2017

Racial and Ethnic Differences in Receipt of Immediate Breast Reconstruction Surgery: Do Hospital Characteristics Matter?

Jaya Shankar Khushalani
Virginia Commonwealth University

Racial and Ethnic Differences in Receipt of Immediate Breast Reconstruction Surgery: Do Hospital Characteristics Matter?

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

by

Jaya Shankar Khushalani
MHA, Tata Institute of Social Sciences, India, 2011
MBBS, Grant Medical College & Sir JJ Group of Hospitals, 2009

Director: Dr. Jan Clement, Ph.D.
Professor
Department of Health Administration

Virginia Commonwealth University
Richmond, Virginia
July, 2017

Acknowledgements

The last four years in the PhD program have been quite a journey with a lot of highs and a few lows. But I wouldn't have been able to make it to my destination without my mentors, family, friends and most importantly, God almighty looking out for me. I want to begin by thanking my Dissertation Chair, Dr. Jan Clement. Her support is the biggest motivating factor that has got me to this day. She has been kind and patient throughout this journey and has also been just a little tough when I needed a push. She read through numerous versions of my dissertation drafts and her clear and insightful feedback made my work much better than I could have imagined. I could not have asked for a better Chair or a better faculty advisor. I have enjoyed working with her through the past four years and my weekly meetings with her are what I will miss the most after leaving the program.

Next, I want to thank Dr. Gloria Bazzoli, Dr. Anna Lin and Dr. Bassam Dahman for being part of my dissertation committee. Dr. Bazzoli has been phenomenal in providing detailed feedback that kept me on track. In spite of her numerous commitments, she was always there to guide me every step of the way. Her classes taught me everything I needed to know about conducting methodologically rigorous research and I continued to learn from her during my dissertation. She has inspired me not only to do rigorous research but to write with brevity and clarity. I am eternally grateful to her for all that I have learnt in this program. Dr. Anna Lin has been a wonderful alumnus and a committee member. With her expertise in cancer research and application of organizational theory to clinical issues, she has been a vital force behind my dissertation. Her detailed feedback on every chapter helped me make the connections between my dissertation and real-world implications for practice and policy. I could not have completed this dissertation without her. Not only has she been an amazing committee member but also a true friend and mentor. She helped me navigate through some tough career decisions and I am so thankful to her for always being there for me as a friend. Dr. Dahman's expertise on the statistical methods I used in this study have been instrumental and invaluable in putting this work together. He has been there to patiently answer all my queries, no matter how big or small, and has spent hours with me trying to simplify complex Stata codes so I understand them better. Working with him has been an enriching experience. I would be remiss if I did not sincerely thank Dr. Lindsay Sabik. Although I could only have her as a committee member for a short time, her guidance led me to choose my dissertation topic and her vision helped me craft my research questions. I would not have been able to get this far without her support when I started this journey.

I also want to thank all the faculty and staff at the Department of Health Administration. Dr. Jami Dellifraine not only made me fall in love with theoretical research, but she was the first person in the department to believe in my potential and made me believe in it as well. I also wanted to thank Dr. Steve Mick and Dr. Laura McClelland for teaching me all about organizational theory. When I went for job interviews, people said that anyone graduating from our program is considered an organizational theory expert, and it is all because of them. Dr. Dolores Clement introduced me to healthcare in the United States. I am so happy that only 2 short years later I could actually teach a class on healthcare in this country and I owe that to her excellent class. Dr. Jon Deshazo taught me how to use data sets when I was new to research. He never turned me away when I showed up at his office with a million inane questions and he always helped me out with a smile. Dr. Diane Dodd-McCue first introduced me to methods and provided a strong foundation that Dr. Bazzoli built on. Dr. Jessica Mittler has been instrumental in helping me talk about my dissertation work to people outside my committee. My dissertation presentation would not have been the same without her feedback. I would also like to thank Dr. Cindy Watts for being a wonderful teacher and an extremely supportive Department Chair. Last but by no means the least, I would like to thank Dr. Yasar Ozcan. I have enjoyed working with him and owe him my first first-authored publication. I want to shout out a big thank you to Carolyn Wells for guiding my first steps in this program and to Chuky Spivey for holding my hand as I started walking. You have added so much happiness to students' lives with the happy hours Chuky. I also want to thank Rochelle Clarke (tech life saver), Megan McDermott, Beth Ayers (I am going to miss our little chats so much), Warran Dawson and Carrie Thornbrugh for making my life so much easier through these years.

I want to sincerely thank the faculty and staff at the Department of Health Behavior and Policy, my second home. I want to start my thanking Dr. Cathy Bradley and Dr. Lindsay Sabik for spearheading the Susan G. Komen predoctoral fellowship (Graduate Training in Disparities Research award GTDR14302086) at the department that has supported me for the last two years and has been a fantastic research experience. I want to thank Dr. Andrew Barnes and Dr. Maria Thompson for continuing the Susan G. Komen fellowship as PIs and for being wonderful mentors. The fellowship was really special to me as it gave me a chance to work with the amazing Dr. April Kimmel. I have learnt so much from her. She introduced me to the world of Decision Sciences and it was her passion about the subject and her unwavering support that got me the fellowship at CDC where I head to next. I owe her so much and I sincerely hope I can make her proud someday. I also wanted to thank Dr. Tiffany Green for her excellent class on

Economics of Health Disparities. This dissertation would have probably taken one more year to complete had it not been for her feedback when I worked on this paper during her class. She has always been around to support and motivate and I feel lucky to have taken her class. Lastly, I wanted to thank Kate Grant for everything she has done for me from answering numerous administrative questions to being there for me when I needed someone to talk to.

I wanted to thank faculty members from other departments at VCU who have taught me so much over the last four years. Most notably, I have to thank my favorite teacher ever-Dr. David Harless. While I may have spent the two semesters I took his classes getting nightmares about in-class questions, I cannot deny that I am much richer for the experience. He rekindled my love for numbers that is going to last a lifetime. I also have to thank Dr. Leslie Stratton for teaching me advanced econometrics that I used in my dissertation. She has the gift of simplifying the complex and it has helped me immensely during my dissertation journey.

While my mentors and professors are the reason I excelled throughout my journey, my friends are the reason I survived this journey. A big thank you to Mandar Bodas. None of this would have been possible without you. I want to thank Anushree Vichare for being my rock throughout these tumultuous four years. From working on class assignments to never-ending chats in person and online to being the first one I run everything by to being my shoulder to cry on to being the one I celebrate every big and small success with. She has been there for me and I am blessed to have friends like her. I also want to thank Preeti Panchang for being there for me last year. I don’t think I would have made it to 2017 without her. Next, I want to thank my colleagues at the department who I am blessed to call my friends. Marisa Roczen for being a model student and researcher. I have learnt so much from her. Her guidelines on formatting the dissertation made the herculean task so much easier. She is amazing and yet so humble. Jen

Early for being a wonderful friend and mentor. Our chats during these four years kept me going every time I felt like quitting. Matt Depuccio for being a superb co-instructor and always helping me out. Tina Highfill for lighting up the department with her brilliance and her smile. Jennifer Palazzolo for being the best colleague anyone could ask for. Our endless discussions inside and outside the classes taught me so much. I also want to thank Priya Chandan for being a great friend and for putting up with me through those Skype chats at crazy hours.

Lastly, I want to thank the most important people in my life-my family. My Mom and Dad are my world and I obviously would have been nothing without them. I miss them every second of every day. Making them proud has been the one driving force of my life and I hope someday they can look at me and feel proud. Family is incomplete without my loving brother Ravi Khushalani who held the fort back home so I could chase my dreams. I also have to thank the one person who made my move to this county and my PhD possible-my sister Pooja Desai. I have been trying to copy everything she does since the day I was born but I always fall short because she is simply inimitable. Although the dynamics of families change, the love doesn't, and I want to thank the two people I will always consider family-Vinayak and Anagha Bodas. While my family back in India are so far away, my family in Richmond are the reason I could make it through my journey. A big thank you to Sharon Landrum (my Richmond mom), Victoria and Ashlyn Landrum (my sisters), and Louis and Linda Watts. They welcomed me with open arms and made Richmond feel like home. And lastly but most importantly, I want to thank God for everything and everyone that I am blessed with in life.

Table of Content

List of Tables

List of Figures

List of Abbreviations

AHA	American Hospital Association
AHRF	Area Health Resource File
AHRQ	Agency for Health Research and Quality
AR	Immediate Autologous Reconstruction
BCS	Breast Conserving Surgery
BMI	Body Mass Index
BRS	Breast Reconstruction Surgery
CI	Confidence Interval
CMS	Center for Medicare and Medicaid Services
DIEP	Deep Inferior Epigastric Perforator
DSH	Disproportionate Share Hospital
HCR	Hospital Cost Report
HCUP	Healthcare Cost and Utilization Project
HHI	Herfindahl-Hirschman Index
IBRS	Immediate Breast Reconstruction Surgery
ICD-9	International Classification of Diseases, Ninth Revision
IR	Immediate Implant Reconstruction
NCI	National Cancer Institute

NIH	National Institutes of Health
NIS	National Inpatient Sample
NS	Not Significant
OSHPD	Office of Statewide Health Planning and Development
RDT	Resource Dependence Theory
SCHIP	State Children's Health Insurance Program
SEER	Survey, Epidemiology and End Results Program
SID	State Inpatient Database
TRAM	Transverse Rectus Abdominis Myocutaneous
UIC	Urban Influence Code
WHCRA	Women's Health and Cancer Rights Act

Abstract

RACIAL AND ETHNIC DIFFERENCES IN RECEIPT OF IMMEDIATE BREAST RECONSTRUCTION SURGERY: DO HOSPITAL CHARACTERISTICS MATTER?

By Jaya Khushalani, Ph.D., MHA, MBBS

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

Virginia Commonwealth University, 2017

Director: Dr. Jan Clement, Ph.D.
Professor, Department of Health Administration

Immediate Breast Reconstruction Surgery (IBRS) is associated with better psychosocial and quality of life outcomes for women who undergo mastectomy for breast cancer. In spite of insurance coverage for IBRS, utilization of IBRS remains low. Not much is known about the association between hospital and market characteristics where patients receive mastectomy and receipt of IBRS by the patient. Patient, hospital and market-level data for the years 2010 to 2012 from multiple publicly available sources are used for this study. Findings suggest that higher bed size, lower racial and ethnic mix, not-for-profit ownership, teaching status, higher market concentration, higher density of plastic surgeons in the market, and large metropolitan status of the market are associated with higher likelihood of receipt of IBRS.

