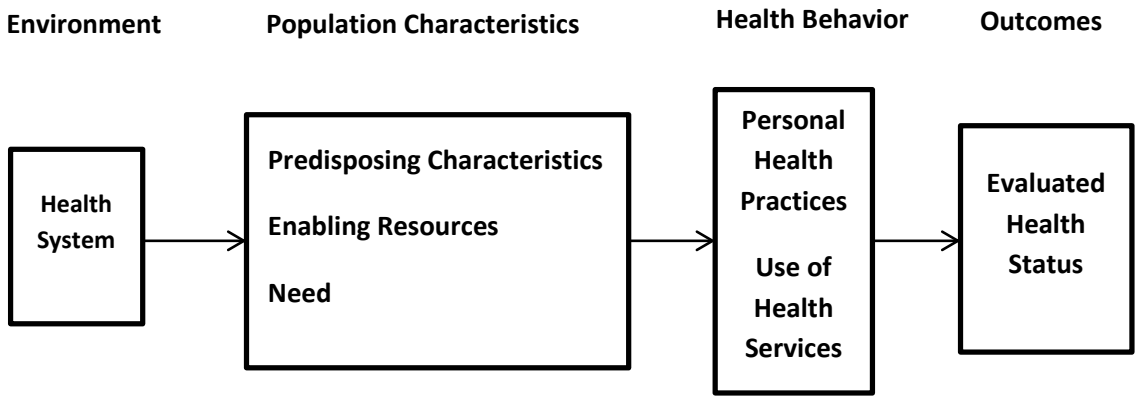
H1: Low-income individuals living in states with generous or moderate expansion are more likely to have better access to and utilization of health services than low-income individuals living in no-expansion states.

H2: Low-income individuals living in states with longer durations of expansion are more likely to have better access to healthcare services than a similar group of individuals living in no-expansion states.

Conceptual Framework

The three papers are related to policy changes in Medicaid eligibility, therefore they share the same conceptual model of healthcare services utilization. As shown in Figure 1, Andersen's (1995) Behavioral Model of Health Services Use suggests that utilization of healthcare services is affected by three types of characteristics: predisposing, need, and enabling (Aday & Andersen, 1974; Andersen, 1995). Predisposing characteristics describe individual's tendency to use healthcare services. Predisposing characteristics include demographic characteristics, such as age, gender, race, and ethnicity. Need characteristics describe an individual's health status or the main reason of seeking care from a healthcare provider. Enabling characteristics describe an individual's resources that can be used to utilize healthcare services. This includes income and health insurance, which facilitate access to care.

The characteristics from the model that are most central to the studies in this dissertation are the enabling characteristics. The model suggests that change in an individual's health insurance coverage status can affect financial ability and affordability of care, and hence utilization of healthcare services. Individuals who lose health insurance coverage through Medicaid disenrollment are more likely to face a financial burden to access care and thus use fewer services. On the other hand, individuals who gain health insurance coverage as a result of Medicaid expansion are more likely to access care and use healthcare services than other people without insurance coverage.



Source: Andersen RM. Revisiting the behavioral model and access to medical care: Does it matter. Journal of Health and Social Behavior 1995;36:1-8

Figure 1: Theoretical Framework of Healthcare Access and Utilization

Scope and Approach

This study will use secondary datasets to test the hypotheses. To answer the first set of questions, I use the 2002– 2008 Tennessee Cancer Registry data, Surveillance, Epidemiology, and End Results data, and income data from the Population Studies Center at University of Michigan. I estimate a difference-in-difference model to examine the association between Medicaid disenrollment and stage at diagnosis and delay in treatment. I use the 2012 and 2013 data from the Behavioral Risk Factor Surveillance System and logistic regression models to answer the second set of questions and examine the association between Medicaid expansion and access to care among cancer survivors living in non-expansion states compared to those living in expansion states. To answer the third set of questions, I use the 2012 restricted Medical Expenditure Panel Survey data and estimate logistic regression models to examine the effect of

generosity and duration of Medicaid expansions on access to and utilization of healthcare services.

Significance of the Study

The population of interest is low-income individuals who either lost or gained Medicaid coverage as a result of a state policy change. Compared with others, poor patients are at higher risk for delay in obtaining care because of cost (Weissman et al., 1991). People who lose Medicaid coverage are more likely to report unmet health care needs and experience increases in emergency department visits and hospitalization than those with continuous insurance (Carlson, DeVoe, & Wright, 2006; Emerson et al., 2012; Lowe, McConnell, Vogt, & Smith, 2008a). On the other hand, gaining Medicaid coverage may facilitate access to care and allow for utilization of healthcare services. However, generosity and duration of Medicaid programs may play an important role in deciding eligibility of low-income individuals across states.

Although most of the current research focuses on Medicaid expansion, few studies have looked at consequences of Medicaid disenrollment. No research has examined the impact of the largest disenrollment, which occurred in Tennessee, on breast cancer diagnosis and treatment. In addition, previous studies did not compare access to care among cancer survivors living in non-expansion states to those living in expansion states. Previous studies did not examine the association between generosity and duration of Medicaid on access to and utilization of healthcare services.

This dissertation addresses important gaps in our knowledge about the impact of Medicaid disenrollment on stage at diagnosis and delay of treatment among the underserved

women. In addition, the study examines the impact of Medicaid policy changes on access to care among underserved populations.

Summary of Remaining Chapters

This chapter provided an overview of the study's specific aims, conceptual framework, and analytical approach. The remainder of this dissertation proceeds as follows. Chapter 2 focuses on the effects of Medicaid disenrollment in Tennessee on disparities in stage at diagnosis and surgery for female breast cancer. Chapter 3 provides a baseline overview on Medicaid expansion and access to care among cancer survivors. Chapter 4 presents the impact of generosity and duration of Medicaid expansion on access to healthcare services. Chapter 5 summarizes conclusions and implications.

Chapter 2: Paper I

Medicaid disenrollment in Tennessee and disparities in stage at diagnosis and surgery for female breast cancer

Abstract

Purpose: To assess the effects of Medicaid disenrollment on stage at diagnosis and delay in surgery and treatment for female breast cancer among nonelderly women.

Background: Although Medicaid expansions have received considerable attention in the literature, Medicaid contractions have received much less attention. Tennessee's Medicaid program experienced a dramatic Medicaid contraction when the program disenrolled approximately 170,000 nonelderly adults after implementing a new benefit policy in 2005. Despite the fact that this was the largest disenrollment in the history of Medicaid, little is known about the effects of this policy change on access to care and health outcomes. This is the first study, to our knowledge, to consider the effect of disenrollment on stage at diagnosis and delay in surgery and treatment for breast cancer.

Methods: We use 2002-2008 data from Tennessee Cancer Registry which collects data on newly diagnosed cases of malignant disease that occur to Tennessee residents from all hospitals, laboratories, facilities and healthcare practitioners. The sample used for this study consists of women aged 21 to 64 who were diagnosed with breast cancer and living in Tennessee during the period of study. We calculate the changes in stage at diagnosis, more than 60-days delay in

surgery, and more than 90-days delay in surgery for female breast cancer among women who were diagnosed with breast cancer and had surgery as the first-line treatment. We also calculate the changes in more than 60 and 90 days delay in treatment for patients for whom surgery was not the first-line treatment. We estimate a difference-in-difference model comparing women who were living in low-income zip codes (and thus more likely to be subject to disenrollment) with women who lived in high-income zip codes before and after Tennessee's 2005 Medicaid disenrollment. We control for age, race/ethnicity, and marital status.

Results: Overall, nonelderly women in TN were diagnosed at later stages and experienced more delays in treatment in the period after disenrollment. Women who lived in low-income zip codes were 3.3 percentage points ($p < 0.05$) more likely to be diagnosed with late stage (regional or distant) breast cancer, compared to women living in high-income zip codes, after Tennessee's Medicaid disenrollment. In addition, nonelderly women who lived in low-income zip codes were 1.9 percentage points ($p < 0.05$) less likely to have more than 60-days delay in surgery than women living in high-income zip codes, after the disenrollment. Women who lived in low-income zip codes were also 1.4 percentage points ($p <0.1$) less likely to have more than 90-days delay in treatment.

Conclusions: While many states are expanding Medicaid eligibility under the Affordable Care Act, there has been discussion among policymakers in some states to reduce eligibility once full federal funding expires. Our results suggest that Medicaid disenrollment leads to later stage at diagnosis for breast cancer patients, indicating negative health impacts of contractions in Medicaid coverage.

In 2005, Tennessee experienced the largest disenrollment in the history of Medicaid. The program disenrolled almost 170,000 participants and terminated their coverage (Bonnyman, 2007; Chang CF & Steinberg SC., 2009). The disenrollment left these patients without health coverage that enables access to healthcare services, including breast cancer screening and treatment.

Breast cancer is the second leading cause of cancer death among women. The American Cancer Society (ACS) estimates that 12% of women in the U.S. will develop breast cancer during their life (American Cancer Society, 2014b). Detection of breast cancer at early stage is associated with longer survival rate than detection at advanced stages. The 5- year relative survival rate for localized breast cancer is 98.5%, but it is 25% for distant stage (Surveillance, Epidemiology, and End Results Program, 2014). At the same time, early treatment is an important element in saving patients' lives. A study, with a median follow-up period of 4.7 years, found that waiting 60 days or more in initiating treatment was associated with significant increase in both overall and breast cancer related mortalities by 66% and 85%, respectively (McLaughlin et al., 2012). To encourage early detection of the disease, the U.S. Preventive Services Task Force recommends that women ages 50 to 74 receive a mammogram every 2 years (U.S. Preventive Services Task Force, 2010). Further, the American Cancer Society guidelines for breast cancer screening recommend annual mammograms starting at age 40 without restricting the screening to an upper age limit (American Cancer Society, 2014a).

Disenrollment from a public health insurance coverage program has the potential to reduce patients' ability to utilize health care services, including mammograms and breast cancer treatment. Research on Oregon and Arizona has provided evidence on the effect of Medicaid disenrollment on utilization of healthcare services. In 2003, many Medicaid enrollees lost their

coverage in Oregon due to implementation of cost saving strategies, including cost sharing, benefit reductions, and tightening of enrollment rules (Carlson et al., 2006). The individuals who lost coverage were more likely to report unmet health care needs and medical debt than individuals who did not lose their coverage. The newly disenrolled people were less likely to report having a primary care visit. Medicaid disenrollment of approximately 10% of children from the Medicaid/ State Children's Health Insurance program in Arizona in 2004 was associated with reduction in ambulatory visits, and increases in emergency department visits and hospitalization (Rimsza, Butler, & Johnson, 2007).

Although Tennessee had the largest disenrollment in the history of Medicaid, little research has examined the effects of this disenrollment in particular. A few studies examined the impact of termination of coverage for Medicaid enrollees on utilization of emergency room visits. Evidence shows that Medicaid disenrollment in Tennessee resulted in a significant increase in emergency department visits by the uninsured (Heavrin, Fu, Han, Storrow, & Lowe, 2011). In their study of the impact of the disenrollment on avoidable hospital visits in Davidson County in Tennessee, Emerson et al. find an increased utilization of the emergency department by patients who became uninsured (Emerson et al., 2012). While these studies suggest that Medicaid disenrollment played a significant role in increasing utilization of emergency room visits, limited evidence exists on the effect of the policy change on cancer prevention, treatment and outcomes.

Background

Tennessee Medicaid Program (TennCare)

In 1994, Tennessee expanded its Medicaid program by creating TennCare to cover the uninsured (those with no insurance) and uninsurable (those who needed medical care, but their coverage was denied from insurers) adults and children (Centers of Medicare and Medicaid, 2014; Gallen, 2014; Moreno & Hoag, 2001). The state enrolled all Medicaid participants in managed care plans and used the planned savings from the managed care plans in funding the expansion (Garthwaite, Gross, & Notowidigdo, 2014). Compared to other states, coverage under the 1994 health reform in Tennessee was very generous (Moreno & Hoag, 2001). Tennessee had three types of Medicaid coverage: (a) mandatory by the federal government, covering poor children, parents, and pregnant women; (b) optional by the state, covering children and pregnant women with higher income levels than the mandatory coverage; and (c) expansion (demonstration or Section 1115 waivers), covering the uninsured, uninsurable, and medically needy spend down individuals (Gallen, 2014). The latter category is defined as people who reach poverty when their medical expenditures are considered (Gallen, 2014).

In 2002, Tennessee initiated TennCare II under another Section 1115 waiver, however, the program continued to face financial difficulties (Bureau of TennCare, 2005). In 2005, Tennessee was allowed to terminate optional and expansion enrollees from TennCare II, under a waiver amendment (Coughlin & Zuckerman, 2008). According to TennCare, the goal of this reform was to close certain eligibility categories, which included individuals ineligible for Medicaid (Bureau of TennCare, 2005). The disenrollment started in August 2005, and resulted in termination of approximately 200,000 adults (categorized as uninsured, medically eligible, non-pregnant medically needy) from Medicaid (Bureau of TennCare, 2005). The disenrolled individuals represented 9.8 percent of the overall Medicaid population in that year. Had the same level of disenrollment occurred in all the states, the U.S could have experienced a larger drop in

overall insurance coverage nationally than during the Great recession of 2008 when millions of people lost their insurance coverage (Garthwaite et al., 2014).

TennCareII Coverage and Take-up Rates

TennCareII covered many categories, including children, pregnant women, and people with disabilities (Bureau of TennCare, 2006). In 2005, 23 percent of the Tennessee population was enrolled in TennCareII (Bureau of TennCare, 2005). The enrollment dropped to 20 percent of the population in 2006 (Bureau of TennCare, 2006). The number of enrollees dropped from 1,336,691 in 2005 to 1,171,947 in 2006 (Bureau of TennCare, 2006). The disenrolled individuals were mostly uninsured and un-insurables.

TennCare II covered many services, including inpatient, outpatient, pharmacy, lab, medical supplies, physician services, and reconstructive breast surgery (Bureau of TennCare, 2005). The program offered the same benefits for all enrollees and did not require low-income people with incomes 100% of the federal poverty level (FPL) or below to pay premiums or co-payments (Gallen, 2014). Among individuals with income below the poverty level, the take-up rate of Medicaid was 71 percent, which is 19 percentage points higher than the national take-up rate in 2002 (Gallen, 2014; Kaiser Family Foundataion Medicaid and the Uninsured, 2005).

Previous cross-sectional studies suggest that health insurance coverage is an important factor to reduce delays in diagnosis and improve health outcomes among women diagnosed with breast cancer (Halpern, Bian, Ward, Schrag, & Chen, 2007; McDavid, Tucker, Sloggett, & Coleman, 2003; Smith et al., 2013). Further, studies on Medicaid disenrollment in different states found that termination of coverage was high among vulnerable populations, and that it increased utilization of the emergency department (Emerson et al., 2012; Lowe, McConnell, Vogt, &

Smith, 2008b; Wallace, Mcconnell, Gallia, & Edlund, 2010) and caused discontinuity of care (Weissman, Witzburg, Linov, & Campbell, 1999). In their study, Emerson et al used a logistic model to examine the effect of Medicaid disenrollment on number of emergency room visits. They found that the number of emergency room visits by the uninsured significantly increased by 18 percentage points. However, the study was limited to only one county in Tennessee (Emerson et al., 2012). A study documented an increase in number of emergency room visits by the uninsured as a result of reducing the Medicaid budget in Oregon. Although the study used two years before and two years after the policy change, it could not conclude whether the higher number of visits was related to the same patients using more services or an increase in the number of uninsured due to disenrollment (Lowe et al., 2008b). The question remains what the impact of loss of Medicaid coverage in Tennessee on healthcare outcomes is and, in particular, on cancer related outcomes such as diagnosis and treatment.