Racial and ethnic minorities are less likely to receive IBRS. The role of hospital and market characteristics in moderating these racial and ethnic differences is not known. A mixed

effects logistic regression model with interactions between Black/Hispanic race/ethnicity and hospital and market variables is estimated to examine whether hospital and market characteristics moderate the relationship between race/ethnicity and receipt of IBRS. Hospitals with higher proportion of racial and ethnic minority patients in the hospital and hospitals located in markets with higher density of plastic surgeons and/or higher competition have wider racial and ethnic gaps in receipt of IBRS.

In order to reduce racial/ ethnic differences in receipt of IBRS, it is important to understand which factors contribute the most to these differences. Fairlie decomposition models are estimated to examine the contribution of independent variables to the racial and ethnic difference in receipt of IBRS. Racial and ethnic differences in being Medicaid insured, residing in low income neighborhoods and receiving care at minority serving hospitals are the three biggest contributors to racial and ethnic differences in receipt of IBRS. The results from this study have significant implications for access to IBRS among racial and ethnic minority patients.

Chapter 1: Introduction

The Study Problem

Breast cancer is the most common cancer in women, affecting nearly one in eight women in the United States in their lifetimes (American Cancer Society, 2016). Around 40% of women with early stages of breast cancer undergo mastectomy (Mahmood et al., 2013). In relation to other breast cancer treatment modalities like breast conserving surgery, the rate of mastectomy in women has been on the rise in recent years and is expected to rise in the future. In spite of its growing frequency, many women believe mastectomy to be a physically and psychologically disfiguring procedure. In a qualitative study conducted by Piot-Ziegler (2010), 13 out of the 19 women in the sample called mastectomy a mutilation of their body and its integrity (Piot-Ziegler, Sassi, Raffoul, & Delaloye, 2010). Around 48% of women who undergo mastectomy are self-conscious about their body image and feel less attractive after a mastectomy (Brandberg et al., 2008). Rosenberg et al. (2013) found that women face difficulties in intimacy and sexual relationships after mastectomy and around 10%-25% of women are diagnosed with depression (Rosenberg et al., 2013).

Change in body image, loss of feminine identity and sexuality, and depression after mastectomy can have far reaching impacts on various areas of a woman's psychosocial functioning, including their identity, confidence, mood, esteem, sexuality, self-satisfaction, and quality of life (Heidari, Shahbazi, & Ghodusi, 2015). Meyer and Aspegren (1989) found adverse long term psychological sequelae for women undergoing mastectomy (Meyer & Aspegren, 1989). Given that 27% of these women undergoing mastectomy are less than 50 years of age, their long term psychosocial status and quality of life are an important concern (American Cancer Society, 2016).

Breast reconstruction surgery (BRS) is procedure to reconstruct the breast after it has been removed during mastectomy. BRS is an important component of overall breast cancer treatment. It improves psychosocial and quality of life outcomes for women who undergo mastectomy (Al-Ghazal, Fallowfield, & Blamey, 2000; Nicholson, Leinster, & Sassoon, 2007; Rubino, Figus, Lorettu, & Sechi, 2007). Clinical guidelines recommend that BRS should be offered to all women who undergo mastectomy (National Comprehensive Cancer Network, 2007). BRS can be initiated at the time of mastectomy (immediate breast reconstruction) or it can be done at a later date after the mastectomy and adjuvant therapy (delayed breast reconstruction). Immediate breast reconstruction surgery (IBRS) is associated with better esthetic results and greater psychosocial benefits for the patient as compared to delayed reconstruction (Al-Ghazal, Sully, Fallowfield, & Blamey, 2000; Schain, Wellisch, Pasnau, & Landsverk, 1985; Wellisch, Schain, Noone, & Little Iii, 1985).

Recognizing the benefits of BRS, the federal government enacted the Women's Health and Cancer Rights Act (WHCRA) in 1998 mandating that group health plans, health insurance companies, and HMOs that cover mastectomy, must also provide coverage for BRS (American Cancer Society, 2014). In addition, certain states have enacted laws that ensure that the state Medicaid covers BRS (Centers for Disease Control and Prevention, 2000; Yang, Newman, Reinke, et al., 2013). In spite of the benefits of IBRS and the federal and state mandates for its coverage, the rate of IBRS still remains between 20-40% depending on the composition of the cohort being analyzed (C. R. Albornoz et al., 2013; Jagsi et al., 2014; Yang, Newman, Lin, et al., 2013). Several studies have evaluated factors that influence receipt of IBRS (Brennan & Spillane, 2013; Nelson, Nelson, Tchou, Serletti, & Wu, 2012). However, most studies evaluate patient-level factors. Very few studies have examined the association between the receipt of IBRS and hospital and market characteristics (Hershman et al., 2012; Onega et al., 2014). This study examines the association between receipt of IBRS and hospital and market characteristics selected based on a theoretical framework created using Resource Dependence Theory.

Uptake of IBRS after mastectomy remains low among certain patient populations, especially among racial and ethnic minorities. Black and Hispanic women are less likely to receive IBRS as compared to Non-Hispanic White women even after controlling for clinical characteristics (Agarwal, Pappas, Neumayer, & Agarwal, 2011; Alderman, McMahon, & Wilkins, 2003; Christian et al., 2006; Enewold et al., 2014; Hershman et al., 2012; In et al., 2013; Iskandar et al., 2015; Kruper, Holt, et al., 2011; Lang et al., 2013; Mahmoudi, Giladi, Wu, & Chung, 2015; Maly, Liu, Kwong, Thind, & Diamant, 2009; Miller & Chandru Kowdley, 2012; Morrow et al., 2005; Offodile, Tsai, Wenger, & Guo, 2015; Reuben, Manwaring, & Neumayer, 2009; Rosson, Singh, Ahuja, Jacobs, & Chang, 2008; Sisco et al., 2012; J. F. Tseng et al., 2004; Yang, Newman, Lin, et al., 2013; Yang, Newman, Reinke, et al., 2013). Racial and ethnic differences in receipt of IBRS have been found consistently in literature across time, data sets and regions. The paradigm of disparities research has moved from Stage 1—demonstrating presence of disparities— to Stage 2—explaining the causes of disparities— and Stage 3—reducing disparities with focused interventions (Kilbourne, Switzer, Hyman, Crowley-Matoka, & Fine, 2006). However, research on racial and ethnic differences in IBRS is still in Stage 1 of the disparities research paradigm.

Thus, there is a critical gap in literature regarding the factors contributing to racial and ethnic differences in IBRS. Examining the causes of racial and ethnic differences in IBRS is an important intermediary step in targeting policy interventions aimed at reducing racial and ethnic differences. Addressing factors at the hospital and market level in addition to those on the patient level that contribute to racial disparities is important in order to identify policies that best target racial and ethnic differences in receipt of IBRS. This study examines whether characteristics of the hospital and hospital market where mastectomy is received moderate the relationship between race/ethnicity and receipt of IBRS.

In order to generate policy recommendations to address racial and ethnic differences in receipt of IBRS, it is important to determine the magnitude of contribution of racial/ethnic differences in patient-level, hospital-level and market-level factors to the racial and ethnic differences in receipt of IBRS. This information helps in prioritizing policy efforts towards those factors that have the largest impact on reducing racial and ethnic differences in receipt of BRS.

Research Questions

This dissertation aims to answer the following research questions:

1) Which characteristics of the hospital and hospital market where mastectomy is received are associated with higher likelihood of receipt of immediate breast reconstruction surgery (IBRS)?
2) Is the relationship between race/ethnicity and likelihood of receipt of IBRS moderated by hospital and market characteristics?
3) Which patient, hospital and market-level characteristics contribute the most to the racial and ethnic differences in receipt of IBRS?

Conceptual Framework

This study combines the Aday Andersen framework of health service utilization with Resource Dependence Theory. This study uses the Aday Andersen framework to conceptualize how health policy at the federal and state level influence the health care delivery system (hospital and market characteristics and resources) and the population (patient characteristics) and, ultimately, receipt of immediate breast reconstruction surgery (Aday & Andersen, 1974). Receipt of IBRS incorporates two separate components—1) IBRS is offered by the health care system where the patient receives care and 2) IBRS is accepted by the patient. The patient-level and policy-level factors included in the statistical model are selected based on the Aday Anderson framework.

Resource Dependence Theory (RDT) (Pfeffer & Salancik, 1978) is used to determine the hospital and market characteristics that are associated with a hospital offering IBRS services. These RDT derived hospital and market characteristics are then embedded within the larger Aday Andersen framework of health service utilization. Hypotheses for research question 1 are derived based on the conceptual framework created using Resource Dependence Theory. Since research questions 2 and 3 are predominantly exploratory in nature, no hypotheses are specified a priori for these questions.

Scope and Approach

The study sample is comprised of women between 30 to 80 years of age who received a mastectomy for breast cancer in hospitals located in Arizona, California, Florida, Kentucky, Maryland, New Jersey, New York, North Carolina and Washington from 2010-2012. Women with secondary metastases or previous history of breast cancer are excluded from the sample along with women who received care at government hospitals that are not open to the general public. The sample is identified from the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) and the California Office of Statewide Health Planning and Development (OSHPD) inpatient database.

The dependent variable is receipt of immediate breast reconstruction surgery identified as the presence of ICD-9 procedure codes for mastectomy along with ICD-9 procedure codes for reconstruction surgery or placement of tissue expanders within the same discharge record. Hospital-level independent variables are obtained from the American Hospital Association (AHA) database and the Center for Medicare and Medicaid Services Hospital Cost Report (CMS-HCR) whereas market characteristics are obtained from the Area Health Resource File (AHRF).

A retrospective pooled cross-sectional design is used to examine the relationship between hospital and market characteristics and receipt of IBRS. Owing to the nested nature of the model, a mixed effects logistic regression is used to examine the hypotheses derived from research question 1. For research question 2, the same mixed effects logistic regression from research question 1 is used with the addition of interaction terms between race and hospital/market characteristics. Lastly, Fairlie decomposition model is used to address research question 3.

Study Contribution

This study extends prior work examining the association between hospital characteristics and receipt of IBRS by examining a wider set of hospital and market characteristics than previous research (Hershman et al., 2012; Onega et al., 2014). These characteristics are chosen based on a theoretical framework derived using Resource Dependence Theory, an organizational theory that has been used in previous research to explain the relationship between a hospital's resources and constraints, and provision of a service (Banaszak-Holl, Zinn, & Mor, 1996). This study also extends prior work by examining whether such theory-based hospital and market characteristics moderate the relationship between race and IBRS.

To the author's knowledge, this is the first study to use decomposition methods to examine the contribution of racial and ethnic differences in patient-level, hospital-level and market-level factors towards racial and ethnic differences in receipt of IBRS. Findings from this paper can help guide policy makers towards addressing higher-level hospital and market level factors which have the potential of improving access to breast reconstruction for a larger number of racial and ethnic minority patients as compared to addressing patient-level factors alone. Policy efforts focused on changing factors at higher levels are likely to bring about larger and more sustained effects in reducing racial and ethnic differences in receipt of IBRS.

Organization of Remaining Chapters

In Chapter 2, a review of literature relevant to the research questions in this study is presented. In Chapter 3, the conceptual frameworks that guide this study and the testable hypotheses generated from these frameworks are described. This is followed by an overview of the research methodology for this study in Chapter 4. Chapter 4 includes the data sources, study population, and analytical approaches used in this study. In Chapter 5, the results of descriptive and statistical analyses are presented. In Chapter 6, the results of this study are summarized followed by a discussion of their implications for policy and practice. Lastly, the limitations of this study and avenues for future research are also presented in Chapter 6.

Chapter 2: Literature Review

Overview of Chapter Structure

The purpose of this chapter is twofold. The first purpose is to provide background information regarding surgical treatment options for breast cancer, especially breast reconstruction. The second purpose of this chapter is to provide an overview of empirical literature and establish gaps in the literature addressed by this study.

This chapter begins with a description of surgical treatment options for breast cancer: a) breast conserving surgery; b) mastectomy alone; c) mastectomy with reconstruction. Next, the timing and types of breast reconstruction is described. This is followed by a discussion of federal and state policies related to breast reconstruction surgery. Empirical research literature that examines links between hospital and market-level factors and the receipt of IBRS is then described. This is followed by a summary of the gaps in literature addressed by research question 1. Next, an overview of the relationship between race/ethnicity and receipt of IBRS is presented. Subsequently, the role of hospital and market characteristics in mitigating or exacerbating racial and ethnic differences in receipt of IBRS is presented followed by a discussion of the gaps in literature addressed by research question 2. Lastly, a summary of patient-level control variables associated with receipt of IBRS is presented followed by a summary of the gaps in literature addressed by research question 3.

Surgical Treatment of Breast Cancer

Surgical treatment options for breast cancer include breast conserving surgery (BCS) also known as lumpectomy, mastectomy alone or mastectomy with breast reconstruction surgery (BRS).

Breast conserving surgery.

Breast conserving surgery (BCS) involves the removal of the tumor and a surrounding margin of tissue whereas mastectomy involves removal of the entire diseased breast. Since BCS is a conservative procedure, it is usually followed by radiation therapy to ensure that no cancer cells are left behind after the surgery. For early stages of breast cancer, survival rates are similar for mastectomy or BCS followed by radiation therapy (Jacobson et al., 1995). Recognizing that BCS is safe and a more conservative option than mastectomy, the National Institutes of Health (NIH) Consensus Development Conference on Treatment of Early-Stage Breast Cancer recommended BCS for the majority of women with stage I or II breast cancer (National Institutes of Health Consensus Development Panel, 1992). BCS is the predominant type of surgery for early breast cancer (Lazovich, Solomon, Thomas, Moe, & White, 1999). However, the rates of BCS have been falling in the recent years due to an increase in rates of mastectomy with and without reconstruction.

Mastectomy.

Mastectomy was the most common surgical treatment option for breast cancer from its origin in 1800s to 1980s. It involves removal of the entire diseased breast along with surrounding lymph nodes and tissues depending on the type of mastectomy performed. Since the 1980s, BCS has replaced mastectomy as the predominant surgical option for early stage breast cancer. This led to a decline in mastectomy rates. However, in the past decade, mastectomy rates began to rise (Dragun, Huang, Tucker, & Spanos, 2012).

Kummerow et al. (2015) found that between 2003 and 2011, the number of women with early stage cancers who chose mastectomy increased by 34%. The observed increase in mastectomy rates is largely attributable to a rise in bilateral mastectomy from 5.4% of mastectomies in 1998 to 29.7% in 2011, with a concurrent increase in reconstructive procedures in their sample from 36.9% to 57.2% during the same time period. Bilateral mastectomy is performed in cases of unilateral breast cancer as a prophylactic measure. It is also known as contralateral prophylactic mastectomy (CPM) in literature. Similar results have been seen in other studies (Dragun et al., 2013; Kurian et al., 2014; Tuttle, Habermann, Grund, Morris, & Virnig, 2007). This trend is not well understood by practitioners and researchers since BCS is the recommended procedure for early stage breast cancer cases.

Increased rates of bilateral mastectomy could be due to patient’s fear of cancer recurrence in the contralateral breast (Dragun et al., 2013; Kurian et al., 2014; Tuttle et al., 2007). The rise of bilateral mastectomies could also be explained by higher rates of genetic testing and celebrity endorsements (for example, Angelina Jolie) of bilateral mastectomy (Tuttle et al., 2007; Wong et al., 2016). Some practitioners also cite patient desire for better breast symmetry after bilateral mastectomy followed by breast reconstruction as an explanation for the trend towards higher bilateral mastectomies (Hawley et al., 2014; Rizki, Nkonde, Ching, Kumiponjera, & Malata, 2013).

Esthetic outcomes after reconstruction are better among women who receive a bilateral mastectomy as compared to unilateral mastectomy (Kroll et al., 1994). A certain degree of breast asymmetry is also observed after BCS where a larger portion of the breast is removed (Waljee et al., 2008). Reconstruction although possible, is trickier in BCS cases due to the radiation therapy (Slavin & Halperin, 2004). These may be some of the reasons why certain researchers attribute the desire for BRS as a contributory factor for the rise in mastectomy rates.

Mastectomy with breast reconstruction surgery.

Breast reconstruction surgery (BRS) refers to the gamut of procedures wherein the breast mound and the nipple-areolar complex can be surgically reconstructed after mastectomy to match the appearance of the removed breast/breasts. Although BRS can be performed in cases of BCS, the reconstructive procedures employed for BCS patients are very different than those for mastectomy patients and are performed less commonly (González, 2013). Thus, for the purpose of this study, the focus is only on BRS after mastectomy.

BRS after mastectomy is associated with a number of psychosocial and quality of life benefits as compared to mastectomy alone. Al-Ghazal et al. (2000) found that anxiety, depression, issues related to sexuality, lower self-esteem and poor body image were less likely in women who underwent breast reconstruction as compared to women who underwent mastectomy alone (Al-Ghazal, Fallowfield, et al., 2000). Nicholson et al. (2007) using patient reported satisfaction measures found that patients who had undergone BRS after mastectomy gave themselves significantly higher scores for cosmetic outcome, overall body satisfaction and breast satisfaction scores in comparison with patients who had undergone mastectomy alone (Nicholson et al., 2007). Rubino et al. (2007) demonstrated that women who underwent BRS after mastectomy had higher levels of social adaptation, quality of social relationships, quality of life and lower likelihood of depression when compared to women who underwent mastectomy alone (Rubino et al., 2007).

BRS is considered to be a safe and well tolerated procedure after mastectomy in early stage cancer patients (Saha et al., 2013). Clinical guidelines recommend that BRS should be offered to all patients undergoing mastectomy if there are no clinical contraindications, and the type and timing of breast reconstruction should be decided by the patient and physician based on patient characteristics and preferences (National Comprehensive Cancer Network, 2007).

The rate of BRS has increased over time. Using data from the National Inpatient Sample (NIS) from 1998 to 2008, Albornoz et al. (2013) found a 78% increase in rates of U.S. immediate breast reconstruction from 20.8% in 1998 to 37.8% in 2008, with an average increase of 5 percent per year (C. R. Albornoz et al., 2013). Similarly, Jagsi et al. (2014) in their study of the employment-based MarketScan Commercial Claims and Encounters database found that rate of BRS increased from 46% in 1998 to 63% in 2007 (Jagsi et al., 2014). Variations in rates of breast reconstruction across datasets are due to the characteristics (age, region, facility, insurance, etc.) of the cohort.

Timing of reconstruction.

BRS can be done at the time of mastectomy under the same anesthetic; it is also known as immediate reconstruction. Alternatively, breast reconstruction can be done months or even years after the mastectomy; it is called delayed breast reconstruction. Reconstruction may be delayed either to allow for completion of adjuvant therapy (chemotherapy and/or radiation therapy) or because the patient may not be prepared or even knowledgeable about immediate breast reconstruction. Radiation therapy can have negative esthetic effects on breast reconstruction and is an important factor to be considered regarding timing of BRS. A new method involves placing a tissue expander under the skin of the breast at the time of mastectomy which can be replaced at a later date by an implant or patient's own tissue (autologous flap). This is known as the immediate delayed method or 2-stage method. In cases where patients need to undergo post mastectomy radiation, the immediate delayed or 2- stage method is preferred to immediate reconstruction in order to avoid complications (BreastCancer.org, 2015c).

A number of research studies suggest that all else being equal, immediate and immediate-delayed breast reconstruction surgery lead to better esthetic results compared to delayed reconstruction (Al-Ghazal, Sully, et al., 2000; Schain et al., 1985; Wellisch et al., 1985) due to the availability of more native breast skin is to envelope the reconstructed breast. The advantages of immediate breast reconstruction are more than just esthetic. Immediate breast reconstruction may have greater psychosocial benefits for patients compared with delayed reconstruction since the patient wakes up after the mastectomy with a reconstructed breast mound and does not have to live with the deformity arising from a full mastectomy for any period (Stevens et al., 1984). Al-Ghazal et al. (2000) compared 38 immediate breast reconstruction patients with 83 delayed reconstruction patients and showed that immediate reconstruction patients had significantly better body image and self-esteem whereas delayed reconstruction patients felt significantly greater anxiety, depression, and impairment of their sexual attractiveness (Al-Ghazal, Sully, et al., 2000). Immediate breast reconstruction is also more cost-effective as compared to delayed breast reconstruction. In a retrospective study of 276 patients conducted at the MD Anderson institute, 57 patients who had a mastectomy followed by a separate surgery for delayed breast reconstruction had 62% higher mean cost to the hospital as compared to the 219 patients who had immediate breast reconstruction (Khoo et al., 1998).