In this study, we provide evidence on the impact of Medicaid disenrollment in Tennessee on timely access to breast cancer screening and treatment. Specifically, we examine the impact of the 2005 Medicaid disenrollment in Tennessee on delays in diagnosis and treatment of breast cancer. We use a quasi-experimental method to examine whether Medicaid disenrollment is associated with delays in diagnosis and treatment of breast cancer. Because cross sectional studies are more likely to suffer from omitted variable bias and thus cannot estimate the causal relationship between changes in insurance coverage and healthcare related outcomes, we examine the impact of arguably exogenous Medicaid disenrollment on breast cancer diagnosis and treatment by using data from the Tennessee Cancer Registry and applying a difference in difference model.

Data

The data were obtained from the Tennessee Cancer Registry (TCR), a population-based cancer registry that collects information on Tennessee residents diagnosed with and/or treated for cancer (Tennessee Department of Health, 2014). TCR collects comprehensive and timely data from all hospitals, laboratories, facilities and healthcare practitioners. The data include information on incidence, stage at diagnosis, treatment, and vital status. The TCR data have met national standards of data completeness and quality since 2004 (silver standard in 2004 and gold standard subsequently).[1] The data on primary payer at diagnosis, however, may not reflect the actual payer, and thus are not reliable for determining whether patients were actually covered by Medicaid.[2] In addition, the registry did not begin to collect data on metastasis and lymph node involvement until 2004.

In total, there were 74,292 observations for women who were diagnosed with female breast cancer during 2000 – 2010. We exclude 421 observations because they were diagnosed at death; 28,187 observations because they were younger than 21 or older than 64; and 215 observations because they were missing both month and day of diagnosis (96 observations), of surgery (55 observations), or of treatment (64 observations). When dates of diagnosis, surgery, or treatment are missing days only, we assume that the missing day was the 15th of the month. In addition, we exclude 76 observations because date of surgery is before date of diagnosis, and 24 observations because date of treatment is before date of diagnosis. Furthermore, we exclude 129 and 38 observations when time to surgery or time to treatment exceeds 365, respectively. We

[1] Source: Martin Whiteside, DC, PhD, MSPH, Director, Office of Cancer Surveillance, Division of Policy, Planning & Assessment, Tennessee Department of Health
[2] http://www.naaccr.org/LinkClick.aspx?fileticket=AtR4s7_3i34%3D&tabid=230&mid=679

also exclude 595 observations because the zip codes in these observations were P.O. Box zip codes and may not represent the actual zip code of the patient's residence.

We merge the Tennessee Cancer Registry data with zip code median income data (2006-2011 release) from the Population Studies Center at University of Michigan. Because we are interested in estimating the effect of the 2005 Medicaid disenrollment on women eligible for Medicaid, we restrict our sample to women between ages 21 and 64 who were diagnosed with breast cancer between 2002 and 2008. We use the three years before (2002 – 2004) and the three years after (2006 – 2008) Medicaid disenrollment. We exclude 2005 because Medicaid disenrollment occurred in that year. We use three samples to conduct our analyses: one for stage at diagnosis, one for delay in surgery (and time to surgery), and the third one for delay in treatment (and time to treatment). Our final sample for stage at diagnosis consists of 19,100 observations with no missing data except for missing data on marital status.[3] After conducting this analysis, we divide the sample into two subsamples: the first subsample contains 15,590 observations that have surgery as first line of treatment (surgery only or surgery followed by adjuvant treatment) while the second subsample consists of 3,510 observations that had neoadjuvant therapy as first line of treatment. For the first sample, we exclude 366 observations that are diagnosed at distant stage because these observations do not usually receive surgery. We also exclude 1,690 observations that have localized or regional stage but have date of surgery of primary site the same as date of diagnosis (we assume these dates should only be the same if the case is in situ). Our final sample for the delay in surgery analyses consists of 13,534 observations. Appendix I illustrates the exclusion criteria and final sample with a flow chart.

[3] We chose not to exclude 601 observations with missing and unknown data on marital status to maximize our sample.

Outcome measures

Our main dependent variable is stage at diagnosis, but we also consider variables related to delay in surgery and treatment to examine the patterns of change in these variables before and after the disenrollment. Therefore, we consider seven dependent variables: one variable for stage at diagnosis, two variables for delay in surgery, two variables for delay in treatment, one variable for time to surgery, and one variable for time to treatment. To define stage at diagnosis, we recode the variable that refers to the SEER Summary Stage into a binary variable that equals one for late diagnoses (regional or distant) and zero for early diagnoses (in situ or localized). For both delays in surgery and delays in treatment, we create two binary variables, the first indicating delay more than 60-days from date of diagnosis and the second indicating delay more than 90-days. For both time to surgery and time to treatment, we use continuous variables representing the difference in days between date of surgery (or treatment) and date of diagnosis. Although date of most definitive surgery is considered more representative for date of surgery, this variable is missing for many of our observations. Hence, to construct the delays in surgery and time to surgery outcome variables, we define date of surgery to be the date of surgery of the primary site. However, we use date of most definitive surgery instead of date of surgery of primary site in particular situations: when date of surgery of primary site is the same as date of diagnosis (as it could be a diagnostic biopsy at the time of diagnosis; 2,215 observations), when surgery was a resection (23 observations), and when date of most definitive surgery is before date of surgery of primary site (because the second operation is likely the most definitive; 18 observations).

Statistical Analyses

We use three different statistical analyses. First, in our primary analysis, we estimate the following difference-in-difference model for each one of our outcomes: stage at diagnosis, delay in surgery, delay in treatment, time to surgery, and time to treatment. The difference-in-difference model compares the outcomes for women who were living in low-income zip codes (and thus more likely to be subject to disenrollment) and women who were living in high-income zip codes before and after Tennessee's 2005 Medicaid disenrollment.

$$Y_{ijt} = \beta_0 + \beta_1 \textit{Low-income}_j + \beta_2 \textit{Post}_t + \beta_3 (\textit{Low-income}_j \times \textit{Post}_t) + \beta_4 X_{ijt} + \epsilon_{ijt} \qquad (1)$$

In the model, *i* indexes individuals, *j* indexes zip codes, and *t* indexes years. $\textit{Low-income}_j$ is a binary variable that is equal to one for women living in zip codes characterized by low-income, and is equal to zero for individuals living in high-income zip codes.[4] $\textit{Post}_t$ is a binary variable for time and it is equal to one for the post-disenrollment years 2006–2008, and is equal to zero for the years 2002–2004. X_{ijt} represents time-varying individual controls, including age at diagnosis, race, ethnicity, and marital status.[5] ϵ_{ijt} is the error term. The coefficient of primary interest is β_3, on the $\textit{Low-income}_j \times \textit{Post}_t$ interaction term, which captures the difference between the outcomes for women living in low-income and high-income zip codes before and after

[4] We define low-income zip codes as those with median income less than or equal to $38,700 (the median income of 200% FPL)

[5] We considered including stage at diagnosis, insurance status, education, and employment as covariates in our models, but we did not include any of them in the main analyses. While stage at diagnosis could affect delay in treatment, it can be endogenous if we think that having a bad doctor is associated with late stage at diagnosis. On the other hand, some researchers would argue that different doctors could have seen the same patients before and after disenrollment and hence stage at diagnosis will not be correlated with the error term. To deal with this argument, we excluded stage at diagnosis from the analyses, but repeated the primary analysis in equation 1 with inclusion of stage at diagnosis and obtained similar results. We chose not to include insurance status in the analyses because we are examining the effect of Medicaid disenrollment on our outcomes and wanted to avoid holding many factors constant in our models. However, we repeated the primary analysis including insurance and obtained similar results. We could not control for education or employment in our analyses because the registry data do not report level of education and more than 86% of observations were missing employment in the original data.

Medicaid disenrollment. We estimate linear probability models for ease of interpretation (Ai & Norton, 2003).

Second, we use another control group for women who lived in Tennessee and were diagnosed with breast cancer. The control group comes from publicly available data from the Surveillance Epidemiology and End Results (SEER) database. SEER is a program of the National Cancer Institute (NCI) and it collects updated data on patient demographics, cancer incidence, survival, and treatment from population-based cancer registries. Including information on survival and stage of cancer at time of diagnosis makes the SEER data the only comprehensive cancer registry dataset on the population of the United States. The SEER program collects data from 18 registries: ten states, five metropolitan areas, and three Native American Registries. For this analysis, we use the following difference-in-difference model:

$$Y_{it} = \beta_0 + \beta_1 TN_i + \beta_2 Post_t + \beta_3 (TN_i \times Post_t) + \beta_4 X_{it} + \epsilon_{it}, \qquad (2)$$

where i indexes individuals and t indexes years. TN_i is a binary variable that is equal to one for women living in Tennessee, and is equal to zero for women living in the SEER states.

Sensitivity Analyses

We performed several sensitivity analyses to assess the robustness of our results. First, we did not exclude observations with localized or regional stage at diagnosis that had the same date for both diagnosis and surgery. Second, we repeated the delay in surgery analyses for the delay in surgery outcomes without replacing dates of surgery of primary site with date of most definitive surgery when date of surgery of primary site was the same as date of diagnosis. Third,

we repeated the analyses without replacing dates that have missing days in dates of diagnosis or surgery with the 15th of the month (observations with missing days are dropped in these analyses). Finally, we repeated the analyses restricting our sample to the years 2004 and 2006 and controlling for metastasis and lymph node involvement, which are missing for 2002 and 2003.

Results

Primary Analyses

Table 1 shows the characteristics of the stage at diagnosis sample by disenrollment and zip code income. The sample consists of 19,100 women who lived in Tennessee between 2002 and 2008 before and after the 2005 Medicaid disenrollment. Before Medicaid disenrollment, 15.9% of the women in the sample lived in low-income zip codes, while 37.1% lived in high-income zip codes after the disenrollment. The table shows that the number of cases diagnosed with distant stages increases in both low- and high-income zip codes after disenrollment. Women living in low-income zip codes before disenrollment had significantly higher delays in more than 60 days surgery (difference = 1.83, $p < 0.001$) and treatment (difference = 0.87, $p = 0.03$) than women living in high-income zip codes. While both women living in low and high-income zip codes had longer delays in surgery and treatment after disenrollment, the delays for women living in high-income zip codes were higher. For example, more than 60 days delay in surgery significantly ($p = 0.005$) increased from 11.98% before disenrollment to 14.34% after disenrollment among women living in low-income zip codes while it significantly ($p < 0.001$) increased from 10.15% before disenrollment to 14.36% after disenrollment among women living

in high-income zip codes. The average age of women in the sample is 51 years, and more than 60% are 50 – 64 years old. Most women in the sample are white, married, and insured. Before disenrollment, almost 80% of the women in our sample did not have any comorbidity, but comorbidities increased for women living in either type of zip code after disenrollment.

Table 2 shows the results from the difference-in-difference models for all the outcome variables. Compared to women living in high-income zip codes, women living in low-income zip codes had a significant increase of 3.3 percentage points ($p = 0.024$) in the probability of being diagnosed at late stages (regional or distant) after the 2005 Tennessee Medicaid disenrollment. Women living in low-income zip codes had a significant decrease of 1.9 percentage points ($p = .024$) and 1.4 percentage points ($p = .054$) in the probabilities of more than 60 and 90 days delay in surgery and treatment, respectively, compared to women living in high-income zip codes. When we use the continuous variables, women living in low-income zip codes have a significant decrease of 2.4 days ($p = .008$) in time to surgery and of 2.8 days ($p= .041$) in time to treatment after disenrollment, compared to women living in high-income zip codes. Regardless of level of zip code income, all women living in Tennessee in our sample had significant or marginally significant delays in surgery and treatment (except for more than 90 days delay in treatment) after disenrollment.

Using the control group consisting of women living in SEER states supports our results from the primary analysis considering stage at diagnosis. Table 3 shows the difference in difference results for this analysis. Compared to women living in SEER states, women living in Tennessee had a significant increase of 3.8 percentage points ($p<.001$) in the probability of being diagnosed at late stage.

Sensitivity Analyses

When we did not exclude observations with localized or regional stage at diagnosis that had the same date for both diagnosis and surgery from the surgery sample, the coefficients were slightly lower than the coefficients in our primary analysis, but they were in the same direction. The coefficient from the model of more than 60 days delay in surgery decreased to – 1.5 percentage points (compared with – 1.9 in the primary analysis) and remained significant ($p = 0.042$) as shown in Table 4. The coefficient from the model of time to surgery also decreased by 0.74 day and became slightly less significant ($p = 0.044$). Table 5 shows the results of the difference-in-difference model in which we did not replace dates of surgery of primary site with date of most definitive surgery when date of surgery of primary site was the same as date of diagnosis. The coefficients were similar for stage at diagnosis and delays in surgery and treatment, but lower and less significant for time to surgery and treatment. Table 6 shows the results for the model in which we repeated the primary analyses without replacing dates of diagnosis or surgery that have missing days with the 15th of the month. The coefficient for stage at diagnosis increases slightly and becomes more significant (3.5 percentage points, $p = 0.017$) while coefficients for delay in surgery and treatment as well as time to surgery and treatment are similar to those in the primary analyses. Table 7 shows the coefficients for the model that only uses data from 2004, 2006 and controls for metastasis and lymph node involvement. While the coefficients for stage at diagnosis decreased slightly, the coefficients for more than 60 days delay in surgery and time to surgery increased and became insignificant (or less significant for time to surgery). The coefficient for more than 90 days delay in treatment increased and became more significant while the coefficient for time to treatment increased and became insignificant. In

summary, our results are robust to many changes in specific variable and sample definitions and model specifications.

Discussion

We examined the effect of the 2005 Medicaid disenrollment in Tennessee on disparities in stage at diagnosis, delay in surgery, and delay in treatment for female breast cancer. We found that Medicaid disenrollment was associated with worsening in diagnosis of breast cancer, but less delay in surgery or treatment for women living in low-income zip codes. Furthermore, we found that women living in Tennessee were diagnosed with breast cancer at later stage than women living in the SEER states. Our findings on stage at diagnosis were the most robust and in the expected direction. Women living in low-income zip codes are diagnosed at late stage of breast cancer because they do not have health insurance, which improves access to care and allows for timely access to healthcare services such as mammography screening. Although the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) in Tennessee provided free mammograms to uninsured and underinsured women who had income below 250% FPL, the program, like similar programs across the country, could only reach twenty percent of eligible women on average (American Cancer Society, 2011; Tangka et al., 2010). Hence, many uninsured women were not able to receive regular mammograms.

Our descriptive results show that women living in either low or high-income zip codes had delays in surgery and treatment after the disenrollment. High-income women have a smaller magnitude of delays in the pre-disenrollment period relative to women living in low-income zip codes and hence a larger increase in delays, though the reason for this pattern is unclear.

Although we hypothesized that women living in low-income zip codes will have greater delays in surgery and treatment than women living in high-income zip codes, our DD estimates suggest that women living in low-income zip codes had 2.4 and 2.8 fewer days of delays in surgery and treatment, respectively, than women living in high-income zip codes after disenrollment. Our results are consistent with results from previous research, which found that women living in the highest income quintiles were 1.47 times more likely to experience delay between diagnosis of breast cancer and surgery than women living in the lowest income quintile (Plotogea et al., 2013).