Immediate reconstruction is associated with higher incidence of complications as compared to delayed reconstruction. Major et al. (2016) in their study of 1408 diabetic women found that the odds of developing 30-day overall complications were significantly higher for the immediate reconstruction as compared with the delayed reconstruction cohort (Major et al., 2016). The best timing for breast reconstruction is arrived at by consideration of the advantages and disadvantages of immediate and delayed breast reconstruction, as well as the circumstances of the individual patient (Chevray, 2008).

For this study, the definition of breast reconstruction surgery is restricted to immediate and immediate delayed or 2-stage reconstruction surgery, collectively called immediate breast reconstruction surgery (IBRS) henceforth. Women who may or may not have received a delayed reconstruction at some point are included in the no reconstruction group. Immediate reconstruction is performed more often than delayed breast reconstruction. Nearly 75-80% of all reconstructions performed are immediate or immediate-delayed and this number is gradually increasing with increasing awareness regarding immediate breast reconstruction (Jagsi et al., 2014; Khoo et al., 1998; Robb, 2007).

Types of breast reconstruction.

IBRS can be done using implants or patient's own tissue (also known as autologous surgery) or both.

Implant reconstruction.

Reconstruction with implants is a shorter and less complex surgery as compared to autologous surgery. It also avoids donor site (site from which patient's own tissue is obtained such as abdomen, back, glutes or thighs) complications that may include scarring, wound complications, muscle weakness and hernia, etc. Implants are better for thinner women with inadequate tissue deposits on their abdomen, back, glutes or thighs.

Implants can be either silicon or saline. While silicone implants feel more like real breast tissue, there is a risk of silicone implants bursting underneath the breast skin. Silicone cannot be spontaneously absorbed within the body, unlike saline implants. Thus, placement of silicone implants requires patients to receive regular MRIs in order to assess whether the silicone implant has ruptured. In addition to rupture, side effects common to saline and silicone implants include implant extrusion or capsular contracture. Implants do not last for the lifetime of a patient and repeat surgery is needed to replace the implant after around 10 years.

Autologous reconstruction.

Reconstruction using patient's own tissue can be done via two methods: a) fat grafting and b) flap reconstruction. In fat grafting, fat tissue is removed from other parts of the (mainly abdomen, glutes or thighs) by liposuction. The tissue is then processed into liquid and injected into the breast area to recreate the breast. Fat grafting is still a relatively new procedure and no large clinical studies have been done on the procedure. Although fat grafting is a relatively safer procedure, its effectiveness may be low because the fat injected into the breast area may be reabsorbed by the body over time and the breast may lose some volume (BreastCancer.org, 2015b).

Flap reconstruction can be done using a pedicled flap or a free flap. When the tissue flap from the abdomen or back can remain attached to its original blood vessels and moved under the skin to the chest area, it is referred to as a pedicled flap. On the other hand, when the tissue (from the abdomen or back or thighs or buttocks) is completely separated from its original blood vessels and picked up and moved to its new place in the chest, it is known as a free flap. In both types, the tissue is formed into the shape of a breast and stitched into place. Commonly used flaps are pedicled or free Transverse Rectus Abdominis Myocutaneous (TRAM) flap from the abdomen region, Deep Inferior Epigastric Perforator (DIEP) flap which is an abdominal free flap most commonly used for reconstruction and a latissimus dorsi flap which may be free or pedicled tissue taken from the back area. Autologous flap reconstruction surgery is longer, more complex and may lead to donor site morbidity. However, flaps tolerate radiation better than implants and do not need to be replaced after a few years (BreastCancer.org, 2015a).

Rates of implant and autologous reconstruction.

In a study of 439 patients who underwent implant or autologous flap reconstruction at a single academic institution between 1999 to 2006, Yueh et al. (2010) found that autologous flap reconstruction had significantly higher general and aesthetic satisfaction than implant-based reconstruction (Yueh et al., 2010). In another study of 64 patients who underwent reconstruction at a single institution in 2004, Tønseth et al. (2008) found that more patients in the autologous reconstruction (with DIEP free flap) group were satisfied with the appearance of their breast and reported an improved social relationship, and fewer patients were sad about their body image after reconstruction than in the implant group (Tønseth, Hokland, Tindholdt, Åbyholm, & Stavem, 2008).

According to Albornoz et al. (2013), autologous reconstructions were more frequent compared with implant reconstructions in 1998; however, after 2002, the relationship switched after concerns related to safety of implants were addressed. By 2008, immediate implant reconstructions outnumbered autologous reconstructions by a ratio of 2:1 (C. R. Albornoz et al., 2013). Similarly, Jagsi et al. (2014) in their study of the employment-based MarketScan Commercial Claims and Encounters database observed that the proportion of autologous reconstructions reduced from 56% in 1998 to 25% in 2007 (Jagsi et al., 2014).

In spite of superior results, autologous flap reconstruction surgeries are being less frequently performed now than implant surgery. This is mainly driven by patients' desire for less complex procedures and the increased acceptance of implants. But there are a number of systemic factors that explain the decreasing popularity of autologous surgery. Autologous flap reconstruction requires special surgical techniques, including microsurgery to reattach the flap's blood vessels after it is placed in the chest, and not all surgeons have experience with microvascular flap reconstruction. Thus, certain hospitals in underserved regions may be unable to provide flap reconstruction. In addition, the cost of autologous surgery to the hospital is higher than that for implants (Alderman, Storey, Nair, & Chung, 2009). In a study of three academic medical centers in the United States (US) and Canada, Matros et al. (2015) found that the cost for unilateral DIEP flap was 75,184 US$ whereas the cost for a unilateral implant surgery was 53,571 US$ (Matros et al., 2015). Other studies have reported similar findings for other flaps (Grover, Padula, Van Vliet, & Ridgway, 2013; Spear, Mardini, & Ganz, 2003). In spite of the significantly higher costs of autologous surgery, the reimbursement for autologous surgery is only slightly higher than that for implants with a 534 US dollar difference in Medicare reimbursement for the two procedures in 2010 (Hernandez-Boussard, Zeidler, Barzin, Lee, & Curtin, 2013). Hernandez-Boussard et al. (2013) found that Medicare reimbursements for autologous reconstruction have significantly decreased by 17% from 2000 to 2010 whereas reimbursements for implants remained nearly unchanged (Hernandez-Boussard et al., 2013). This corresponds with the decrease in frequency of autologous reconstructions during the same time period. In a study by Kulkarni et al. (2013), 63% of the plastic surgeons surveyed cited low reimbursement as a barrier for performing autologous reconstruction (Kulkarni, Sears, Atisha, &

Alderman, 2013). Thus, in spite of higher patient satisfaction with the procedure as compared to implants, autologous reconstruction is less likely to be performed.

For the purpose of this study, separate supplemental analyses are conducted for type of IBRS (autologous reconstruction vs implant reconstruction) for all three research questions in this study.

Health Policy Related to Breast Reconstruction Surgery

Federal health policies have been enacted to increase access to BRS after mastectomy. Recognizing that BRS is an integral part of breast cancer treatment, the federal government enacted The Women's Health and Cancer Rights Act (WHCRA) in 1998 (American Cancer Society, 2014). It is also known as Janet's law, named after Janet Franquet who was denied reconstructive surgery after a mastectomy in 1997. The law requires that all sponsored group health plans, insurance companies, individual policies and health maintenance organizations offering medical and surgical benefits for a mastectomy must also offer coverage for reconstructive surgery (including implants) in a manner determined in consultation with the attending physician and the patient. WHCRA ensures that insurance coverage by the above entities includes reconstruction of the breast on which the mastectomy was performed along with surgery and reconstruction of the other breast to produce a symmetrical appearance. The act requires that benefits paid for reconstruction are at the same level as benefits paid for other health services covered under the plan. The WHCRA also requires insurers to inform the enrollees about the WHCRA provision at the time of enrollment and annually thereafter. The WHCRA does not apply to plans that do not provide coverage for mastectomy. It also does not apply to patients covered by Medicare or Medicaid (American Cancer Society, 2014).

Other federal laws applicable to BRS include the recently passed Breast Cancer Patient Education Act of 2015. The Breast Cancer Patient Education Act requires the Secretary of Health and Human Services to plan and implement an education campaign to inform breast cancer patients about the availability and coverage of breast reconstruction and other available alternatives post-mastectomy. Educational materials created by the Secretary of Health and Human Services will inform women of their right to breast reconstruction under federal law (the WHCRA) and provide women with information about when breast reconstruction or prostheses may be appropriate within their recovery plan. This act is aimed at raising awareness regarding BRS options especially among the underserved (The Breast Reconstruction Awareness Campaign, 2016).

Federal policy has had mixed success in increasing access to breast reconstruction surgery. According to a study by Alderman and Wilkins using the Surveillance, Epidemiology, and End Results (SEER) database, reconstruction rates did not increase significantly immediately after the WHCRA-- i.e. from 2000-2002. They also found that racial disparities in receipt of BRS did not decline significantly after the WHCRA (Alderman, Wei, & Birkmeyer, 2006). Since 2002, a number of studies have shown that rates of breast reconstruction have increased significantly. The WHCRA has been credited for this increase in breast reconstruction rates. Despite the increase in reconstruction rates, only 30-40% of the women receive breast reconstruction surgery after mastectomy (Alderman et al., 2006). Thus, there is a need for better understanding of factors associated with receipt of BRS in order to direct policy effort since current policies have been unable to increase utilization of BRS beyond 40% (Alderman et al., 2006). Additionally, racial disparities have not significantly declined even a decade after the WHCRA (Shippee, Kozhimannil, Rowan, & Virnig, 2014; Yang, Newman, Reinke, et al., 2013).

Thus, there is a need to understand factors that contribute to racial and ethnic differences in receipt of BRS. In the next section, empirical literature that examines factors associated with BRS is summarized followed by a review of literature on racial and ethnic differences in receipt of BRS and its likely causes. It is important to note that although the focus of this study is only on IBRS, existing literature summarized in the next section often combines IBRS and delayed reconstruction or in some cases, the authors do not specify the timing of reconstruction included in their study. Thus, while summarizing previous literature, the term breast reconstruction or BRS is used instead of IBRS.

Empirical Research Concerning Factors Associated with Receipt of BRS

There is a large body of empirical literature on factors associated with receipt of BRS, most of which focuses on patient-level clinical and sociodemographic factors. While addressing individual-level factors is important, change at the health system level has the potential to impact a much larger number of patients. Thus, it is important to understand and address hospital and market characteristics associated with receipt of BRS. Few studies have examined the association between the receipt of breast reconstruction and hospital and market characteristics (Hershman et al., 2012; Onega et al., 2014). The studies that do examine hospital and market characteristics in relation to receipt of BRS are neither representative of the patient population nor of the hospitals in the United States (Hershman et al., 2012; Onega et al., 2014). Thus, there is a need to understand the gaps in literature on the relationship between hospital and market characteristics and receipt of BRS and address them. This section begins with a summary of the literature that examines hospital- and market-level characteristics related to receipt of BRS.

Hospital-level and market-level factors.

Hospital characteristics associated with patient's receipt of breast reconstruction that have been examined in earlier empirical studies include: volume of breast reconstruction performed in the hospital, academic/teaching status of the hospital, National Cancer Institute (NCI) cancer center designation of the hospital, safety net status of the hospital, cooperative oncology group participation, bed size and density of plastic surgeons in the hospital. Hospital and market characteristics that have been examined in relation to patient's receipt of BRS are rurality and region. The literature examining these factors is summarized below.

A high volume of breast reconstructions performed in the hospital where a patient receives mastectomy is associated with higher likelihood of the patient receiving BRS (Hershman et al., 2012; Onega et al., 2014). Of all hospital characteristics examined, the academic/teaching status of the hospital is most frequently studied in association with patient receipt of BRS. According to the American Hospital Association (AHA), a hospital is recognized as a teaching/academic center if it is recognized for one or more Accreditation Council for Graduate Medical Education accredited programs or it reported a medical school affiliation to American Medical Association or lastly, if it is a member of Council of Teaching Hospital of the Association of American Medical Colleges (COTH) (American Hospital Association, 2014). Patients receiving mastectomy at teaching hospitals are 1.5 to 3 times more likely to receive BRS, especially immediate breast reconstruction (Agarwal et al., 2015; Hershman et al., 2012; In et al., 2013; Kruper, Holt, et al., 2011; Kruper, Xu, Henderson, & Bernstein, 2011; Kruper, Xu, Henderson, Bernstein, & Chen, 2013; Onega et al., 2014; Reuben et al., 2009; Shippee et al., 2014; Sisco et al., 2012).

A patient receiving mastectomy at a hospital designated as a National Cancer Institute comprehensive cancer center has nearly 2 times higher odds of receiving BRS as compared to patients receiving mastectomy at non-NCI designated cancer centers (In et al., 2013; Kruper, Holt, et al., 2011; Kruper, Xu, et al., 2011; Kruper et al., 2013). NCI designated cancer centers are recognized for their scientific leadership, resources, and the depth and breadth of their research. There are currently 47 NCI designated cancer centers in the United States that form the backbone of NCI's programs for studying and controlling cancer (National Cancer Institute, 2016). A patient receiving mastectomy at a hospital that is a participant in a cooperative oncology group has higher likelihood of receiving BRS as compared to patients receiving mastectomy at hospitals that are not part of cooperative oncology groups (In et al., 2013; Onega et al., 2014).

Onega et al. (2014) found that likelihood of receiving BRS is not significantly different among patients who receive care at safety net hospitals compared to patients who receive mastectomy at non-safety net hospitals (Onega et al., 2014). Bed size of the hospital where patient receives mastectomy is associated with receipt of BRS by the patient. Compared to patients who receive mastectomy at hospitals with less than 400 beds, patients who receive mastectomy at hospitals with 400-600 beds have higher likelihood of receiving BRS (In et al., 2013; Shippee et al., 2014). Density of plastic surgeons in the hospital where a patient receives mastectomy is associated with receipt of BRS. An additional reconstruction surgeon per 100 annual breast procedures in a hospital where a patient receives surgical treatment for breast cancer is associated with higher odds (OR: 1.38, 95% confidence interval: 1.29-1.59) of receipt of reconstruction as compared to breast surgery procedures without reconstruction (C. C. Greenberg et al., 2011).

Lastly, urbanicity of the county where patients receive mastectomy is associated with higher odds of receipt of BRS by the patient. Patients receiving mastectomy at urban hospitals are 2 to 4 times more likely to receive immediate breast reconstruction as compared to patients receiving mastectomy at rural hospitals (Hershman et al., 2012; Onega et al., 2014; Reuben et al., 2009; Shippee et al., 2014). This may be explained by regional referral patterns, availability of reconstructive surgeons, financial incentives and patient preferences (Alderman et al., 2003).

The region where patients receive mastectomy is also associated with odds of receipt of BRS by the patient. Patient receiving mastectomy at hospitals located in the south and northeast are more likely to receive BRS (OR: 1.28, 95% confidence interval: 1.21-1.35) as compared to patients receiving mastectomy at hospitals located in midwest or west regions (Reuben et al., 2009). This could be because hospitals in the south were pioneers of breast reconstruction surgery (Reuben et al., 2009). Hospitals in the northeast are more likely to provide BRS because major academic health care centers are located in the northeast (Hershman et al., 2012).

Aside from the characteristics of a hospital's immediate market, state-level policy characteristics are also associated with a patient's receipt of IBRS. Policies, practice and referral patterns related to breast reconstruction differ across states. For example, in New York and Texas, it is mandatory for the breast surgeon to discuss reconstruction options with all patients (Mahmoudi et al., 2015). Additionally, certain states like Pennsylvania ensure additional coverage beyond the Women's Health and Cancer Rights Act (WHCRA) for BRS for Medicaid patients (Centers for Disease Control and Prevention, 2000; Yang, Newman, Lin, et al., 2013). Mahmoudi et al. (2015) and Yang et al. (2013) found that discussing BRS options with patients and expanding Medicaid coverage for BRS increased odds of receiving BRS for breast cancer patients.

Of all the literature reviewed for the purpose of this study, only a few papers examine the association between hospital or market level factors with patient receipt of breast reconstruction surgery. The majority of the papers include only few hospital-level controls such as teaching status and NCI designation (In et al., 2013; Kruper, Holt, et al., 2011; Kruper, Xu, et al., 2011; Kruper et al., 2013; Morrow et al., 2005; Reuben et al., 2009). Only two studies examine a broader range of hospital and market characteristics. However, these two studies suffer from certain limitations. Onega et al. only examine elderly patients with Medicare insurance whereas Hershman et al. use a voluntary hospital database (with predominantly (>90%) urban hospitals (Hershman et al., 2012; Makadia & Ryan, 2014; Onega et al., 2014). Thus, neither of these studies are representative of the US population. This study aims to address this gap by including patients between 30 to 80 years of age with all types of insurance and by including all hospitals in the 8 states included in the study. Additionally, these two studies do not include important hospital characteristics such as racial and ethnic mix, payer mix and financial performance, and market characteristics such as competition, that are known to be associated with provision of expensive and complex healthcare services. This study aims to address this gap by including these additional hospital and market-level characteristics that are known to be related to service provision. In all the literature on breast reconstruction, there is scarce discussion regarding a theoretical framework for the choice of hospital and market-level factors that were examined. This study aims to address this gap by using Resource Dependency Theory to derive hospital and market characteristics that play a role in the receipt of IBRS. Thus, the first research question is:

RQ1. Which characteristics of the hospital and hospital market where mastectomy is received are associated with higher likelihood of receipt of immediate breast reconstruction surgery (IBRS)?

Although the focus of Research Question 1 is on hospital and market characteristics, receipt of a treatment modality is a patient-level outcome. Hence, it is important to include a number of patient-level control variables while examining research question 1. In the next section, summary of patient-level clinical and sociodemographic factors known to be associated with receipt of immediate breast reconstruction surgery is provided. This is followed by an in-depth review of the relationship between race and ethnicity, a patient-level sociodemographic factor associated with receipt of immediate breast reconstruction surgery since research question 2 and 3 focus on racial and ethnic difference in receipt of IBRS.

Patient-level control variables.

Patient-level factors associated with IBRS in literature are clinical and sociodemographic. These factors are included in this study as control variables for research question 1.

Patient-level clinical factors.

Patient-level clinical factors associated with receipt of breast reconstruction include age, comorbid conditions, body mass index (BMI), receipt of radiation therapy, receipt of chemotherapy, stage of tumor, tumor grade, tumor size, nodal status, laterality of mastectomy (unilateral or bilateral) and hormone receptor status. The literature examining these factors is summarized below.

According to a study of 10104 women who underwent mastectomy by Alderman et al. (2003), the odds of receiving breast reconstruction for women aged 35-44 years was 1.52 (1.28-1.80), 55-64 years was 0.42 (0.35-0.49), 65-74 years was 0.16 (0.13-0.19) and more than 75 years was 0.04 (0.03-0.06) as compared to a reference group of women aged 45-54 years (Alderman et al., 2003). In absence of any contraindications, BRS is considered to be a safe procedure and improves quality of life even among elderly women (Howard-McNatt et al., 2011;

Walton, Ommen, & Audisio, 2011). In spite of this, the reconstruction rate among elderly remains significantly lower than younger women.

Higher number and/or severity of comorbidities measured using the Elixhauser comorbidity score (Elixhauser, Steiner, Harris, & Coffey, 1998) or the weighted Charlson comorbidity score (Charlson, Pompei, Ales, & MacKenzie, 1987) are associated with lower likelihood of receiving breast reconstruction, especially immediate reconstruction. Compared to women with a Charlson Comorbidity Index —a weighted comorbidity score—of 4, the odds of receiving immediate breast reconstruction for women with a score of 1 was 3.41 (2.84-4.10), score of 2 was 1.71 (1.43-2.05) and for a score of 3 was 1.53 (Reuben et al., 2009). In terms of specific comorbid conditions, disease conditions such as Diabetes Mellitus and Hypertension are associated with lower likelihood of BRS (Miller & Chandru Kowdley, 2012; Preminger et al., 2012).

Obesity is another condition that is associated with a lower likelihood of breast reconstruction. The odds of receiving BRS for obese women (BMI: 25-<30) are 0.67 (0.54-0.83) and for severely obese women (BMI: 25-<30) are 0.44 (0.35-0.55) as compared to non-obese (BMI:20-<25) women (Christian et al., 2006). Although obesity is not a contraindication for BRS, it is associated with higher complications after breast reconstruction in a few studies (Beahm, Walton, & Chang, 2006; Fischer et al., 2013). Thus, some surgeons may avoid offering or recommending breast reconstruction to obese patients.