There are several ways to interpret our findings on late stage at diagnosis and fewer delays in surgery and treatment for low-income women. First, diagnosis of cancer depends on regular access to preventive services provided by a primary care physician not an oncologist. Low-income women who previously had Medicaid coverage but lost it because of the disenrollment, will most likely lose the possibility of access to preventive services such as mammography screening, which is an important tool to detect breast cancer in early stages. Once uninsured low-income women are diagnosed with breast cancer, they usually become covered by Medicaid through the Breast and Cervical Cancer Prevention and Treatment Act (BCCPTA) and start their treatment as indicated by their oncologists (French, True, McIntyre, Sciulli, & Maloy, 2004). In this way, low-income women who lost their Medicaid coverage are re-enrolled in Medicaid to receive cancer treatment (and other healthcare services) after being diagnosed with breast cancer. However, Medicaid coverage only after diagnosis with breast cancer is not helpful as continuous coverage beginning before diagnosis. A previous study highlighted the importance of Medicaid coverage before diagnosis by finding that uninsured women were two times more likely to be diagnosed with late stage breast cancer compared to women who were insured by

Medicaid in the same month of diagnosis (Bradley, Given, & Roberts, 2003). Second, women living in high-income zip codes are assumed to be more likely to have private insurance and thus be less affected by the disenrollment. Since these women have access to preventive care services, they are more likely to have regular mammography screenings, which detect cancer at an early stage. Once high-income women are diagnosed with breast cancer, they need to receive surgery or neoadjuvant therapy. Because these women have higher incomes, they may need extra time to schedule their appointments and begin treatment because they may choose to have plastic surgery,[6] seek a second opinion from other oncologists, or even contact their health insurance plan to inquire about covered services. These factors and others may result in a few days of delay in surgery or treatment despite early diagnosis of the disease.

Several limitations must be acknowledged. First, although this study can be generalized to the southern states, it is not possible to generalize it to the whole country. The states in this study are different from the rest of the U.S. in terms of demographics and un-insurance and poverty rates. Second, there is a difference in quality of the data requested from the Tennessee Cancer Registry before and after Medicaid disenrollment. The data requested have only met the national gold standards of data completeness and quality for the period 2004–2008. They have met the silver standards in 2004. Therefore, the difference in quality of the data may bias the estimates in the study. Third, although date of most definitive surgery is the most accurate date for surgery, this variable was missing for more than 40% of observations in the original dataset and we had to use date of surgery of primary site instead. Similarly, more than 35% of observations were missing date therapy initiated based on SEER, and we had to use dates from Commission on Cancer (CoC) instead. Fourth, the cancer registry data do not include reliable

[6] Receiving plastic surgery is beyond the scope of this paper, but we will consider that in future research.

information on type of health insurance coverage or income, so we were not able to identify women with Medicaid coverage or low household incomes. To deal with that, we used living in a zip code with a particular median income as a proxy for income and Medicaid coverage. Fifth, we were not able to control for metastasis or lymph node involvement in our analyses because these variables were missing in 2002 and 2003. To control for these variables when it was possible, we conducted a restricted sensitivity analysis with 2004 represents pre-disenrollment and 2006 represents post-disenrollment and found that stage at diagnosis decreased slightly and time to surgery increased slightly but both became marginally significant. Sixth, there were 352 observations for which date of diagnosis and 152 observations for which date of surgery of primary site were incomplete (missing day of the month). To deal with this issue, we considered the missing day to be the 15th of the month but conducted a sensitivity analysis without this consideration. Our results were similar to those in the primary analyses. Seventh, we were not able to control for level of education because the cancer registries do not collect data on education. Finally, we could not control for employment because more than 86% of the observations in the original sample were missing this information.

Our findings may have important policy implications for states that may consider terminating coverage of new Medicaid enrollees under the ACA after expanding Medicaid for a few years. Medicaid expansion under the Affordable Care Act (ACA) increases the Medicaid eligibility threshold to 138% FPL, with the goal of reducing the uninsurance rate (Kaiser Family Foundation, 2014a). During the first three years of Medicaid expansion, the federal government is providing complete funding to cover new Medicaid enrollees (Center on Budget and Policy Priorities, 2012). Starting in the third year, 2017, the responsibility of funding the program will be shared gradually between the states and the federal government. Although the ACA was

written with the intent of expanding Medicaid in all states, the 2012 Supreme Court decision made it optional for states to expand Medicaid (Kaiser Family Foundation, 2012). As of August 2015, 29 states and DC decided to expand Medicaid while the rest of the states did not expand the program (Kaiser Family Foundation, 2014b). In 2013, the Michigan House of Representatives approved the Medicaid expansion to enroll newly eligible adults in the program. However, it authorized Michigan to withdraw from the expansion in the event that the savings from the expansion do not offset Medicaid cost in 2017 or later (Ayanian, 2013). A decision such as this would lead to termination of coverage for many low-income people. The 2005 Medicaid disenrollment in Tennessee can provide several lessons to be learned in respect to access and utilization of preventive care services, and subsequent delays in diagnosis and treatment of diseases such as breast cancer, which has better prognosis when diagnosed early (American Cancer Society, 2014c). Our results indicate that losing Medicaid coverage has important health consequences for low-income patients subsequently diagnosed with cancer, and these health impacts should be considered by policymakers weighing the costs and benefits of implementing or continuing expanded Medicaid coverage under the ACA.

Table 1: Descriptive statistics of the stage at diagnosis sample by disenrollment and income

	Pre-disenrollment (n= 8,525)			Post-disenrollment (n= 10,575)		
	Low-income zip codes (n= 3,028)	High-income zip codes (n= 5,497)	P Value	Low-income zip codes (n= 3,486)	High-income zip codes (n= 7,089)	P Value
Stage at diagnosis (%)						
In situ	14.17	15.88	.02	14.95	18.07	<.001
Localized	50.43	49.48		44.89	45.69	
Regional	32.79	32.80		36.66	32.59	
Distant	2.61	1.84		3.50	3.65	
Delay in surgery_60 days (%)	11.99	10.15	.01	14.34	14.36	.98
Delay in surgery_90 days (%)	8.88	7.70	.05	9.93	9.58	.57
Delay in treatment_60 days (%)	3.67	2.80	.03	5.57	5.98	.39
Delay in treatment_90 days (%)	1.59	1.24	.18	2.21	1.92	.32
Age at diagnosis ± (SD)	51.50±(8.57)	51.23±(8.36)	.16	51.62±(8.23)	51.84±(8.27)	.19
Age (%)						
21–39 years	10.11	9.61	.30	8.38	8.31	.83
40–49 years	27.41	28.92		29.49	28.96	
50–64 years	62.48	61.47		62.13	62.73	
Race (%)						
White	78.10	87.90	<.001	77.57	86.15	<.001
African American	21.47	10.57		21.80	12.08	
Asian	0.26	0.98		0.37	1.38	
Other	0.17	0.55		0.26	0.39	
Hispanic (%)	0.40	0.38	.92	0.69	0.49	.21
Marital status (%)						
Married	62.45	70.66	<.001	59.84	69.08	<.001
Unmarried	33.55	26.81		35.48	28.41	
Missing	4.00	2.53		4.68	2.51	
Insured (%)	98.35	98.85	.05	98.31	98.67	.14
Comorbidities (%)						
0 Comorbidity	80.28	78.75	.07	62.56	65.10	.03
1 Comorbidity	6.97	7.77		13.37	11.54	
2 Comorbidities	3.90	4.93		7.77	7.56	
3+ Comorbidities	8.85	8.55		16.29	15.80	

Table 2: Results of the difference-in-difference model (Primary analysis)

	Stage at diagnosis	>60 days delay in surgery	>90 days delay in surgery	>60 days delay in treatment	>90 days delay in treatment	Time to surgery (days)	Time to treatment (days)
Observations	19,100	13,534	13,534	3,510	3,510	13,534	3,510
Low-income_Post	0.033** (0.024)	-0.019** (0.024)	-0.000 (0.957)	-0.009 (0.410)	-0.014* (0.054)	-2.442*** (0.008)	-2.815** (0.041)
Low-income	-0.002 (0.833)	0.013** (0.039)	0.002 (0.611)	0.002 (0.807)	0.012** (0.026)	1.724** (0.014)	0.732 (0.460)
Post	0.017* (0.055)	0.031*** (0.000)	0.005* (0.078)	0.020*** (0.003)	0.007 (0.100)	6.043*** (0.000)	6.943*** (0.000)
40-49 years	-0.095*** (0.000)	0.003 (0.675)	-0.001 (0.803)	0.001 (0.881)	0.005 (0.391)	0.287 (0.741)	-0.961 (0.385)
50-64 years	-0.145*** (0.000)	-0.000 (0.996)	-0.002 (0.614)	-0.007 (0.374)	-0.001 (0.867)	0.349 (0.670)	-2.043** (0.050)
African American	0.077*** (0.000)	0.046*** (0.000)	0.034*** (0.000)	0.032*** (0.000)	0.020*** (0.000)	5.665*** (0.000)	6.655*** (0.000)
Asian	0.095*** (0.009)	0.031 (0.135)	0.026** (0.035)	-0.025 (0.398)	-0.007 (0.730)	3.129 (0.165)	1.902 (0.621)
Other race	0.033 (0.561)	-0.035 (0.262)	0.005 (0.808)	-0.031 (0.652)	-0.009 (0.850)	-1.636 (0.630)	13.311 (0.134)
Hispanic	0.003 (0.950)	0.059* (0.057)	-0.000 (0.984)	0.175*** (0.000)	0.194*** (0.000)	6.980** (0.040)	17.220*** (0.001)
Married	-0.029*** (0.000)	-0.014*** (0.002)	-0.001 (0.607)	-0.007 (0.232)	-0.004 (0.365)	-1.349*** (0.006)	-3.270*** (0.000)
Married_missing	-0.031 (0.126)	-0.009 (0.453)	0.006 (0.437)	-0.001 (0.962)	0.016 (0.162)	-3.761*** (0.003)	-0.109 (0.959)
1 Comorbidity	-0.027** (0.020)	0.024*** (0.000)	0.009** (0.033)	0.001 (0.950)	0.009 (0.131)	1.841** (0.011)	-1.791 (0.101)
2 Comorbidities	-0.019 (0.185)	0.002 (0.775)	0.002 (0.648)	-0.009 (0.408)	0.004 (0.563)	0.009 (0.992)	-1.498 (0.273)
3+ Comorbidities	0.012 (0.259)	0.020*** (0.001)	0.008** (0.031)	-0.010 (0.189)	-0.002 (0.730)	1.743*** (0.008)	-1.741* (0.089)

Table 3: Results of the difference-in-difference model (using SEER states as the control group)

	Stage at diagnosis
Observations	240,598
TN_Post	0.038*** (0.000)
TN	0.029*** (0.000)
Post	-0.013*** (0.000)
40-49 years	-0.120*** (0.000)
50-64 years	-0.147*** (0.000)
African American	0.078*** (0.000)
Asian	-0.012*** (0.002)
Other race	0.027*** (0.003)
Hispanic	0.066*** (0.000)
Married	-0.034*** (0.000)
Married_missing	-0.055*** (0.000)

Sensitivity analyses:

Table 4: Results of the difference-in-difference model (including localized, and regional but include observations that have the same date for surgery and diagnosis)

Note: The results of stage at diagnosis and delays in treatment are not affected by this (it only affects delays in surgery)

	>60 days delay in surgery	>90 days delay in surgery	Time to surgery (days)
Observations	15,224	15,224	15,224
Low-income_Post	-0.015** (0.042)	0.001 (0.882)	-1.737** (0.044)
Low-income	0.009 (0.103)	0.001 (0.841)	0.683 (0.288)
Post	0.030*** (0.000)	0.006** (0.030)	7.131*** (0.000)

Table 5: Results of the difference-in-difference model (No replacement for dates of surgery of primary site with date of most definitive surgery when date of surgery of primary site is the same as date of diagnosis)

	Stage at diagnosis	>60 days delay in surgery	>90 days delay in surgery	>60 days delay in treatment	>90 days delay in treatment	Time to surgery (days)	Time to treatment (days)
Observations	19,104	14,055	14,055	2,215	2,215	14,055	2,215
Low-income_Post	0.033** (0.023)	-0.018** (0.028)	0.001 (0.831)	-0.010 (0.541)	-0.020* (0.083)	-2.088** (0.025)	-2.568 (0.183)
Low-income	-0.002 (0.825)	0.010 (0.101)	-0.000 (0.941)	-0.001 (0.940)	0.016* (0.051)	1.421** (0.045)	-0.873 (0.531)
Post	0.016* (0.057)	0.031*** (0.000)	0.005 (0.116)	0.027** (0.012)	0.010 (0.167)	6.073*** (0.000)	8.761*** (0.000)

Table 6: Results of the difference-in-difference model (No replacement of missing day of date of diagnosis or surgery with the 15th of the month)

	Stage at diagnosis	>60 days delay in surgery	>90 days delay in surgery	>60 days delay in treatment	>90 days delay in treatment	Time to surgery (days)	Time to treatment (days)
Observations	18,907	13,450	13,450	3,412	3,412	13,450	3,412
Low-income_Post	0.035** (0.017)	-0.019** (0.022)	-0.000 (0.923)	-0.017 (0.102)	-0.014** (0.044)	-2.452*** (0.007)	-2.937** (0.029)
Low-income	-0.002 (0.882)	0.013** (0.036)	0.002 (0.572)	0.000 (0.976)	0.009** (0.071)	1.713** (0.013)	0.362 (0.706)
Post	0.015* (0.085)	0.032*** (0.000)	0.006** (0.033)	0.021*** (0.001)	0.008* (0.072)	6.214*** (0.000)	6.696*** (0.000)

Table 7: Results of the difference-in-difference model (Using 2004 as pre- and 2006 as post-disenrollment and controlling for lymph nodes involvement and metastasis)

	Stage_Dx	Delay_surg_60	Delay_surg_90	Delay_ttt_60	Delay_ttt_90	Delay_surg_cont	Delay_ttt_cont
Observations	5,807	4,442	4,442	1,245	1,245	4,442	1,245
low_income_200_Post2	0.027* (0.025)	0.002 (0.902)	0.002 (0.807)	0.003 (0.853)	-0.020*** (0.049)	-2.674* (0.096)	-3.055 (0.107)
low_income_200	-0.003 (0.703)	-0.005 (0.611)	-0.006 (0.373)	-0.004 (0.736)	0.015** (0.041)	0.699 (0.564)	1.447 (0.293)
Post2	-0.000 (0.997)	-0.006 (0.468)	-0.002 (0.679)	-0.003 (0.792)	0.002 (0.718)	1.858** (0.039)	2.630** (0.028)

Chapter 3: Paper II

Medicaid Expansion and Access to Care among Cancer Survivors: A Baseline Overview

Abstract

Purpose Medicaid expansion under the Affordable Care Act facilitates access to care among vulnerable populations, but 21 states have not yet expanded the program. Medicaid expansions may provide increased access to care for cancer survivors, a growing population with chronic conditions. We compare access to healthcare services among cancer survivors living in non-expansion states to those living in expansion states, prior to Medicaid expansion under the Affordable Care Act.

Methods We use the 2012 and 2013 Behavioral Risk Factor Surveillance System to perform multiple logistic regression models to compare inability to see a doctor because of cost, having a personal doctor, and receiving an annual checkup in the past year between cancer survivors who lived in non-expansion states and survivors who lived in expansion states.

Results Cancer survivors in non-expansion states had statistically significantly lower odds of having a personal doctor (adjusted odds ratio [AOR] 0.77; 95 % confidence interval [CI] 0.64–0.94; $p<0.001$) and higher odds of being unable to see a doctor because of cost (AOR 1.19, 95 % CI 1.03–1.38, $p<0.05$). Statistically significant differences were not found for annual checkups.