Tumor characteristics such as size, stage and grade are associated with receipt of BRS. Tumor stage refers to the size and extent of the tumor and whether or not tumor cells have spread in the body whereas tumor grade refers to the degree of abnormality of tumor cells under the microscope which serves as an indicator for the aggressiveness of tumor cells. Compared to carcinoma in situ stage, higher tumor stage is associated with lower odds of BRS (In et al., 2013; Iskandar et al., 2015). Similarly, compared to Grade 1 tumor, higher grade tumor is associated with a lower likelihood of receipt of BRS (Lang et al., 2013). Larger tumor size is associated with lower likelihood of breast reconstruction surgery (Christian et al., 2006; Lang et al., 2013). The involvement of lymph nodes is associated with lower likelihood of BRS (Hershman et al., 2012; Jagsi et al., 2014). Higher the number of involved nodes, lower is the likelihood of immediate or delayed BRS (Christian et al., 2006; Lang et al., 2013).

Receipt of adjuvant therapy, especially radiation therapy is associated with lower odds of receiving breast reconstruction surgery, especially immediate breast reconstruction surgery (Alderman et al., 2003; Enewold et al., 2014; W. H. Tseng et al., 2010). Although radiation therapy is not a contraindication for immediate reconstruction, it leads to poor esthetic results for immediate reconstruction surgery. Delayed autologous surgery is preferred in cases where it is known that the patient will need post-mastectomy radiation therapy (Kronowitz & Robb, 2009). The odds of autologous reconstruction are much higher than implants for irradiated breasts since implants are associated with higher complications and poor esthetic results after radiation therapy (Gurunluoglu, Gurunluoglu, Williams, & Tebockhorst, 2013; Jagsi et al., 2014). Two-stage immediate delayed reconstruction is another option in case of radiation therapy. Tissue expanders can be deflated during radiation treatment and expanded after completion of radiation therapy (S. A. Chen et al., 2013). The tissue expanders can then be replaced with implants or more commonly, autologous tissue.

Receipt of chemotherapy before or after mastectomy is also independently associated with lower odds of immediate breast reconstruction (Alderman, Hawley, et al., 2009; Christian et al., 2006). Hormone receptor status is also associated with receipt of breast reconstruction in one study (Lang et al., 2013). The relationship between laterality of mastectomy and receipt of breast reconstruction has been receiving considerable attention by researchers and the media. The odds of breast reconstruction are 2 to 5 times higher after bilateral mastectomy than unilateral mastectomy (Hershman et al., 2012; Iskandar et al., 2015; Jagsi et al., 2014).

Patient-level sociodemographic factors.

Patient-level socio-demographic factors associated with receipt of breast reconstruction include insurance, managed care, income, education, employment, geographical region, rurality, marital status and most importantly, race and ethnicity. The literature examining these factors is summarized below.

Type of insurance is a frequently examined factor in association with receipt of BRS. Women with Medicaid insurance who have a mastectomy are less likely to receive BRS as compared to women with private insurance who have a mastectomy in studies of national and state-level databases. Similarly, compared to privately insured women, women who are Medicare insured or women who do not have any insurance (self-pay) are less likely to receive BRS (Alderman, Hawley, et al., 2009; Mahmoudi et al., 2015; Shippee et al., 2014; Yang, Newman, Lin, et al., 2013). Compared to women without health insurance (self-pay) having a mastectomy, women who are insured by Medicare or Medicaid having a mastectomy are more likely to receive BRS and women with private insurance having a mastectomy have even higher odds of receiving BRS (Hershman et al., 2012). Compared to women with Medicaid, women with Medicare do not have significantly different odds of receiving BRS in one study (Kruper et al., 2013) and have higher odds in another study (Kruper, Xu, et al., 2011). Both these studies were based in California, a state that has Medicaid coverage for IBRS. Thus, even when Medicaid covers BRS, Medicaid insured patients receiving a mastectomy are less likely to receive BRS.

Even within private insurance, mastectomy patients enrolled in plans with capitation are less likely to receive BRS (Jagsi et al., 2014). These differences in likelihood of BRS may be explained by the reimbursement differences for BRS across various types of insurance as mentioned in the previous section of this chapter.

Income is another sociodemographic factor examined in literature in relation to receipt of BRS. According to Morrow et al. (2001), compared to patients with annual family income less than 40,000$ who receive a mastectomy, patients with family income equal to or greater than 40,000$ receiving a mastectomy are twice as likely to receive BRS in a study of the National Cancer Database (Morrow, Scott, Menck, Mustoe, & Winchester, 2001). Chen (2009) found similar results in their study of the Los Angeles cancer registry (J. Y. Chen et al., 2009). In a number of studies that include income, it is measured at the patient's zip code level due to unavailability of patient-level income in commonly available datasets. Patient residing in census tracts or counties with higher median or mean family or household income (either continuous or percentiles or quartiles) have a significantly higher likelihood of receipt of BRS as compared to patients residing in low income census tracts and neighborhoods (Agarwal et al., 2011; In et al., 2013; Jagsi et al., 2014; Mahmoudi et al., 2015; Onega et al., 2014; Rosson et al., 2008; Sisco et al., 2012). Patients residing in census tracts with higher percentage of population below the poverty rate have lower likelihood of receipt of BRS as compared to patients residing in census tracts with lower percentage of population below the poverty rate (Anthony P. Polednak, 1999; A. P. Polednak, 2001).

A patient's educational attainment is also associated with receipt of BRS. The decision to seek and receive BRS is a medically complex one and women with higher levels of education may be more likely to understand and assimilate information regarding BRS and choices for various types of BRS. Among patients undergoing mastectomy, women with less than high school education have lower odds ranging from 0.38-0.73 of receiving BRS as compared to women with more than high school education (Christian et al., 2006; Morrow et al., 2005). College graduates are 14 times more likely to score higher on breast reconstruction knowledge survey as compared to women who have not graduated college (Lee et al., 2011). In addition, surgeons are nearly 3 times more likely to discuss breast reconstruction with women who are college graduates as compared to women who did not graduate from college (Caprice C. Greenberg et al., 2008). Level of education in the patient's neighborhood is also related to the receipt of BRS by the patient (Mahmoudi et al., 2015; Rosson et al., 2008). This could be due to a social network effect or association of education with higher socioeconomic status of patient's neighborhood (Rosson et al., 2008).

Geographical variation in receipt of BRS is observed in literature. Compared to women living in San Francisco, women living in Connecticut, Hawaii, Iowa and Seattle are less likely to receive breast reconstruction whereas women living in metropolitan Atlanta, metropolitan Detroit, San Jose-Monterey, Los Angeles, New Mexico and Utah are more likely to receive BRS (Agarwal et al., 2011; Alderman et al., 2003). Geographical differences also exist across urban-rural areas. Among patients receiving mastectomy, women residing in rural non-metropolitan regions are less likely to receive breast reconstruction as compared to women living in urban metropolitan regions (Agarwal et al., 2011; W. H. Tseng et al., 2010). This could be explained by availability of plastic surgeons in certain regions. Patients residing in counties with higher density of plastic surgeons have higher likelihood of receiving breast reconstruction surgery as compared to patients residing in counties with lower density of plastic surgeons (Jagsi et al., 2014; Kaplan et al., 2011).

Compared to immigrant women receiving mastectomy, women born in the US receiving mastectomy are 3.5 times more likely to receive BRS (Caprice C. Greenberg et al., 2008). Employed women receiving mastectomy is have higher likelihood of receiving BRS as compared to unemployed women receiving mastectomy even after controlling for type of insurance (Christian et al., 2006; Kaplan et al., 2011). This could be explained by the fact that employment is an indicator of socioeconomic status or it could be that women who are employed may be more interested in getting a BRS for cosmetic and psychosocial reasons. Marital status is also a predictor of receiving BRS. Women who are married or have a partner are more likely to receive BRS as compared to women who are single (Agarwal et al., 2011; J. Y. Chen et al., 2009; Hershman et al., 2012; In et al., 2013). This may be due to psychological, social and financial support provided by a partner or a woman's desire to improve cosmetic appearances for their partner.

Race and ethnicity are the most frequently examined sociodemographic factors associated receipt of breast reconstruction in literature. This literature is summarized in the next section.

Racial and Ethnic Differences in Receipt of BRS

This section begins with an overview of literature that examines race and ethnicity in association with receipt of BRS followed by a description of factors that are cited as causes for the racial and ethnic differences in literature. This is followed by a discussion of the gaps in literature addressed by research questions 2 and 3.

Empirical research about racial and ethnic differences in receipt of BRS.

African American women undergoing mastectomy have significantly lower odds (ranging from 0.2 to 0.9) of receiving breast reconstruction surgery as compared to non-Hispanic women undergoing mastectomy (Agarwal et al., 2011; Alderman, Hawley, et al., 2009; J. Y.

Chen et al., 2009; Christian et al., 2006; Hershman et al., 2012; In et al., 2013; Jagsi et al., 2014; Kaplan et al., 2011; Kruper, Holt, et al., 2011; Lang et al., 2013; Mahmoudi et al., 2015; Miller & Chandru Kowdley, 2012; Rosson et al., 2008; Shippee et al., 2014). Additionally, Asian women (odds ranging from 0.2-0.6) and Native American women (odds ranging from 0.4-0.7) also have lower likelihood of receipt of breast reconstruction compared to non-Hispanic White women (Agarwal et al., 2011; Alderman et al., 2003; In et al., 2013; Iskandar et al., 2015; Kruper, Holt, et al., 2011; Kruper et al., 2013; Lang et al., 2013).

Hispanic women have significantly lower odds of receiving breast reconstruction in a number of studies as compared to non-Hispanic White women (Agarwal et al., 2011; Alderman et al., 2003; Caprice C. Greenberg et al., 2008; Kruper, Holt, et al., 2011; Kruper et al., 2013; Lang et al., 2013; Nelson et al., 2012; Shippee et al., 2014). The odds are especially lower for less acculturated Latinas as compared to highly acculturated Latinas (Alderman, Hawley, et al., 2009).

Compared to non-Hispanic African American women, women of all other races and ethnicities are more likely to receive breast reconstruction surgery (Reuben et al., 2009). Over time between the year 2005 to 2011, the likelihood of breast reconstruction has increased for African American women and Hispanic women but has decreased for Asian women (Offodile et al., 2015).

Racial and ethnic differences in receipt of BRS have persisted across time in literature (Jagsi et al., 2014; Offodile et al., 2015; Shippee et al., 2014; Sisco et al., 2012). Racial and ethnic differences are seen not only in national databases such as SEER and NIS but also in state level studies (Kruper, Holt, et al., 2011; Rosson et al., 2008; Yang, Newman, Reinke, et al., 2013), single institution studies (J. F. Tseng et al., 2004) and studies using data from the

Department of Defense Medical Claims (Enewold et al., 2014). Alderman et al. (2006), Mahmoudi et al. (2015) and Yang et al. (2013) have all demonstrated that racial and ethnic differences in receipt of BRS persist in spite of state and federal policies that enhance access to breast reconstruction (Alderman et al., 2006; Mahmoudi et al., 2015; Yang, Newman, Reinke, et al., 2013).

Racial and ethnic differences are also observed in the type of breast reconstruction surgery. African American women are more likely to receive an autologous reconstruction (OR: 1.45, 95% confidence interval: 1.24-1.69) but less likely to receive an implant reconstruction (OR: 0.59, 95% confidence interval: 0.5-0.68) as compared to non-Hispanic White women (Offodile et al., 2015). The authors explain the higher likelihood of receiving an autologous reconstruction for African American women is because they are more likely to have higher BMI and receive care at large, academic medical centers in inner city regions. All of these factors are independently associated with higher odds of receiving autologous reconstruction (Offodile et al., 2015). Women of Hispanic ethnicity have lower likelihood of receiving implant reconstruction as compared to non-Hispanic White women. However, there are no significant differences in likelihood of implant reconstruction between non-Hispanic White women and Asian women.

Over time between the years 2005 to 2011, the likelihood of implant breast reconstruction decreased for African American women, Hispanic women and Asian women. On the other hand, the likelihood of pedicled autologous breast reconstruction increased for Hispanic women over time between 2005 and 2011 but did not change for African American and Asian women. Lastly, the likelihood of free flap autologous breast reconstruction increased for African American women over the same time period but did not change for Hispanic women and Asian women (Offodile et al., 2015).

In the next sub-section, the hospital and market-level factors that may contribute to racial and ethnic differences in receipt of BRS are presented followed by a summary of the gap in literature addressed by research question 2. Next, patient-level factors that may contribute to racial and ethnic differences in receipt of BRS are explained followed by a summary of the gap in literature addressed by research question 3.

Factors contributing to racial and ethnic differences in receipt of BRS.

Hospital and market-level factors.

Racial and ethnic minorities are less likely to receive care at the hospitals frequented by non-Hispanic Whites and are more likely to receive care at hospitals with poorer quality of surgical outcomes (D. J. Gaskin et al., 2011). Onega et al. (2014) found that African Americans are more likely to receive care at disproportionate share hospitals and less likely to receive care at hospitals that have an NCI cancer center designation or participate in a cooperative oncology group (Onega et al., 2014). Onega et al. (2014) also found that African Americans were more likely to be admitted to urban, teaching hospitals with high surgery volume (Onega et al., 2014). Urban, teaching hospitals are associated with higher rates of reconstruction (Hershman et al., 2012; Kruper, Holt, et al., 2011; Onega et al., 2014; Reuben et al., 2009; Shippee et al., 2014). However, Popescu et al. (2011) and Gaskin et al. (2011) found that after controlling for distance from the hospital, African Americans are significantly less likely than Whites to receive care in urban, teaching hospitals with high volume and high quality outcomes (D. J. Gaskin et al., 2011; Popescu, Cram, & Vaughan-Sarrazin, 2011). In spite of the known racial and ethnic differences in characteristics of the hospital and market where care is received, the role of hospital and market characteristics in explaining racial and ethnic differences in receipt of BRS has not been explored.

Certain hospitals may be less likely to perform BRS for racial and ethnic minority patients, thereby widening racial and ethnic differences in receipt of BRS. This could result from a hospital's lack of experience in treating racial/minority patients, language discordance among providers and patients or other factors that are not fully understood. Onega et al. (2014) examined whether hospital and market characteristics moderate the relationship between women of color and receipt of BRS. However, they found that hospital characteristics such as teaching status, NCI cancer center designation, participation in a cooperative oncology group and market characteristics such as urban location do not significantly moderate the relationship between race/ethnicity and receipt of BRS (Onega et al., 2014).

An important limitation of the Onega et al (2014) study is that their sample consisted of women above 65 years of age wherein the rate of reconstruction is only 10% (Onega et al., 2014). In this paper, we address the gaps in the previous literature by studying a wider age group of women undergoing mastectomy and by examining theoretically driven hospital and market characteristics. Thus, the second research question is:

RQ2. Is the relationship between race/ethnicity and likelihood of receipt of IBRS moderated by hospital and market characteristics?

Patient-level factors.

Racial and ethnic differences in health status can contribute to racial and ethnic differences in receipt of BRS. Several health status indicators such as late stage tumor, clinical comorbidities and obesity are associated with lower likelihood of BRS (Christian et al., 2006; Miller & Chandru Kowdley, 2012; Reuben et al., 2009). Racial and ethnic minorities are likely to receive late diagnoses of breast cancer at more advanced tumor stages as compared to non-Hispanic Whites (Katz & Hofer, 1994; Press, Carrasquillo, Sciacca, & Giardina, 2008; Shavers & Brown, 2002). In addition, racial and ethnic minorities may have higher comorbidities as compared to non-Hispanic Whites (Tammemagi, Nerenz, Neslund-Dudas, Feldkamp, & Nathanson, 2005). Higher comorbidities and late stage diagnoses may be due to poor access to health care facilities owing to location or socioeconomic factors. It could also be a representation of the lack of trust in the healthcare system expressed by certain racial minorities, which in turn is a product of long-term racial discrimination. Lastly, certain racial and ethnic minorities are more likely to be obese as compared to their White counterparts (Trust for America's Health and Robert Wood Johnson Foundation, 2014). This could represent racial/ethnic disparities in access to high quality food and in access to playgrounds or parks for exercise (Sallis & Glanz, 2009). Thus, racial/ethnic differences in stage of tumor, clinical comorbidities and obesity can contribute to racial and ethnic differences in receipt of BRS.

Although no study explicitly examines the contribution of socioeconomic factors to the racial/ethnic differences in receipt of BRS, a number of studies cite racial/ethnic differences in insurance, income, education and other neighborhood factors as potential explanations for BRS differences (Christian et al., 2006; Morrow et al., 2005; Shippee et al., 2014; J. F. Tseng et al., 2004). Racial and ethnic minorities are more likely to be uninsured (Hoffman, 2008) or Medicaid insured (The Henry J. Kaiser Family Foundation, 2013). Medicaid insurance and uninsured status are associated with lower likelihood of BRS in literature (Hershman et al., 2012; Kruper, Holt, et al., 2011; Kruper et al., 2013; Shippee et al., 2014; Yang, Newman, Lin, et al., 2013; Yang, Newman, Reinke, et al., 2013). Thus, racial/ethnic differences in insurance status may contribute to racial/ethnic differences in receipt of BRS.

In addition, racial and ethnic minorities are also more likely to have lower income (Mead & Fund, 2008) which may lead to financial barriers in receiving BRS. The WHRCA permits states to allow private insurers to add additional premiums and out of pocket expenses to provide BRS to the beneficiaries (American Cancer Society, 2014) which may affect access to BRS for low-income patients. Patient's income and the affluence of a patient's neighborhood are associated with higher likelihood of receipt of BRS (Agarwal et al., 2011; In et al., 2013; Jagsi et al., 2014; Mahmoudi et al., 2015; Onega et al., 2014; Rosson et al., 2008; Sisco et al., 2012). In addition, racial and ethnic minorities are likely to be less educated and more likely to be unemployed as compared to non-Hispanic Whites (Ritter & Taylor, 2011; Ryan & Bauman, 2016; Williams & Jackson, 2005). Educational attainment and employment are associated with higher likelihood of BRS (Christian et al., 2006; Caprice C. Greenberg et al., 2008; Kaplan et al., 2011; Lee et al., 2011; Morrow et al., 2005). Thus, racial and ethnic differences in income, educational attainment and employment may contribute to racial/ethnic differences in receipt of BRS.

In the two sub-sections above, racial/ethnic differences in patient-level, hospital-level and market-level characteristics that may contribute to racial/ethnic differences in receipt of BRS are described. In order to direct policy efforts towards reducing racial and ethnic differences, these multiple factors need to be prioritized. One way to prioritize policy efforts is to determine which factors contribute the most to racial and ethnic differences in receipt of breast reconstruction. No study to date has examined the multi-level factors that contribute to racial and ethnic differences in receipt of breast reconstruction. Results from this study help fill this gap and prioritize policy efforts. Decomposition analyses help to quantify the proportion of each factor's contribution to the racial and ethnic differences. Th results from these analyses aid policy makers focus their limited resources on addressing the factors that have the largest contribution to these differences. Thus, the last research question is:

RQ3. Which patient, hospital and market-level characteristics contribute the most to the racial and ethnic differences in receipt of IBRS?

Factors contributing to racial and ethnic differences in type of surgery.

Rubin et al. (2013) found that African Americans prefer autologous BRS compared to implants since they prefer use of their own body tissue than a foreign body (implant) due to religious and cultural reasons (Rubin, Chavez, Alderman, & Pusic, 2013). However, autologous BRS is a more complex surgery and is not provided by all medical centers. Additionally, rates of physician reimbursement by surgical time are lower for autologous reconstruction as compared to implants (Alderman, Storey, et al., 2009). Even in urban areas with high availability of plastic surgeons, racial/ethnic minorities in resource-poor hospitals may face barriers to receipt of immediate autologous reconstruction which requires complex surgery, more time in the surgical room and coordination of multiple surgeons but is reimbursed at a lower rate (Alderman, Storey, et al., 2009). In order to understand the contribution of hospital and market factors in receipt of autologous vs implant surgery, separate supplemental analyses for type of IBRS (autologous reconstruction vs implant reconstruction) for research questions 2 and 3.

Chapter 3: Conceptual Framework

Overview of Chapter

The purpose of this chapter is to develop a conceptual framework for the research questions outlined in Chapter 2. The Aday Andersen Framework describes the patient-level and health system-level factors along with the health policy context that is associated with utilization of a health service such as Immediate Breast Reconstruction Surgery (IBRS). However, the Aday Anderson framework does not incorporate a comprehensive set of health system (includes hospital and market) characteristics. Thus, Resource Dependence Theory (RTD) is used to address this gap and derive the hospital- and market-level characteristics associated with utilization of IBRS. After describing Aday Andersen framework and RDT, the combined conceptual framework for the current study is presented, as are the study hypotheses for Research question 1. Research question 2 examines whether hospital and market characteristics moderate the relationship between race/ethnicity and receipt of IBRS. No directional hypotheses for research question 2 are presented. Research question 3 focuses on the magnitude of contribution of the patient, hospital and market-level characteristics, derived from the Aday Andersen framework and RDT, to the racial and ethnic differences in IBRS. Since research question 3 examines the magnitude rather than the direction of relationships, no specific directional hypotheses are specified for research question 3.