Conclusions Prior to the passage of the Affordable Care Act, cancer survivors living in expansion states had better access to care than survivors living in non-expansion states. Failure to expand Medicaid could potentially leave many cancer survivors without access to routine care.

Implications for Cancer Survivors Existing disparities in access to care are likely to widen between cancer survivors in non-expansion and expansion states.

Key words Medicaid expansion. Cancer survivors. Access to care. Disparities.

Introduction

Cancer survival is improving as a result of earlier detection of the disease and advances in treatment (Centers for Disease Control and Prevention, 2015). In 2014, there were 14.5 million adults and children with a history of cancer living in the United States, and approximately 1.6 million new cases of cancer are estimated to be diagnosed in 2015 (American Cancer Society, 2014c). Given the high incidence and survival rates, cancer survivors consume a considerable amount of health care services (Erikson, Salsberg, Forte, Bruinooge, & Goldstein, 2007). For example, they require oncology visits for cancer surveillance and follow-up care as well as primary care visits for routine care related to other health conditions, pain and other symptom control, and secondary malignancy screenings (Earle, Burstein, Winer, & Weeks, 2003; Earle, 2006; Mayer et al., 2012; McCabe & Jacobs, 2012). However, many cancer survivors face financial problems that prevent them from receiving timely and recommended health care (Yabroff et al., 2013). A study using data from the National Health Interview Survey (NHIS) found that cancer survivors were more likely to delay care because of cost than the general population and among cancer survivors who reported financial difficulties, they were

more likely to delay or even give up medical care entirely (Kent et al., 2013; Weaver, Rowland, Bellizzi, & Aziz, 2010).

The Institute of Medicine (IOM), the Centers for Disease Control and Prevention (CDC), and the American Society of Clinical Oncology (ASCO) recommend that each cancer survivor receive a survivorship care plan to facilitate follow-up care (American Society of Clinical Oncology, 2014; Centers for Disease Control and Prevention, 2014a). For example, ASCO recommends that breast cancer patients receive a physical examination every three to six months for the first three years following breast cancer treatment, every six to 12 months in the fourth and fifth years, and annually thereafter (American Society of Clinical Oncology, 2014). However, among uninsured and publicly insured individuals aged 18 to 64 years, cancer survivors are less likely to have a usual source of care and use preventive services than other individuals who were not diagnosed with cancer (Yabroff et al., 2013).

While transitioning to survivorship, cancer patients may experience difficulties, such as lack of health insurance, low socioeconomic status, poor communication with primary care providers, and uncertainty about follow-up care (Dulko et al., 2013; Earle & Neville, 2004). These and other factors contribute to lack of coordinated care or even absence of care for disadvantaged patients (Steinberg, 2008). When older breast cancer survivors were asked how they could be helped to deal with the financial burden of cancer, they reported that they mostly needed financial assistance through public agencies and better health insurance with lower cost-sharing (Pisu, Martin, Shewchuk, & Meneses, 2014).

Prior to the Affordable Care Act (ACA), Medicaid provided health insurance coverage to certain groups of low-income people, including children, pregnant women, and disabled

individuals. Medicaid eligibility varied across states, but the program covered mandatory services such as laboratory services, family planning, prescription drugs, and inpatient and outpatient hospital services. In addition, states varied in their pre-ACA expansion experiences. Many states, such as Arkansas and Oregon received Section 1115 waivers to expand Medicaid eligibility to childless adults. These waivers were not only different in implementation year and duration, but also in their eligibility requirements, creating differences in generosity of Medicaid across states. For example, Massachusetts and Vermont were very generous, with eligibility thresholds higher than 200% of the federal poverty level (FPL), while Michigan's threshold was below 100% FPL (Kaiser Family Foundation, 2013).

Medicaid expansion under the ACA provides coverage for individuals, including childless adults, with income up to 138% of the FPL. Medicaid expansion will broadly cover preventive services, but narrowly cover prescription drugs (Paradise, June, 2014). Although Medicaid expansion aims to reduce the uninsurance rate, the debate continues as to whether Medicaid will improve access to care and use of services (Antos, 2013; Kaiser Family Foundation Medicaid and the Uninsured, 2012). While there is evidence of poorer outcomes among Medicaid enrollees than uninsured individuals in some domains, research shows an association between Medicaid coverage and improvement in access to care and health outcomes (Gottlieb, 2011). Compared to their low-income privately insured peers, Medicaid beneficiaries have comparable access to services such as doctor visits and preventive care (Coughlin et al., 2005; Long et al., 2005). Medicaid expansion to adults prior to the Affordable Care Act (ACA) was associated with a reduction in all-cause mortality, an increase in insurance coverage, and a reduction in delayed care related to cost among older adults, nonwhite, and poor individuals (Sommers, Baicker, & Epstein, 2012). However, under the ACA, only 29 states and the District

of Columbia expanded Medicaid coverage to low-income childless adults (Garfield, Damico, Stephens, & Rouhani, 2014).

Despite general agreement about the importance of receiving follow-up care for cancer survivors, little is known about the receipt of care among cancer survivors living in non-expansion states compared to those living in expansion states (American College of Surgeons, 2014; Balogh et al., 2011; Horning, 2008). Previous studies have focused on the type of provider seen by survivors, survivors' perceptions of care options, personal barriers to receive care, challenges of providers, and qualitative studies to identify unmet needs of survivors (Dulko et al., 2013; Friese et al., 2014; Khan, Evans, & Rose, 2011; Mayer et al., 2012; McCabe & Jacobs, 2012; Miedema & Easley, 2012; Pisu et al., 2014). No study to date has focused on the changes in Medicaid policies that influence care during the survivorship period.

The purpose of this paper is to compare access to healthcare services among cancer survivors who reside in states that have not expanded Medicaid under the ACA and those who reside in states that expanded Medicaid, using data prior to the implementation of the ACA. We assess whether, at baseline, cancer survivors were unable to see a doctor because of cost, if they had a personal doctor, and if they received annual checkups in non-expansion states compared to expansion states. To rule out the effect of other potential factors affecting the association between residence in non-expansion or expansion states, we control for demographic characteristics, income, and insurance coverage. As nearly half of states debate Medicaid expansion, an understanding of pre-expansion access to care among cancer survivors can inform policy and clinical decisions.

Methods

Data sources

We use pooled cross sectional data from the 2012 and 2013 Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a nationally representative annual survey that collects information on self-reported preventive health practices and risk behaviors. It is a random, population-based telephone survey of non-institutionalized adults in all 50 states and the District of Columbia (DC) (Centers for Disease Control and Prevention, 2013a). In addition to using BRFSS data, we use 2012 and 2013 information from the Department of Health and Human Services to construct a measure of income as a percentage of the FPL for each household in every year (U.S. Department of Health & Human Services, 2015).

Study population

We restrict our analyses to cancer survivors who responded to the BRFSS survey during the study period. We define a cancer survivor as any individual aged 18 to 64 years who reports having been diagnosed with any type of cancer other than skin cancer. We use this age range because it allows for inclusion of adults who may be eligible for Medicaid coverage. We only include patients who reported to be diagnosed with any type of cancer and were never told to have skin cancer. We exclude survivors with skin cancer because this type of cancer is rarely life threatening and we did not have data on skin cancer for 2013. After this exclusion, we identified 30,249 cancer survivors. We excluded observations with missing data on income (n=3,295),

checkup (n=261), inability to see a doctor because of cost (n=52), personal doctor (n=38), race/ethnicity (n=386), and missing data on education, employment, marital status, and insurance coverage (n=164). The sample used for the analysis consists of 26,053 cancer survivors.

Dependent variables

We use three self-reported dependent variables from the BRFSS health care access module, which contains questions about the ability of respondents to access health care services (Centers for Disease Control and Prevention, 2013b). The first two dependent variables are whether the respondent was unable to see a doctor because of cost and if the respondent reported having a personal doctor in the past year. The third outcome is related to utilization of preventive health care services and focuses on whether the respondent received an annual checkup in the past 12 months.

Independent variables

The independent variable of interest is residence in a non-expansion state. We classify states into two groups: non-expansion and expansion states. We define non-expansion states as those which have not decided to expand Medicaid under the ACA as of June, 2015. We obtained information on states' Medicaid expansion from the Centers for Medicare and Medicaid Services (CMS) (Centers for Medicare and Medicaid Services, 2014). Additional covariates include demographic information (age, race, ethnicity, marital status, childlessness "not having children under 18 years old") and socioeconomic status (income, education, employment status, insurance

coverage). Age is constructed as a categorical variable (18 –29 [reference group], 30– 39, 40–49, 50 –59, 60 –64 years). Race is a categorical variable of racial groups (white [reference group], African American, Asian, other). Ethnicity, marital status, and childlessness are binary variables. Income is a categorical variable (less than 138% of FPL [reference group], 138 – 400% of FPL, more than 400% of FPL). Education is a categorical variable (less than high school [reference group], high school, some college, college or more). Employment and insurance status are binary variables.

Statistical analysis

We use multiple logistic regression models to compare differences in the outcome measures between cancer survivors living in non-expansion and expansion states. We generate adjusted odds ratios and 95% confidence intervals to compare the estimated differences in each outcome measure between cancer survivors living in non-expansion and expansion states. In addition to using the full sample (n=26,053), we repeat the analyses using a subsample consisting of low-income cancer survivors (n=8,862). Low-income survivors are most affected by changes in insurance status and are less likely to access care if they do not have affordable insurance (National Cancer Institute, 2008). We use survey weights in the analyses to control for the complex sampling design of the BRFSS survey, nonresponse, and telephone non-coverage rates among respondents in different states (Centers for Disease Control and Prevention, 2013a). All statistical analyses were conducted using Stata 12.

Because states are different in the generosity of their pre-ACA Medicaid eligibility, we repeated our analyses comparing states that had generous Medicaid eligibility (before the ACA)

with the same set of post-ACA non-expansion states. We defined generous states as those with Medicaid eligibility threshold equal to or higher than 200% FPL. We hypothesized that comparing these two groups would show larger differences in outcome measures between non-expansion and generous eligibility states than the differences we obtained from the primary analysis when we compared non-expansion states with all post-ACA Medicaid expansion states.

Results

Table 8 reports descriptive statistics for cancer survivors for expansion and non-expansion states. Significantly greater proportions of cancer survivors in non-expansion states were African American (15.8%), had household incomes lower than 138% FPL (46.1%), and had lower rates of insurance coverage (83.4%) than survivors residing in expansion states. Survivors residing in non-expansion states had a statistically significantly greater rate of inability to see a doctor in the past year because of cost (26.0% versus 21.1%, $p< 0.001$). In addition, survivors residing in non-expansion states were significantly less likely to report having a personal doctor (85.7% compared to 89.4%, $p< 0.001$), but had comparable probabilities of receiving annual checkups to survivors residing in expansion states.

Tables 9 and 10 report results from the adjusted logistic regression analyses that assessed factors associated with access to and utilization of healthcare services for both the full sample and the low-income sample. Residing in a non-expansion state was positively and statistically significantly associated with inability to see a doctor because of cost in the full sample (adjusted odds ratio [AOR] 1.19; 95 % confidence interval [CI] 1.03–1.38; $p<0.05$) and (AOR 1.30; 95% CI 1.06–1.58, $p<0.05$) in the full sample and the low-income sample, respectively. Cancer

survivors residing in non-expansion states had statistically significantly lower odds for having a personal doctor in the past year (full sample AOR 0.77; 95% CI 0.64–0.94, $p<0.001$; low-income sample AOR 0.77, 95% CI 0.59–0.99, $p<0.05$). There was no statistically significant difference in the odds of receiving annual checkups in the full or the low-income sample. Further, annual household income was positively associated with having a personal doctor and receiving annual checkups and negatively associated with inability to see a doctor in the full sample.

Table 11 reports the coefficients of the logit model for the three outcomes when we restricted our sample to survivors living in non-expansion states and states with generous eligibility prior to the ACA. The results show that cancer survivors residing in non-expansion states had statistically significantly lower odds (AOR 0.76, 95% CI 0.60–0.98, $p<0.05$) of having a personal doctor in the past year than survivors residing in states with generous eligibility. Low-income survivors who live in non-expansion states had marginally statistically significantly higher odds of inability to see a doctor because of cost (AOR 1.26, 95% CI 0.98–1.61, $p<0.10$), lower odds of having a personal doctor (AOR 0.73, 95% CI 0.53–1.02, $p<0.10$), but higher odds of receiving annual checkups (AOR 1.25, 95% CI 0.97–1.61, $p<0.10$).

Discussion

We compared access to care, prior to Medicaid expansion under the ACA, among cancer survivors who live in states that expanded Medicaid and survivors who live in states that did not expand Medicaid under the ACA. In all analyses, we controlled for other factors that may affect access including demographic characteristics, income, and insurance coverage. Cancer survivors who live in non-expansion states were more likely to face financial barriers to see a doctor and

less likely to have a personal doctor than cancer survivors who live in expansion states. These findings were statistically significant in the full sample and the low-income sample. However, we did not find statistically significant differences in receiving annual checkups.

While cancer survivors are at high risk of developing other cancers or experiencing late effects of treatment, our findings imply that survivors living in non-expansion states are less likely to access healthcare services, which are necessary to receive the care they need (American Cancer Society, 2014d; Hong, Nekhlyudov, Didwania, Olopade, & Ganschow, 2009; Ng & Travis, 2008). Our finding highlights a gap between non-expansion and expansion states prior to the ACA Medicaid expansions. These differences in access to care may exacerbate known disparities in non-expansion states. Uninsured non-elderly survivors are less likely to have a usual source of care or use preventive services than a similar group of privately insured survivors (Yabroff et al., 2013). When uninsured survivors fail to receive continuous care, they will be at high risk for adverse health events. Our findings inform the debate on Medicaid expansions by providing an important understanding of baseline access to care for cancer survivors in states that expanded Medicaid as of June 2015 and those who are still exploring the option of expanding the program.

We did not observe statistically significant differences for receiving annual checkups, but instead found comparable rates among survivors living in expansion and non-expansion states. We can interpret this finding in different ways. A respondent could have been diagnosed with cancer in the past year and still be receiving treatment, alleviating the need for checkups or follow-up visits. Additionally, survivors may be vigilant about annual checkups and continue to receive care from their oncologists or other providers regardless of other barriers to access.

Several limitations must be acknowledged. Like other survey-based research, the analyses are based on self-reported data, creating concerns about validity and reliability. However, self-reported measures of preventive care in the BRFSS have been used in several previous studies that examined changes in Medicaid (Adams, Kenney, & Galactionova, 2013; Weissman, Zaslavsky, Wolf, & Ayanian, 2008; Wherry, 2013). To address concerns on self-reported data, we used sampling weights to account for complex sampling design and correct for potential nonresponse biases (Centers for Disease Control and Prevention, 2014b). Another limitation is that the BRFSS data do not have information on Medicaid coverage. We used Medicaid eligibility threshold of 138% FPL to create the low-income sample that would be eligible for Medicaid. Last, as this study is specific to cancer survivors, it may not be generalizable to populations with other chronic conditions or acute illness.

Medicaid expansion under the ACA aims to increase health insurance coverage for low-income populations. While the original law intended that all the states expand Medicaid, the 2012 decision of the Supreme Court gave each state the option to expand or not. Cancer survivors, like many other patients with chronic conditions, need regular care with a primary care provider to manage their health and receive follow-up screenings and tests (Earle, 2006; McCabe & Jacobs, 2012). Medicaid expansion provides insurance coverage for people with annual income lower than 138% of FPL. This study provides insight regarding the pre-existing differences in access to care before Medicaid expansion under the ACA. States that choose not to expand Medicaid could potentially leave many cancer survivors without access to routine healthcare services, exacerbating disparities between states.

Table 8: Descriptive statistics for cancer survivors sample by 2015 state Medicaid expansion status

Characteristic	**Expansion States (N= 15,478)**	**Non-expansion States (N= 10,575)**	**P Value**
Inability to see a doctor because of cost (%)	21.1	26.0	<0.001
Having a personal doctor (%)	89.4	85.7	<0.001
Annual checkup (%)	74.7	74.9	
Age group (%)			
18– 29 years	7.8	7.3	
30– 39 years	12.1	12.3	
40– 49 years	19.1	20.1	
50– 59 years	37.9	37.2	
60– 64 years	23.1	23.0	
Sex (%)			
Male	30.3	29.2	
Female	69.7	70.8	
Race (%)			
White	80.9	77.5	
African American	9.3	15.8	
Asian	4.5	1.5	
Other race	5.3	5.2	
Ethnicity (%)			
Hispanic	11.5	7.5	
Non-Hispanic	88.5	92.5	<0.001
Marital status (%)			
Married	54.0	56.7	
Unmarried	46.0	43.3	<0.05
Education (%)			
Less than high school	13.2	14.9	
High school	27.7	27.4	<0.10
Some college	34.3	34.8	
College	24.7	22.9	
Income (%)			
<138% of FPL	40.1	46.1	
138–400% of FPL	42.9	39.0	<0.001
>400% of FPL	17.0	14.9	
Employment (%)			
Employed	54.0	52.3	
Unemployed	46.0	47.7	
Insurance coverage (%)			
Insured	87.1	83.4	
Uninsured	12.9	16.6	<0.001
Childlessness (%)			
Childless adult	65.7	65.0	
Has dependent children	34.3	35.0	

Table 9: Logistic regressions estimations of outcome measures on state Medicaid expansion status for Full sample (N= 26,053)

	Cost Barrier OR	95% CI	Personal Doctor OR	95% CI	Checkup OR	95% CI
Expansion status (Expansion state reference category)						
Non-expansion state	1.19**	(1.03 - 1.38)	0.77***	(0.64 - 0.94)	1.07	(0.94 - 1.21)
Household income (< 138% of FPL reference category)						
>400% of FPL	0.18***	(0.13 - 0.23)	2.48***	(1.80 - 3.41)	1.54***	(1.26 - 1.88)
138-400% of FPL	0.41***	(0.35 - 0.49)	1.87***	(1.50 - 2.33)	1.19**	(1.01 - 1.39)
Age (18- 29 years reference category)						
Age 60-64 years	0.49***	(0.34 - 0.71)	4.08***	(2.84 - 5.86)	1.79***	(1.34 - 2.39)
Age 50- 59 years	0.71**	(0.52 - 0.99)	3.80***	(2.72 - 5.31)	1.46***	(1.11 - 1.93)
Age 40- 49 years	1.05	(0.75 - 1.46)	2.63***	(1.87 - 3.70)	1.37**	(1.05 - 1.80)
Age 30- 39 years	1.09	(0.77 - 1.55)	1.52**	(1.07 - 2.17)	1.08	(0.80 - 1.45)
Gender (female reference category)						
Male	0.74***	(0.61 - 0.89)	0.74***	(0.61 - 0.90)	0.99	(0.87 - 1.13)
Race (White reference category)						
African American	0.95	(0.76 - 1.20)	1.09	(0.81 - 1.48)	2.04***	(1.62 - 2.57)
Asian	1.36	(0.64 - 2.87)	1.04	(0.60 - 1.79)	1.21	(0.65 - 2.26)
Other race	1.08	(0.80 - 1.47)	0.73*	(0.51 - 1.05)	0.84	(0.63 - 1.13)
Ethnicity (Non-Hispanic reference category)						
Hispanic	0.91	(0.66 - 1.25)	0.95	(0.67 - 1.35)	1.30*	(0.99 - 1.71)
Marital status (unmarried reference category)						
Married	0.83**	(0.71 - 0.96)	1.24**	(1.01 - 1.52)	1.04	(0.91 - 1.18)
Education (less than high school reference category)						
College or more	0.58***	(0.44 - 0.75)	1.70***	(1.26 - 2.28)	1.00	(0.79 - 1.27)
Some college	0.83	(0.65 - 1.05)	1.65***	(1.24 - 2.20)	0.88	(0.70 - 1.10)
High school	0.85	(0.67 - 1.09)	1.24	(0.92 - 1.67)	1.01	(0.80 - 1.27)
Employment (not employed reference category)						
Employed	0.75***	(0.64 - 0.88)	0.73***	(0.60 - 0.89)	0.82***	(0.72 - 0.93)

* p<0.10, **p<0.05, ***p<0.01

Table 9: Logistic regressions estimations of outcome measures on state Medicaid expansion status for Full sample (Continued).

Insurance status (uninsured reference category)						
Insured	0.14***	(0.12 - 0.17)	6.16***	(5.02 - 7.55)	3.86***	(3.26 - 4.56)
Childlessness (has dependent children reference category)						
Childless adult	1.28***	(1.07 - 1.54)	0.79**	(0.65 - 0.97)	1.02	(0.87 - 1.20)

* p<0.10, **p<0.05, ***p<0.01

Table 10: Coefficients of logistic regressions for the low-income sample (N= 8,862)

	Cost Barrier OR	95% CI	Personal Doctor OR	95% CI	Checkup OR	95% CI
Expansion status (Expansion state reference category)						
Non-expansion state	1.30**	(1.06 - 1.58)	0.77**	(0.59 - 0.99)	1.16	(0.95 - 1.41)

* p<0.10, **p<0.05, ***p<0.01

Table 11: Coefficients of logistic regressions for states with generous eligibility as a comparison group

	Cost Barrier OR	95% CI	Personal Doctor OR	95% CI	Checkup OR	95% CI
Full sample (N= 14,175)						
Expansion status (Expansion state with generous eligibility reference category)						
Non-expansion state	1.11	(0.92 - 1.30)	0.76**	(0.60 - 0.98)	1.08	(0.93 - 1.27)
Low-income sample (N= 5,048)						
Expansion status (Expansion state with generous eligibility reference category)						
Non-expansion state	1.26*	(0.98 - 1.61)	0.73*	(0.53 - 1.02)	1.25*	(0.97 - 1.61)

* p<0.10, **p<0.05, ***p<0.01

Chapter 4: Paper III

The impact of generosity and duration of Medicaid expansion on access to healthcare services

Abstract

Objective To examine the effect of generosity and duration of Medicaid expansions on access to and utilization of preventive services among low-income adults.

Data Sources/Study Setting 2012 Medical Expenditure Panel Survey (MEPS) – Household Component Full Year Consolidated File data.

Study Design Multiple logistic models comparing outcomes among low-income people living in 6 generous expansion, 6 moderate expansion, and 12 no-expansion states.

Data Collection/Extraction Methods The analytic sample includes low-income non-elderly respondents ages 21–64 who live in one of the 24 states.

Principal Findings Among low-income adults, moderate and generous Medicaid expansions were associated with significant increase in the probabilities of having Medicaid coverage, having a usual source of care, and having blood pressure checked in the past two years. Low-income individuals living in states with longer durations of expansion were more likely to have better access to healthcare services than a similar group of individuals living in no-expansion states.

Conclusions While generosity alone was associated with more access to and utilization of health care services, the combination of generosity and longer duration of expansion intensified the association. The study informs policy makers that, relative to no expansion, moderate or generous expansion is associated with improvement in access to and utilization of healthcare services. It also provides evidence on the power of durability of the Medicaid program in improving access to and utilization of healthcare services.

Key words: Medicaid expansions, generosity, duration, low-income, access, utilization

Background

The benefits of preventive health services are well established in the literature, indicating their importance in managing diseases and avoiding life-threatening illnesses (Maciosek, Coffield, Flottemesch, Edwards, & Solberg, 2010). Compared to insured individuals, uninsured people are less likely to access care and receive recommended preventive services (Buchmueller, Grumbach, Kronick, & Kahn, 2005; Devoe, Fryer, Phillips, & Green, 2003). Expanding Medicaid under the Affordable Care Act (ACA) is expected to be a key factor in increasing access to healthcare services for low-income individuals (McMorrow, Kenney, & Goin, 2014). Early evidence from implementation of the ACA shows improvement in access to care (Sommers, Gunja, Finegold, & Musco, 2015).

Prior to the ACA, some states obtained Section 1115 waivers from the federal government and expanded Medicaid programs to low-income parents and childless adults who were not eligible to be covered by Medicaid under federal requirements (Centers for Medicare and Medicaid, 2014). Expansions in these states differed in their generosity (Medicaid eligibility thresholds) and year of implementation, creating variation in access to care among eligible

individuals across states that expanded Medicaid. For example, Indiana started its pre-ACA Medicaid expansion in 2008 with an eligibility threshold of 200% federal poverty level (FPL) while Arizona's expansion was implemented in 2008 with a 100% FPL threshold.

Access to care is not only affected by Medicaid policy, but also by the level of physician payment, which affects acceptance of Medicaid patients (S. L. Decker, 2012). While the goal of Medicaid expansions is to increase health insurance coverage for low-income people, physicians' acceptance of these new patients remains an issue. Recent data show that the percentage of office-based physicians accepting Medicaid decreased from 73.5% during 1999–2000 to 64.5% in 2008–2009 (Centers for Disease Control and Prevention, 2011). Further, one third of physicians in 2011 reported that they would not accept new Medicaid patients but also stated that higher payments may increase their willingness to accept such patients (S. L. Decker, 2012). Medicaid-to-Medicare Physician Fee Index is a ratio of fees paid for physicians when they treat Medicaid patients relative to Medicare patients in each state (Kaiser Family Foundation, 2016). Previous research found that higher Medicaid fees are associated with increase in physician participation in Medicaid and thereby improve access to care among children. However, higher payments may slightly improve access to and use of care among adults and children (Brunt & Jensen, 2014; S. Decker, 2007; Hahn, 2013; Shen & Zuckerman, 2005).

Previous studies confirmed the association between Medicaid coverage and access to and utilization of preventive services, but no study has examined the effect of generosity of Medicaid eligibility or the combination of generosity and duration on access to healthcare services (Finkelstein et al., 2012; Kaiser Family Foundation Medicaid and the Uninsured, 2013; Sommers et al., 2012). Here, we define generosity based on Medicaid eligibility threshold of coverage. We define states with generous expansion as those with eligibility threshold of 138% FPL or higher,

and states with moderate expansion as those with threshold less than 138% FPL. This study examines the effect of Medicaid generosity in covering low-income individuals on access to and utilization of healthcare services. In particular, we assess having Medicaid coverage, having a usual source of care, inability to get necessary medical care, receiving a checkup in the past year, and receiving a blood pressure checkup in the past two years for low-income individuals living in moderate or generous expansion states relative to those living in no-expansion states.

Methods

Data and Sample

We use publicly available data from the 2012 Medical Expenditure Panel Survey (MEPS) – Household Component Full Year Consolidated File along with restricted MEPS information on states' identifiers. MEPS is a nationally representative database of the U.S. population and includes information on healthcare expenditures, utilization, and access to care (Agency for Healthcare Research and Quality, 2009). The response rate was 56.3% in 2012. We obtain information on Medicaid generosity, years since expansion, and the 2012 Medicaid-to-Medicare Physician Fee Index from the Kaiser Family Foundation reports and personal communication with sources in different states (Kaiser Family Foundation, 2016). The analytic sample includes low-income nonelderly adults aged 18–64 who responded to the MEPS survey in the 24 MEPS states during 2012. We define low-income respondents as those who reported that their family income was poor (<100% FPL), near poor (100–150% FPL), or low-income (150–200% FPL) (Banthin JS & Selden TM, 2006).

Dependent variables

Our dependent variables are access to and utilization of preventive services. Access to care includes Medicaid coverage, having a usual source of care, and inability to get necessary medical care. Utilization of preventive services includes receipt of annual checkup in the past year and evaluation of blood pressure within the past two years.

Independent variables

We use information on Medicaid expansion to classify the 29 large MEPS states based on threshold of the expanded program and year since expansion. We focus on federally funded expansions and exclude Connecticut, Pennsylvania, and Tennessee because they only had state-funded programs. Based on Medicaid eligibility threshold, we classify states into generous (with threshold ≥ 138% FPL), moderate (with threshold <138% FPL), and no-expansion states. We exclude Colorado and Minnesota because their federally funded expansions started in 2012 (zero years of expansion relative to 2012). Excluding these states allows us to use 24 states in our analysis. Table 12 provides information on Medicaid generosity and years since expansion for the 24 states used in this study.

We control for Medicaid-to-Medicare Physician Fee Index, a key factor in determining access to and utilization of healthcare services. High indices make physicians more likely to accept Medicaid patients, reducing one of the barriers to access healthcare services among low-income individuals. Other independent variables include age, sex, race, ethnicity, marital status, education, employment, and number of MEPS priority conditions.

Statistical Analysis

We use multiple logistic regression models to assess the effect of the differences in Medicaid expansion on access to and utilization of healthcare services. We use level of

expansion (generous expansion, moderate expansion, no-expansion) as the main independent variable as shown in Equation (1):

$$Logit\ (Y) = \beta_0 + \beta_1\ ModerateExp + \beta_2\ GenerousExp + \beta_3\ Index + \beta_4\ Xs + \epsilon \quad (3)$$

where *Y* is the dependent variable, defined as one of the access or utilization measures. *ModerateExp* is a binary variable equals to one for states with moderate expansion (threshold <138% FPL) and zero otherwise. *GenerousExp* is a binary variable equals to one for states with generous expansion (threshold ≥ 138% FPL) and zero otherwise. Index is a continuous variable for the 2012 Medicaid-to-Medicare Physician Fee Index for each state and Xs indicates the other control variables. Our first coefficient of interest is β_1, which captures the difference in outcomes for low-income individuals living in moderate expansion states and a similar group of individuals living in states that did not expand Medicaid. Similarly, our second coefficient of interest is β_2, capturing the differences in outcomes for low-income individuals living in generous expansion states relative to low-income individuals living in states that did not expand Medicaid.

Next, we add years of expansion and interaction terms to control for duration of expansion in each state. *YearsExpansion* is a continuous variable obtained by subtracting year of expansion from 2012 (shown in Table 12).

$$Logit\ (Y) = \beta_0 + \beta_1\ ModerateExp + \beta_2\ GenerousExp + \beta_3\ Index + \beta_4\ ModerateExp * YearsExpansion + \beta_5\ GenerousExp * YearsExpansion + \beta_6\ Xs + \epsilon \quad (4)$$

where, *ModerateExp * YearsExpansion* is an interaction term of Moderate expansion states and years since expansion, and *GenerousExp * YearsExpansion* is an interaction term of Generous expansion states and years since expansion.

We use survey weights in the analyses to control for the complex sampling design of the MEPS survey. All statistical analyses were conducted using Stata 12.

Results

Table 13 compares the characteristics for low-income individuals living in no-expansion, moderate, and generous expansion states in 2012. Just over half individuals live in no-expansion states (52%) while approximately 20% and 28% live in moderate and generous expansion states, respectively. In no-expansion states, the rate of Medicaid coverage is 19% while it is 33% in moderate and 29% in generous expansion states. The rates of having a usual source of care, receiving an annual checkup, and having blood pressure evaluated in the past two years are the lowest for low-income individuals living in no-expansion states compared to either moderate or generous expansion states. For example, the rate of having a usual source of care is 60, 73, and 65% for low-income individuals living in no-expansion, moderate, and generous expansion states, respectively. Further, inability to get necessary medical care is the highest (9%) among low-income individuals living in no-expansion states compared to similar groups living in moderate (7%) or generous (4%) expansion states.

Table 14 reports the association between Medicaid generosity and access to and utilization of healthcare services, controlling for Medicaid-to-Medicare Physician Index and demographic variables. Residing in moderate or generous expansion states was associated with more access to and utilization of healthcare services compared to residing in states with no-expansion. Low-income individuals living in moderate expansion states had statistically significant higher odds for having Medicaid coverage (adjusted odds ratio [AOR] 1.88, 95 %

confidence interval [CI] 1.33–2.67, p<0.001) and having a usual source of care (AOR 1.99, 95 % CI 1.42–2.77, p < 0.001) than low-income individuals living in no-expansion states. Similarly, residing in generous expansion states was positively and statistically significantly associated with having Medicaid coverage (AOR 1.91, 95 % CI 1.32–2.75, p < 0.001) and a usual source of care (AOR 1.54, 95 % CI 1.13–2.11, p < 0.001). Further, low-income individuals living in generous expansion states had statistically significant lower odds for inability to get necessary medical care (AOR 0.46, 95 % CI 0.27–0.76, p < 0.001). Low-income individuals living in moderate expansion states also had lower odds for inability to get necessary medical care, but this result was insignificant (AOR 0.65, 95 % CI 0.37–1.15, p = 0.14).

For utilization of preventive services, low-income individuals living in moderate expansion states had statistically significant higher odds for receiving annual checkup in the past year (AOR 1.92, 95 % CI 1.39–2.65, p < 0.001) and evaluation of blood pressure within the past two years (AOR 2.17, 95 % CI 1.43–3.29, p < 0.001) than low-income individuals living in no-expansion states. In addition, low-income individuals living in generous expansion states had statistically significant higher odds for receiving evaluation of blood pressure within the past two years (AOR 2.15, 95 % CI 1.39–3.33, p < 0.001), but the result for receiving an annual checkup was not significant.

Medicaid-to-Medicare Physician Fee Index was associated with marginally significant higher odds for having a usual source of care (AOR 2.58, 95 % CI 0.97–6.87, p < 0.1) and receiving evaluation of blood pressure within the past two years (AOR 3.09, 95 % CI 0.84–11.35, p < 0.1).

Table 15 reports results from the logistic regression models controlling for Medicaid-to-Medicare Physician Index, years since expansion, and demographics. To explain these findings and understand the effect of the combination of generosity and duration of expansion on access to care, we use the odds ratios of generosity of expansion in Table 15 to calculate the odds ratios of generosity during years (3, 6, and 9) of expansion for all of the outcomes (Table 16). We use these years because they represent a wide range of duration of expansion in the states included in our study. Results in Table 16 describe the implication of the estimates for the effect of years of expansion. There is a gradual decrease in inability to get necessary medical care with longer duration of expansion. The magnitude of other outcomes (except having a usual source of care and receiving a checkup in the past year in moderate expansion states) increases gradually with longer periods of expansion. After 6– 9 years of expansion, almost all moderate and generous expansions are associated with significant increases in access and utilization measures as shown in Table 16. Nonetheless, low-income individuals living in moderate expansion states experience a significant decrease in having a personal doctor. After nine years of expansion, low-income individuals living in moderate expansion states have statistically significant higher odds for having Medicaid coverage (AOR 2.17, 95 % CI 1.49–3.17, $p<0.001$), lower odds for inability to get necessary medical care (AOR 0.54, 95 % CI 0.29–0.99, $p<0.05$), and higher odds for having blood pressure evaluation in the past two years (AOR 2.17, 95 % CI 1.32–3.55, $p<0.001$) than low-income individuals living in no-expansion states.

Discussion

We examined the differences in access to and utilization of healthcare services for low-income individuals living in moderate and generous expansion states compared to those living in states that did not expand Medicaid before 2012. Low-income individuals living in moderate or generous expansion states were more likely to have access to and utilization of preventive services than those living in no-expansion states. We also examined the effect of duration of expansion on access to and utilization of healthcare services. Low-income individuals living in states with longer durations of expansion were more likely to have better access to healthcare services than a similar group of individuals living in no-expansion states. Our findings indicate that while generosity alone was associated with more access to and utilization of health care services, the combination of generosity and longer duration of expansion played an important role in facilitating access to and utilization of healthcare services.

The positive association between Medicaid expansion and access to and utilization of healthcare services are consistent with previous research on the effect of pre-ACA expansions on improving Medicaid coverage and access to care among low-income adults (Baicker & Finkelstein, 2011; Coughlin, Long, Graves, & Yemane, 2006; Sommers et al., 2012). Low-income individuals who gain Medicaid coverage are usually assigned to a primary care physician or a community clinic. Therefore, they have a usual source of care and are able to receive recommended services such as regular checkups and blood pressure evaluations.

Our findings that longer duration of expansion was associated with gradual increases in access and utilization measures highlights the importance of durability of the Medicaid program in affecting access and utilization in the long run. Having a usual source of care declined over time may be attributed to the churning process (switching between losing and gaining Medicaid coverage due to changes in income and Medicaid eligibility as a result). Individuals who lose

their coverage may be more likely to be assigned to different physicians from those they used to see and therefore they do not have the same source of care. Our findings that inability to get necessary medical care in states with moderate expansion were only significant after 9 years of expansion may be related to the existence of factors other than Medicaid coverage. Medicaid enrollees may face other barriers that hinder their ability to access healthcare services including co-payments, inability to miss work, or possibly refusal of physicians to see Medicaid patients (S. L. Decker, 2012; Ku, 2005).

Our study has a few limitations. First, the study only includes 24 states that received federal waivers and for which restricted data are available through the Agency for Healthcare Research and Quality (AHRQ). Therefore, the findings may not be generalized to the whole country. Nonetheless, states used in the study are considered among those that implemented relatively large Medicaid expansions prior to the ACA. Second, as other survey data, MEPS are self-reported data that may be inaccurate. AHRQ performs quality control checks to ensure reliability and accuracy of data before release (Call et al., 2008; U.S. Department of Health and Human Services, 2015). Finally, the sample size for low-income individuals living in moderate or generous expansion states is small, which may have caused insignificant results for some outcome measures.

This study has important policy implications for states that have not yet decided on implementing Medicaid expansion. The study informs policy makers that, relative to no expansion, moderate or generous expansion is associated with better access to and utilization of preventive services. States deciding on Medicaid expansion under the ACA will be implementing a generous expansion (≥ 138% FPL) and will increase the likelihood that low-income residents will have Medicaid coverage and a usual source of care for a few years after

expansion (as long as these people are eligible for the program). Further, this study supports the evidence on importance of higher payments for physicians who treat Medicaid patients and increase the probability of having a usual source of care. The study provides evidence on the importance of the combination of generosity and longer duration of the Medicaid program to improve access to and utilization of healthcare services. States that may reconsider Medicaid expansion under the ACA once the complete federal funding ends in 2017, may need to realize the power of durability of the Medicaid program to fulfill its goals of increasing access to and utilization of healthcare services for the low-income population.

Table 12: Classification of states available in MEPS (federally funded programs)[7,8]

Generous expansion ≥138% FPL				Moderate expansion <138% FPL				No-expansion States
State	Eligibility threshold	Expansion Years of this program	Number of years since expansion (2012 – first year of expansion)	State	Eligibility threshold	Expansion Years of this program	Number of years since expansion (2012 – first year of expansion)	
CA	200	08–12	4	AZ	100	02–12	10	AL
IN	200	08–12	4	CO	10	12–12	0	FL
MA	200	00–12	12	MD	116	08–12	4	GA
MN	250	12–12	0	MI	35	04–12	8	IL
OK	185	06–07	6	NJ	24-100	11–12	1	KY
	200	08–12		NY	100	02–12	10	LA
OR	170	00–02	12	WA	133	11–12	1	MO
	185	03–09						NC
	201	10–12						OH
WI	200	09–12	3					SC
								TX
								VA

[7] Connecticut, Pennsylvania, and Tennessee are excluded because each had a state funded program.
[8] Colorado and Minnesota are excluded from the analysis because their expansions started in 2012.

Table 13: Descriptive statistics of sample by generosity of expansion (n= 3,032) as of 2012

	No-expansion	Moderate expansion	Generous expansion
N	1,580	599	853
Medicaid coverage (%)	19.10	32.66	29.22
Have a usual source of care (%)	60.42	72.91	64.71
Unable to get necessary medical care (%)	8.59	7.09	4.46
Received checkup in the past year (%)	52.36	67.20	53.98
Blood pressure checked in the past two years (%)	81.28	89.02	85.67
Index Mean (±SE)	0.64 (±.008)	0.52 (±.013)	0.53 (±.020)
Years of Expansion relative to 2012 Mean (±SE)	NA	6.77 (±.367)	5.39 (±.284)
Age (%)			
21–29	28.06	25.03	26.41
30–39	23.05	23.34	27.28
40–49	22.45	22.03	21.63
50–<65	26.45	29.60	24.68
Male (%)	44.47	47.06	45.73
Race (%)			
White	72.83	71.55	79.10
African American	23.73	21.64	8.94
Other	3.44	6.81	11.96
Hispanic	24.34	20.97	42.63
Married (%)	39.18	36.20	40.87
Education (%)			
Less than high school	27.60	21.93	26.72
High school	32.95	38.81	34.31
Some college	29.24	25.33	25.70
College or more	10.21	13.93	13.28
Employed (%)	52.52	45.17	50.85
Chronic diseases (%)			
0 comorbidity	44.92	40.88	48.32
1 comorbidity	20.57	22.43	18.86
2 comorbidities	11.78	14.80	11.39
3+ comorbidities	22.73	21.89	21.42

Table 14: Adjusted odds ratios from multiple logistic regressions (model 3) for the outcome measures

	Medicaid coverage	Have a usual source of care	Unable to get necessary medical care	Received checkup in the past year	Blood pressure checked in the past two years
Moderate expansion	1.88*** (1.33 - 2.67)	1.99*** (1.42 - 2.77)	0.65 (0.37 - 1.15)	1.92*** (1.39 - 2.65)	2.17*** (1.43 - 3.29)
Generous expansion	1.91*** (1.32 - 2.75)	1.54*** (1.13 - 2.11)	0.46*** (0.27 - 0.76)	1.18 (0.87 - 1.61)	2.15*** (1.39 - 3.33)
No-expansion	Ref.	Ref.	Ref.	Ref.	Ref.
Index	0.19*** (0.07 - 0.52)	2.58* (0.97 - 6.87)	0.24 (0.04 - 1.55)	0.99 (0.43 - 2.28)	3.09* (0.84 – 11.35)
Age 50–<65	0.54*** (0.35 - 0.84)	2.31*** (1.63 – 3.29)	0.82 (0.42 - 1.63)	1.72*** (1.27 - 2.35)	1.03 (0.68 - 1.55)
Age 40–49	0.81 (0.55 - 1.20)	1.74*** (1.28 - 2.36)	1.76 (0.89 - 3.51)	1.25 (0.93 - 1.66)	0.94 (0.63- 1.42)
Age 30–39	1.20 (0.86 - 1.67)	1.31** (1.05 - 1.64)	1.04 (0.57- 1.89)	1.15 (0.88 - 1.51)	0.82 (0.60 - 1.13)
Age 21–29	Ref.	Ref.	Ref.	Ref.	Ref.
Male	0.51*** (0.40 - 0.65)	0.45*** (0.38 - 0.53)	0.53*** (0.34 - 0.84)	0.54*** (0.46 - 0.64)	0.30*** (0.23 - 0.39)
Female	Ref.	Ref.	Ref.	Ref.	Ref.
African American	1.48** (1.08 - 2.02)	0.90 (0.66 - 1.23)	0.54** (0.32 - 0.93)	1.79*** (1.41 - 2.29)	1.31 (0.91 - 1.89)
Other	1.17 (0.72 - 1.92)	1.19 (0.69 - 2.07)	1.11 (0.51 - 2.41)	1.50* (0.92 - 2.47)	1.16 (0.60 - 2.26)
White	Ref.	Ref.	Ref.	Ref.	Ref.
Hispanic	0.73** (0.53 - 0.99)	0.62*** (0.46 - 0.84)	0.41*** (0.23 - 0.71)	0.96 (0.68 - 1.36)	0.55*** (0.37 - 0.84)
Non-Hispanic	Ref.	Ref.	Ref.	Ref.	Ref.
Married	0.49*** (0.37 - 0.64)	1.37*** (1.09 - 1.73)	0.65* (0.41 - 1.03)	1.16 (0.93 - 1.44)	1.15 (0.87 - 1.51)
Unmarried	Ref.	Ref.	Ref.	Ref.	Ref.
College or more	0.28*** (0.17 - 0.45)	1.61** (1.10 - 2.36)	0.79 (0.35 - 1.78)	2.19*** (1.58 - 3.04)	1.92** (1.10 - 3.35)
Some college	0.51*** (0.37 - 0.71)	1.31* (0.98 - 1.76)	0.97 (0.54 - 1.77)	1.51*** (1.11 - 2.06)	1.73*** (1.23 - 2.44)
High school	0.77** (0.60 - 0.98)	1.22 (0.93 - 1.59)	0.85 (0.47 - 1.51)	1.30** (1.03 - 1.63)	1.10 (0.82 - 1.48)
Less than high school	Ref.	Ref.	Ref.	Ref.	Ref.
Employed	0.36*** (0.27 - 0.48)	0.86 (0.71 - 1.05)	0.78 (0.51 - 1.21)	0.73*** (0.60 - 0.89)	0.87 (0.67 - 1.13)

Unemployed	Ref.	Ref.	Ref.	Ref.	Ref.
3+ comorbidities	3.99*** (2.69 - 5.92)	3.92*** (2.80 - 5.50)	3.26*** (1.67 - 6.37)	4.72*** (3.34 - 6.68)	14.05*** (7.20 - 27.43)
2 comorbidities	1.96*** (1.34 - 2.86)	2.20*** (1.56 - 3.11)	3.96*** (1.98 - 7.95)	2.39*** (1.74 - 3.28)	4.31*** (2.72 - 6.83)
1 comorbidity	1.24 (0.88 - 1.75)	1.70*** (1.31 - 2.21)	1.87** (1.01 - 3.44)	1.54*** (1.17 - 2.04)	1.63*** (1.14 - 2.33)
0 comorbidity	Ref.	Ref.	Ref.	Ref.	Ref.

* p<0.10, **p<0.05, ***p<0.01

Table 15: Adjusted odds ratios from multiple logistic regressions (model 4) for the outcome measures

	Medicaid coverage	Have a usual source of care	Unable to get necessary medical care	Received checkup in the past year	Blood pressure checked in the past two years
Moderate expansion*Year	1.12*** (1.05 - 1.20)	0.94 (0.88 - 1.01)	0.93 (0.83 - 1.04)	1.00 (0.92 - 1.07)	1.01 (0.92 - 1.10)
Generous expansion*Year	1.17*** (1.07 - 1.29)	1.14** (1.02 - 1.27)	0.94 (0.81 - 1.09)	1.05 (0.96 - 1.15)	1.05 (0.91 - 1.21)
No-expansion*Year	Ref.	Ref.	Ref.	Ref.	Ref.
Moderate expansion	0.77 (0.44 - 1.37)	2.77*** (1.47 – 5.24)	1.04 (0.41 - 2.61)	1.92** (1.01 - 3.63)	2.05** (1.07 - 3.93)
Generous expansion	0.74 (0.39 - 1.41)	0.74 (0.40 - 1.40)	0.62 (0.23 - 1.72)	0.89 (0.49 - 1.60)	1.70 (0.72 - 4.04)
No-expansion	Ref.	Ref.	Ref.	Ref.	Ref.
Index	0.10*** (0.04 - 0.29)	1.33 (0.51 - 3.48)	0.23 (0.03 - 1.80)	0.78 (0.30 - 2.03)	2.65 (0.65 - 10.71)
Age 50–<65	0.54*** (0.34 - 0.85)	2.28*** (1.60 – 3.23)	0.81 (0.41 - 1.60)	1.72*** (1.26 - 2.34)	1.03 (0.68 - 1.55)
Age 40–49	0.83 (0.56 - 1.23)	1.72*** (1.27 - 2.33)	1.74 (0.88 - 3.46)	1.24 (0.93 - 1.66)	0.94 (0.63 - 1.41)
Age 30–39	1.21 (0.87 - 1.68)	1.32** (1.05 - 1.65)	1.05 (0.57 - 1.92)	1.16 (0.88 - 1.52)	0.82 (0.60 - 1.13)
Age 21–29	Ref.	Ref.	Ref.	Ref.	Ref.
Male	0.51*** (0.40 - 0.64)	0.44*** (0.37 - 0.52)	0.52*** (0.34 - 0.82)	0.54*** (0.45 - 0.64)	0.30*** (0.23 - 0.39)
Female	Ref.	Ref.	Ref.	Ref.	Ref.
African American	1.50** (1.10 - 2.06)	0.92 (0.67 - 1.25)	0.55** (0.32 - 0.94)	1.81*** (1.42 - 2.30)	1.31 (0.91 - 1.89)
Other	1.20 (0.73 - 1.96)	1.19 (0.69 - 2.05)	1.09 (0.50 - 2.38)	1.51* (0.93 - 2.46)	1.15 (0.59 - 2.25)
White	Ref.	Ref.	Ref.	Ref.	Ref.
Hispanic	0.75* (0.55 - 1.02)	0.61*** (0.46 - 0.82)	0.40*** (0.23 - 0.70)	0.96 (0.68 - 1.36)	0.55*** (0.37 - 0.84)
Non-Hispanic	Ref.	Ref.	Ref.	Ref.	Ref.
Married	0.48*** (0.36 - 0.62)	1.38*** (1.10 - 1.74)	0.66* (0.41 - 1.05)	1.16 (0.93 - 1.44)	1.14 (0.86 - 1.51)
Unmarried	Ref.	Ref.	Ref.	Ref.	Ref.
College or more	0.25*** (0.15 - 0.41)	1.54** (1.05 - 2.28)	0.80 (0.36 - 1.80)	2.14*** (1.54 – 2.99)	1.90** (1.08 - 3.33)
Some college	0.51*** (0.37 - 0.70)	1.29* (0.97 - 1.72)	0.96 (0.53 - 1.75)	1.50* (1.10 - 2.05)	1.73*** (1.23 - 2.44)
High school	0.74** (0.58 - 0.96)	1.21 (0.92 - 1.58)	0.85 (0.48 - 1.51)	1.29** (1.02 - 1.63)	1.10 (0.81 - 1.48)

Less than high school	Ref.	Ref.	Ref.	Ref.	Ref.
Employed	0.35*** (0.26 - 0.48)	0.88 (0.72 – 1.07)	0.79 (0.51 - 1.21)	0.73*** (0.60 - 0.89)	0.87 (0.67 – 1.14)
Unemployed	Ref.	Ref.	Ref.	Ref.	Ref.
3+ comorbidities	3.90*** (2.62 - 5.81)	3.95*** (2.81 - 5.53)	3.35*** (1.71 - 6.58)	4.69*** (3.31 - 6.63)	13.95*** (7.15 - 27.21)
2 comorbidities	1.98*** (1.34 - 2.93)	2.17*** (1.53 - 3.07)	3.91*** (1.94 - 7.90)	2.38*** (1.74 - 3.25)	4.28*** (2.70 - 6.77)
1 comorbidity	1.24 (0.88 - 1.75)	1.71*** (1.32 - 2.22)	1.86** (1.01 - 3.43)	1.54*** (1.16 - 2.04)	1.63*** (1.14 - 2.32)
0 comorbidity	Ref.	Ref.	Ref.	Ref.	Ref.

* p<0.10, **p<0.05, ***p<0.01

Table 16: Adjusted odds ratios from multiple logistic regressions (model 4) for the outcome measures after 0, 3, 6, and 9 years of expansion[a]

Years since expansion	Medicaid coverage		Have a usual source of care		Unable to get necessary medical care		Received checkup in the past year		Blood pressure checked in the past two years	
	Moderate Expansion	Generous Expansion	Moderate Expansion	Generous Expansion	Moderate Expansion	Generous Expansion	Moderate Expansion	Generous Expansion	Moderate Expansion	Generous Expansion
0	0.77 (0.44–1.37)	0.74 (0.39–1.41)	2.77*** (1.47–5.24)	0.74 (0.40–1.40)	1.04 (0.41–2.61)	0.62 (0.23–1.72)	1.92** (1.01–3.63)	0.89 (0.49–1.60)	2.05** (1.07–3.93)	1.70 (0.72–4.04)
3	1.09 (0.72–1.66)	1.20 (0.77–1.86)	2.32*** (1.45–3.70)	1.10 (0.75–1.61)	0.83 (0.42–1.65)	0.52* (0.26–1.02)	1.90*** (1.20–3.00)	1.03 (0.70–1.51)	2.09*** (1.29–3.38)	1.95** (1.14–3.33)
6	1.54** (1.09–2.17)	1.94*** (1.37–2.75)	1.94*** (1.37–2.75)	1.62*** (1.17–2.23)	0.67 (0.39–1.16)	0.43*** (0.26–0.73)	1.88*** (1.34–2.63)	1.19 (0.87–1.63)	2.13*** (1.41–3.22)	2.23*** (1.42–3.50)
9	2.17*** (1.49–3.17)	3.15*** (2.02–4.90)	1.63*** (1.16–2.28)	2.39*** (1.43–3.99)	0.54** (0.29–0.99)	0.36*** (0.18–0.71)	1.85*** (1.31–2.62)	1.38 (0.89–2.14)	2.17*** (1.32–3.55)	2.55*** (1.26–5.14)

[a] Results for 0 years of expansion are the adjusted odds ratios for moderate and generous expansion states from Table 15

* p<0.10, **p<0.05, ***p<0.01

Chapter 5: Conclusion

Medicaid expansion is one of the major provisions of the ACA, however, changes in Medicaid eligibility and other policies are not new to the Medicaid program. There have been different types of expansions prior to the ACA. In this study, I focused on the influence of Medicaid expansions (or contractions) on access to and utilization of healthcare services among the low-income population. This is an important policy issue that affects public health.

This study explored three research questions: 1) what is the impact of Medicaid disenrollment in Tennessee on disparities in stage at diagnosis and surgery for breast cancer; 2) how does access to care for cancer survivors compare at baseline in states that did not expand Medicaid and those that expanded Medicaid under the ACA; and 3) what is the impact of generosity and duration of Medicaid expansion on access to healthcare services. The study used Tennessee Cancer Registry data from 2002–2008, SEER data, 2012 and 2013 BRFSS data, and 2012 MEPS data. It used econometric models to test seven hypotheses.

The study findings suggested that women living in low-income zip codes were more likely to be diagnosed at late stage of breast cancer compared to women living in high income zip codes after Medicaid disenrollment. The findings also suggest that cancer survivors living in expansion states were more likely to have better access to care than survivors living in non-expansion states. Further, low-income individuals living in states with longer durations of expansion were more likely to have better access to healthcare services than a similar group of individuals living in no-expansion states.

The study has important policy implications. Our findings are important for states that may scale back Medicaid expansion due to changes in the state government (similar to the current discussion after the change of governor in Kentucky). In addition, existing disparities in access to care are likely to widen between cancer survivors in non-expansion and expansion states. Finally, durability of the Medicaid program improves access to and utilization of healthcare services. The dissertation findings present new opportunities for future research, including the effects of Medicaid contractions on other health outcomes and diseases.

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Appendix I

1. *Exclusion of elderly people and those who were diagnosed at death*

The data contain 74,292 observations of women who were diagnosed with female breast cancer from 2000 – 2010 for all ages. We exclude 421 observations that were diagnosed at death, 8 observations who were young (< 21 years old), 12 observations who were above 99 years old, and 28,167 observations who were 65 years or older. With these exclusions, we have a sample of 45,684 of women diagnosed of breast cancer and their ages ranged between 21 and 64.

2. *Incomplete dates*

Since date of diagnosis have incomplete data (missing day and month or day only), we assume that the missing day in dates that have years and months only is the 15^{th} of the month for 352 observations. We compare the number of observations missing date of surgery with those missing date of most definitive surgery and find that most of the observations (4,834) that have missing data on date of surgery have also missing data on date of most definitive surgery.

We exclude 96 observations that have year only for date of diagnosis (missing day and month). We replace 19 observations of dates of surgery that have month and year only with dates of most definitive surgery that have complete dates. We also replace two observations of date of primary surgery that have month and year only with date of most definitive surgery that have month and year only (date of most definitive surgery is more accurate). We also replace two

observations of dates of surgery that have year only with complete dates from most definitive surgery. For 133 observations that are missing day only in date of surgery of primary site, we assume that day to be the 15th of the month. We also replace 23 dates of treatment based on CoC that are missing day with complete dates from treatment based on SEER. We replace two dates of treatment based on CoC that have missing data with complete dates from treatment based on SEER. We replace 11 observations of dates of treatment CoC that have missing data with complete dates of treatment SEER. For 367 observations that have missing days of dates of treatment CoC, we assume the missing days to be the 15th of the month.

3. *Create new variables for date of surgery and treatment*

While we wanted to use date of most definitive surgery instead of date of surgery of primary site, we could not because date of most definitive surgery had data with large number of missing values. We create a new variable for date of surgery from date of surgery of primary site, but replace it with dates of most definitive surgery in specific cases where dates of most definitive surgery should be used. For example, we use date of most definitive surgery in 23 observations when patients had resection. In addition, we use date of most definitive surgery for 18 observations when date of surgery of primary site took place before date of most definitive surgery because the second operation is usually the most definitive. Furthermore, we use date of most definitive surgery for 2,302 observations when date of surgery of primary site was the same as date of diagnosis because that same date could have been surgical and diagnostic at the same time. We exclude 55 observations with year only date of surgery, and 64 observations with year only date of treatment. We use date of treatment CoC as the date of initiation of treatment.

4. *Create a variable indicating first line of treatment*

We create a variable to indicate whether surgery is the first and only line of treatment, if treatment is first, and if surgery is first and is followed by another treatment. We use the new date of surgery to create a new variable for time to surgery (new date of surgery – date of diagnosis), and similarly, we use the new date of treatment to create time to treatment (date of treatment – date of diagnosis). We exclude 76 observations with date of surgery preceding date of diagnosis, and 24 observations with date of treatment preceding date of diagnosis.

We consider time to surgery or treatment an outlier if it exceeds 365 days. We create a variable that categorizes the number of comorbidities into 0, 1, 2, 3 or more. We considered whether time to treatment exceeding 365 days is associated with higher numbers of comorbidities, but that was not the case. (For example, when we compared those who had more than 365 days delay in surgery, we found that 77 of them had no comorbidities, 19 had one comorbidity, 14 had two comorbidities, and 19 had three comorbidities or more). We decided to exclude 129 and 38 observations with time to surgery or treatment more than 365 days, respectively. With these exclusions, we have a sample of 45,202 observations.

5. *Zip codes*

We use zip code median income data (2006 - 2011 release) from the Population Studies Center at University of Michigan. When we compare the zip codes in the Tennessee Cancer Registry data with those from the Population Center, we find that there are 134 zip codes (595 observations) that existed in the TN data but not in the income data. We use a free zip code database and found that the zip codes that were missing income data were P.O. Box zip code numbers, so they didn't represent actual zip codes (United States Zip Codes, 2014). We drop these 595 observations and merged our data using the zip code median income data. While

44,600 observations are matched, 24 observations are not matched. These include 7 observations from the Tennessee data and 17 observations from the median income data. We drop the 24 non-matched observations and, at this point, the sample includes 44,600 observations from 2000–2010.

6. Analytical sample

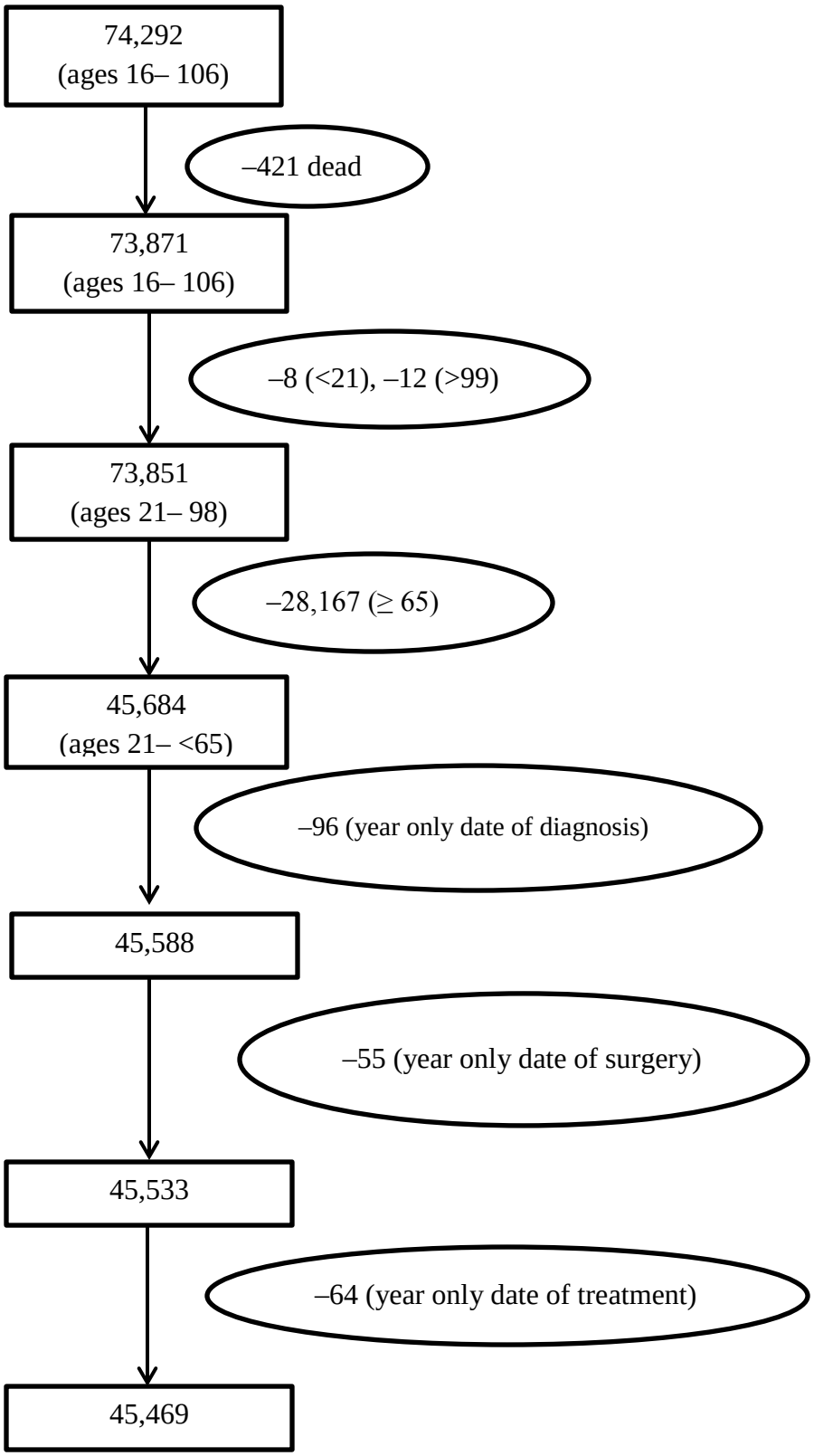
We restrict our sample to three years before (2002 – 2004) and three years after (2006 – 2008) Medicaid disenrollment, so we exclude 20,599 observations from the other years. From a sample of 24,001, we exclude 461 observations with unknown or missing data on stage at diagnosis, 2,305 observations with missing data on time to surgery, 2,114 observations with missing data on ethnicity, and 21 observations with missing time to treatment. We do not have missing data on race, age, or comorbidities. Our final sample consists of 19,100 observations with no missing data.

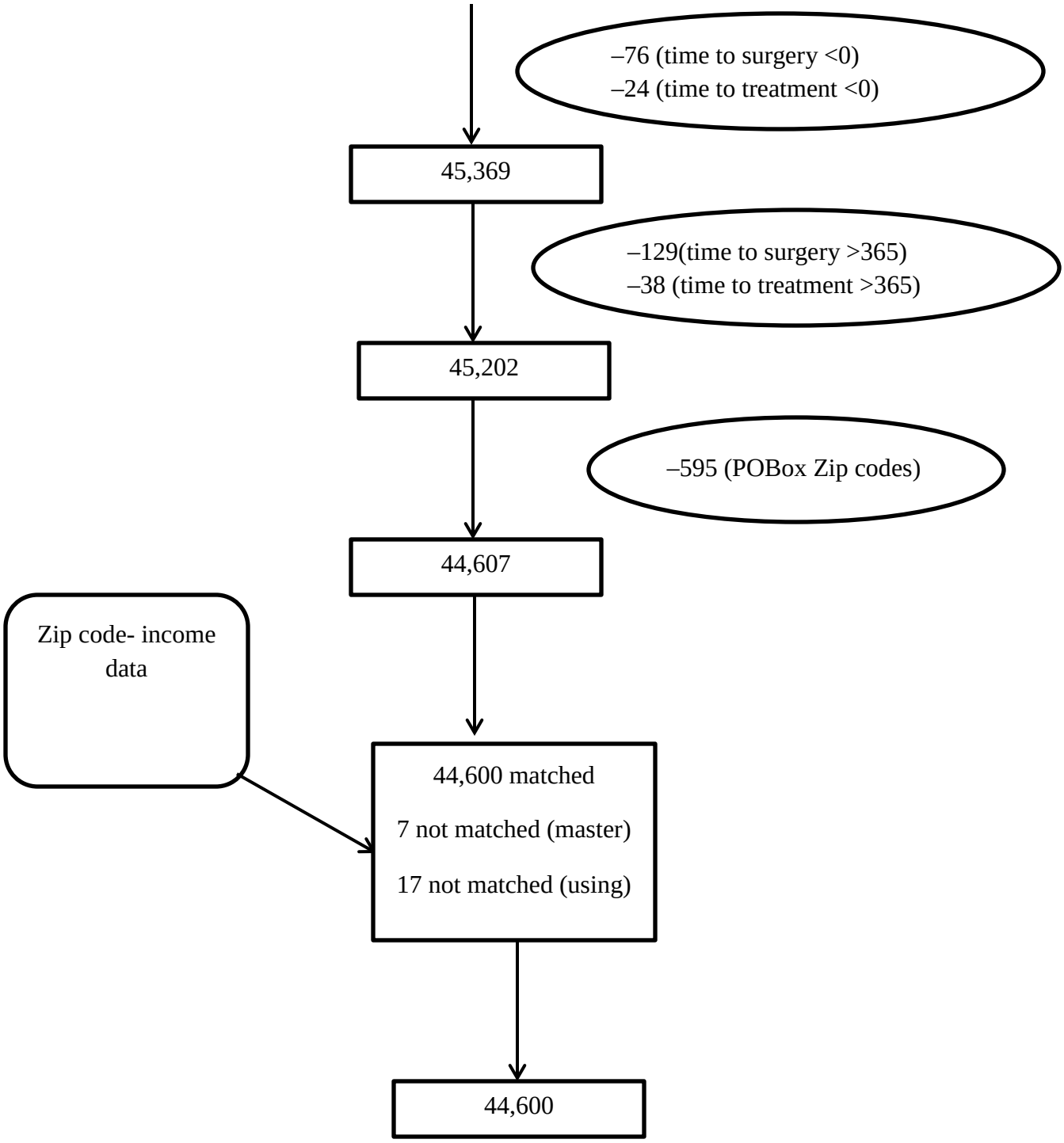
We reviewed the poverty guidelines for 2002 – 2008 from the Department of Health and Human Services (HHS) and found that the median income of poverty over these years was $19,350 (it is also the income based on the poverty guideline in 2005 when disenrollment happened). We use 200% of this poverty guideline (2 * $19,350= $38,700) as a threshold to stratify zip codes into high and low-income zip codes (we created a binary variable which equals 1 for zip codes with median income below $38,700 and 0 for zip codes with median income above this threshold).

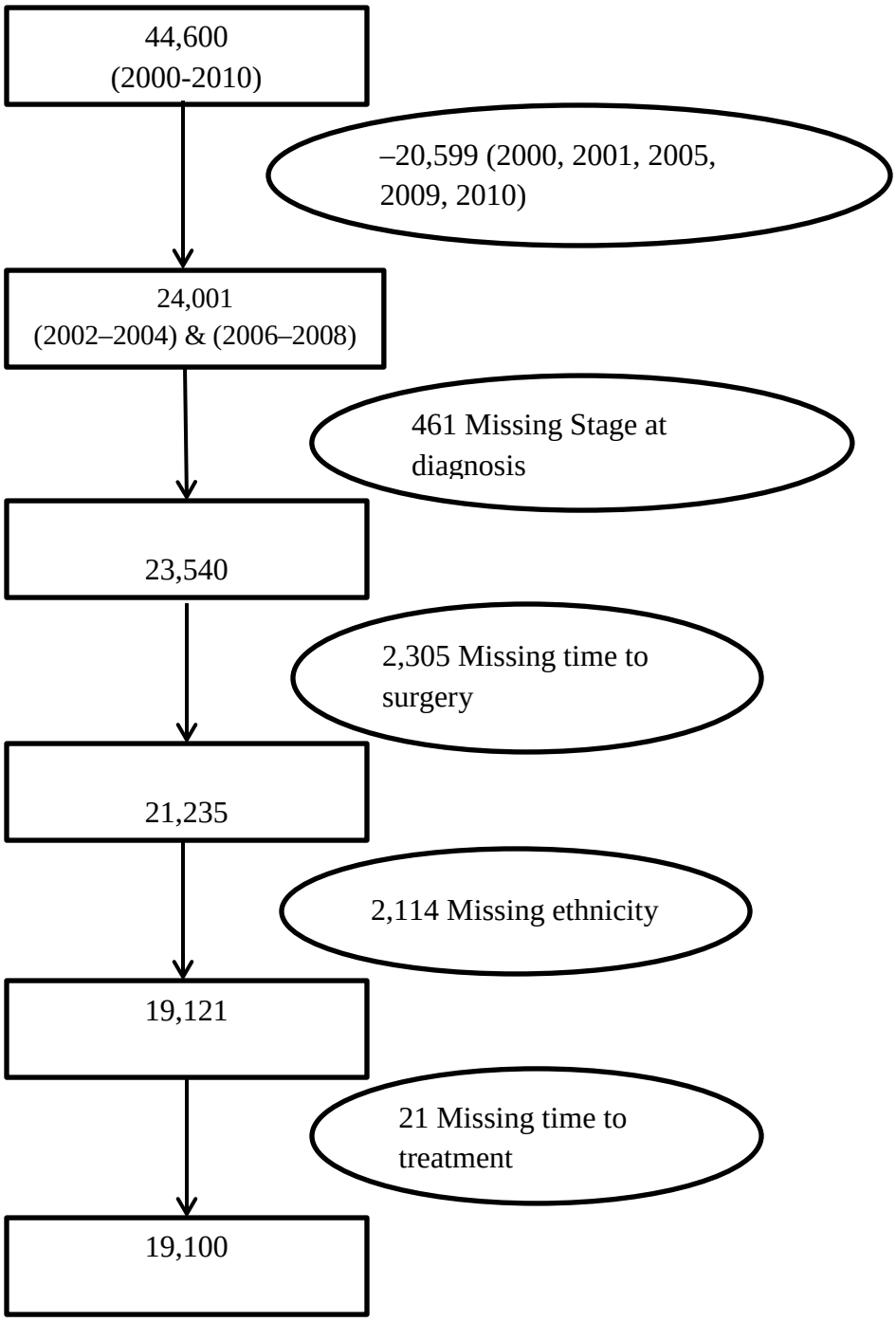
We create a binary variable for more than 60 days delay in surgery and another binary variable for more than 90 days delay in surgery. Similarly, we create two binary variables one for more than 60 days delay in treatment and the other for more than 90 days delay in treatment.

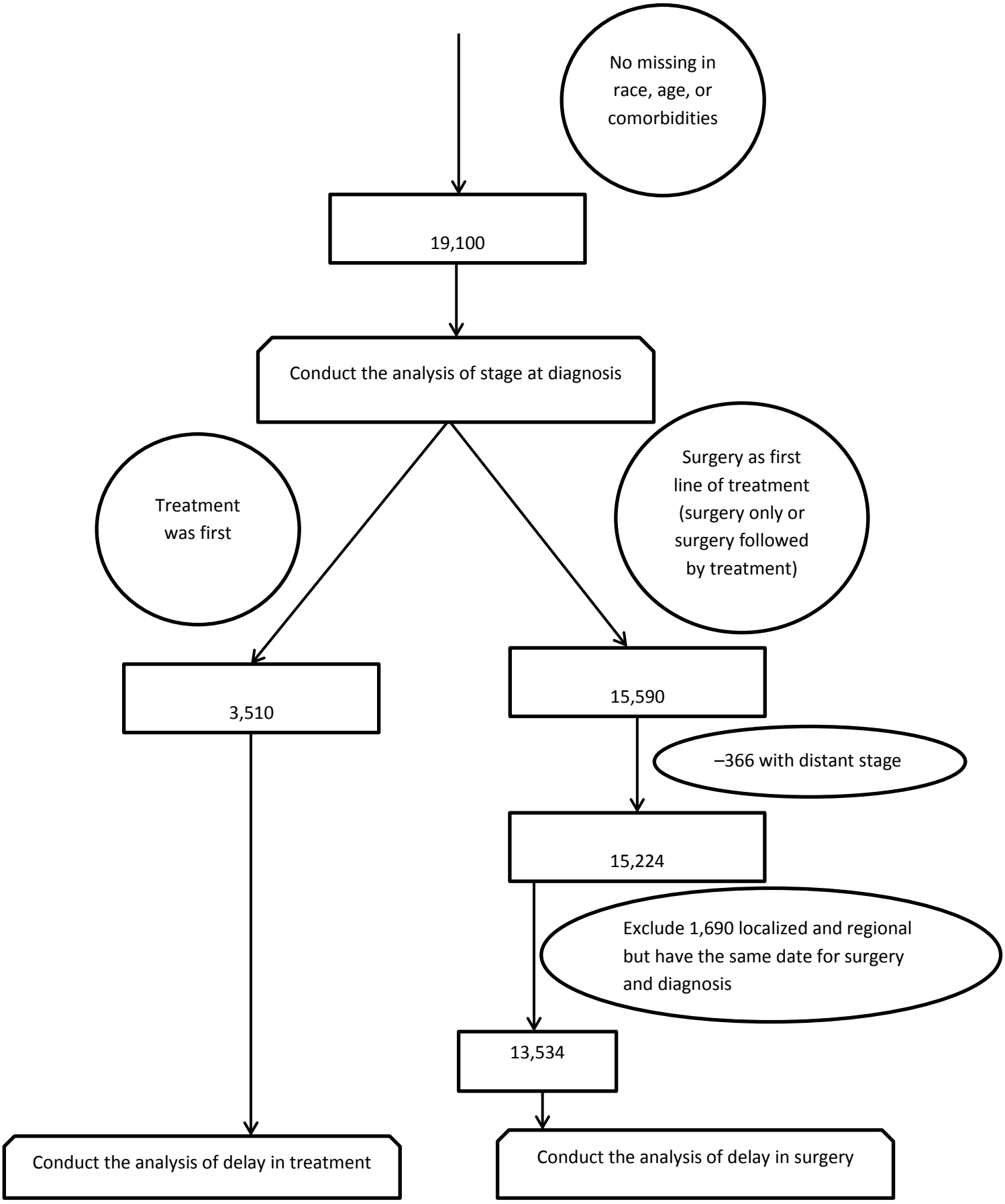
We create a sample with no missing data for women aged 21– 64 who were diagnosed with breast cancer and lived in Tennessee from 2002– 2008.

Flow Chart of our exclusion criteria




–76 (time to surgery <0)
–24 (time to treatment <0)
45,369
–129(time to surgery >365)
–38 (time to treatment >365)
45,202
–595 (POBox Zip codes)
44,607
Zip code- income data
44,600 matched
7 not matched (master)
17 not matched (using)
44,600


44,600
(2000-2010)
–20,599 (2000, 2001, 2005, 2009, 2010)
24,001
(2002–2004) & (2006–2008)
461 Missing Stage at diagnosis
23,540
2,305 Missing time to surgery
21,235
2,114 Missing ethnicity
19,121
21 Missing time to treatment
19,100


No missing in race, age, or comorbidities
19,100
Conduct the analysis of stage at diagnosis
Treatment was first
Surgery as first line of treatment (surgery only or surgery followed by treatment)
3,510
15,590
–366 with distant stage
15,224
Exclude 1,690 localized and regional but have the same date for surgery and diagnosis
13,534
Conduct the analysis of delay in treatment
Conduct the analysis of delay in surgery

Vita

Wafa W. Tarazi was born on May 28, 1976 in Gaza, Palestine. She graduated with a Bachelor of Pharmacy from Al-Azhar University in 1998 and worked as a pharmacist in a primary care center for more than ten years. She came to the U.S. as a Fulbright student and earned a Master in Health Policy and Administration from Washington State University in 2012. Wafa served as an administrative intern with two large physician groups in the Northwest. In 2012, Wafa started her doctoral training in Healthcare Policy and Research at Virginia Commonwealth University, focusing on public health insurance and cancer care. She primarily worked with Dr. Cathy Bradley and Dr. Lindsay Sabik on a National Cancer Institute grant that explored cancer prevention and control among underserved populations. Wafa also taught a few sessions of Health Economics Theory and Principles. Wafa's research has been funded by a fellowship from Susan G. Komen Foundation and Massey Cancer Center. Wafa has presented her research widely at national conferences and received several recognition awards, including Excellence in Scholarship from the College of William and Mary, first place in Presenting Research in Compelling Ways from AcademyHealth, and Scholar-in-Training Award from the American Association for Cancer Research. In August 2016, Tarazi will start the CDC Steven M. Teutsch Prevention Effectiveness Fellowship (hosted by the Office of the Assistant Secretary for Planning and Evaluation).