Aday Andersen Framework

Andersen (1968) created the original behavioral model of health service utilization as part of his dissertation (Andersen, 1968). In this original three-stage model with the family as the unit of analysis, Andersen (1968) uses predisposing, enabling, and need components in an attempt to explain families' widely differing use of medical care services. The model postulates that utilization of a health care service takes place when a family is predisposed to receive medical care, when conditions make health services available to the family and when the family perceives a need for these services and responds to it. The focus is on the predisposing, enabling and need characteristics of the family (Andersen, 1968).

Andersen and Newman (1973) modified the 1968 model to shift the unit of analysis from the family to the individual and to include societal as well as health services system characteristics. Later, Aday and Andersen (1974) modified the 1973 framework to include health policy and health system characteristics. According to this revised 1974 model, utilization of health services is dependent on 1) health policy characteristics; 2) health system characteristics; 3) predisposition of the individual to use health services (predisposing characteristics); 4) the individual’s ability to secure these health services (enabling characteristics) and lastly 5) the individual’s illness level that determines his/her need for health services and his/her beliefs about their illness level (need characteristics) (Andersen & Newman, 1973). The basic Aday Andersen framework is presented in Figure 1 followed by a brief description of all the elements in the framework. This is followed by an adaptation of this framework to the current study.

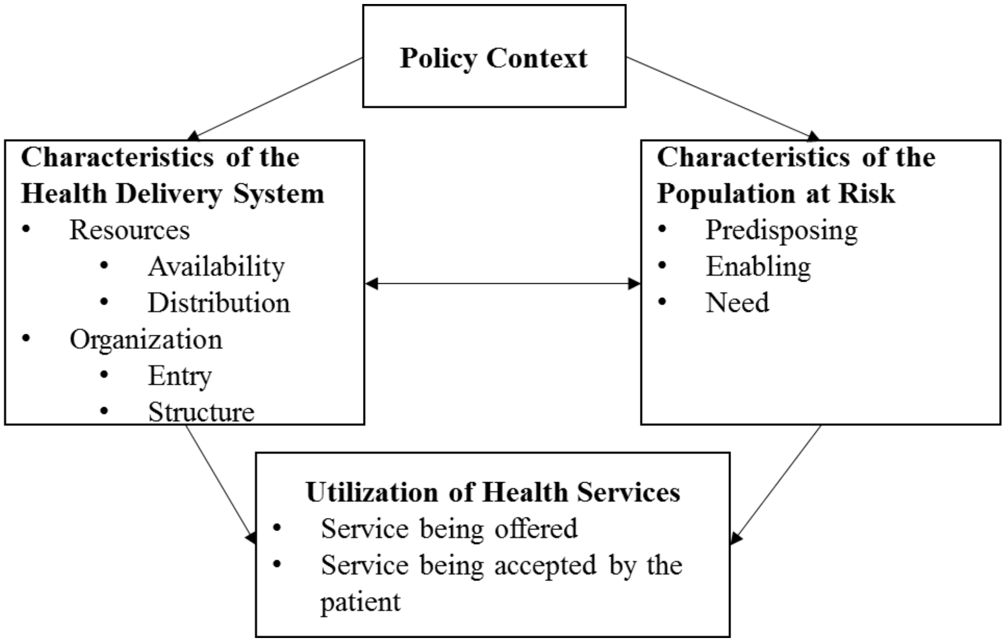

Figure 1. Aday Andersen Framework

Health policy and health services system determinants.

Aday Anderson (1974) state that access should be examined in the context of health policy since ensuring access to care is an important goal of health policy. Health policy can bring about change in mutable factors at the health system and the individual level in order to improve access. Thus, these authors place health policy at the pinnacle of the framework and all other characteristics of the health system and the individuals at risk proceed from the health policy component. The health policy component includes policies related to financing of health care at the system and at the individual level, education of providers and patients, availability, distribution and type of health care manpower and lastly, organization of the health services system.

The health services system determinants included in this model are resources and organization. In this model, the health services system refers to the larger health care system at the national level (Aday & Andersen, 1974). Resources refer to labor and capital devoted to healthcare at the national level. The resource component includes total volume of resources relative to the population served and the distribution of these resources throughout the country. Organization describes what the system does with its resources. The two components of the organization described in the model are access and structure. Access refers to the means through which a patient enters the health care system. This component refers to the barriers that need to be overcome in order to enter the health care system. Structure is the second component of organization. Structure deals with what happens to patients once they enter the health care system. It encompasses the nature of medical practices of the physicians, processes of referral and characteristics of hospital care.

Predisposing, enabling and need characteristics.

Certain individuals have a higher propensity to use health services than others. This higher propensity is irrespective of the disease condition that necessitates care. The predisposing characteristics at the individual level that are associated with this propensity to utilize health services may be demographic (age and sex) or related to the social structure (education, race, ethnicity) which in turn are related to values concerning health and illness, attitudes towards health services and knowledge about disease and care processes.

Demographic variables such as age and sex are related to the types and amounts of past illness and past use of health care. Past use of health care is considered to be a determinant of future use and thus age and sex are related to an individual's predisposition to use health services. Social structure variables such as education, race and ethnicity among others, reflect the status of an individual in the society. These status variables are an indicator for the patient's lifestyle and an accumulation of lifetime social and economic advantages and disadvantages which shape the patient's health status along with patient's beliefs and behaviors regarding the use of health services.

Lastly, the beliefs of an individual, which to a certain extent are shaped by their demographics and social structure, are related to their inclination toward use of health services. For instance, patients with strong beliefs about the importance of their disease and the value of medical care along with a positive attitude towards health services, shaped by past interactions with the health system, are all associated with higher inclination to use health services.

Even if individuals have a propensity to seek health services and/or have a need for a health service, they cannot do so without the means that enable them to receive health services. Enabling characteristics in this model represent those means that enable individuals to receive care. These include income and insurance, the resources that provide financial access to care. Enabling characteristics also include an accessible regular source of health care.

Community characteristics such as availability of medical personnel, hospital beds and other medical/surgical resources enable easy accessibility to health services. These community characteristics are thus considered to be enabling factors. The distribution of these resources within a community varies across geographical regions in the country. Thus, urbanicity and region are also considered to be enabling characteristics.

Need characteristics are also called illness level characteristics by Andersen and Newman (1973). The illness level can be perceived or evaluated. Perceived illness level is the individual's perception of their disease. On the other hand, disease conditions and their stage and severity as diagnosed by a physician are components of the evaluated illness level. Whereas symptoms are a component of perceived illness, physical signs as elicited on physical exam or diagnostic tests are a component of evaluated illness level. Presence and severity of other diagnosed clinical comorbidities is also considered a component of evaluated illness level. All these perceived and evaluated need characteristics serve as the immediate drivers of seeking health services in the presence of predisposing and enabling characteristics.

Adaptation of the Aday Andersen framework for utilization of IBRS.

Utilization of IBRS is the outcome of interest for the current study. Utilization is possible when IBRS is offered by health systems and when it is accepted by the patients. As seen from Figure 1, the Aday Andersen framework begins with the policy context as the most distal factor that is associated with utilization of health services. The policy context relevant for examining the utilization of IBRS is state-level health policy related to insurance coverage and patient education, specifically for breast reconstruction surgery. The execution of federal health policies related to IBRS (e.g. the Women's Health and Cancer Rights Act) varies significantly across states (Centers for Disease Control and Prevention, 2000). States can add additional riders for coverage of IBRS by private insurers (e.g. state of Florida). While most states provide Medicaid coverage for IBRS, the level of reimbursement varies significantly. In addition, certain states like Pennsylvania extend Medicaid coverage for IBRS to uninsured women. Other social, economic and health policies that may influence any of the multilevel factors associated with receipt of IBRS also vary across states. Thus, indicators for the state in which the patient receives care are included in the Aday Andersen framework to address differences in policy contexts across states.

Based on the Aday Andersen framework, the health system characteristics (including hospital and market-level factors) associated with acceptance of IBRS include volume and distribution of resources along with entry to and structure of the organization. According to Andersen and Newman (1973), the components of the health services system—volume and distribution of resources along with access to and structure of the organizations—are the most difficult to define and to relate to utilization patterns compared to other components of the model. In order to address these issues, Resource Dependence Theory is used to establish the links between the characteristics of the health services system and the utilization of health services in the paper.

As noted in Chapter 2, most of the previous literature examines patient-level factors associated with receipt of IBRS. In this study, patient-level predisposing, enabling and need characteristics serve as controls and are derived using the Aday Andersen framework. The predisposing characteristics associated with receipt of IBRS are patient's age, race and ethnicity. Younger patient age is associated with higher likelihood of IBRS since younger age is associated with fewer comorbidities and higher perceived benefit from IBRS (Alderman et al., 2003; In et al., 2013). There is a physician bias towards offering IBRS to younger women as compared to older women (Caprice C. Greenberg et al., 2008). Minority race and ethnicity are associated with lower likelihood of receiving IBRS (Agarwal et al., 2011; Alderman, Hawley, et al., 2009; J. Y. Chen et al., 2009; Christian et al., 2006; Hershman et al., 2012; In et al., 2013; Jagsi et al., 2014; Kaplan et al., 2011; Kruper, Holt, et al., 2011; Lang et al., 2013; Mahmoudi et al., 2015; Miller & Chandru Kowdley, 2012; Rosson et al., 2008; Shippee et al., 2014). Not much is known about the reasons for these racial and ethnic differences. Research questions 2 and 3 in this study aim to address this gap.

Enabling characteristics associated with receipt of IBRS are patient's income and insurance. Patients with private insurance have a higher likelihood of receipt of IBRS as compared to patients with Medicaid or uninsured patients (Alderman, Hawley, et al., 2009; Mahmoudi et al., 2015; Shippee et al., 2014; Yang, Newman, Lin, et al., 2013). Similarly, patient income is also associated with higher likelihood of receipt of IBRS (Agarwal et al., 2011; In et al., 2013; Jagsi et al., 2014; Mahmoudi et al., 2015; Onega et al., 2014; Rosson et al., 2008; Sisco et al., 2012). Both income and insurance are commonly studied enabling factors in most studies that utilize the Andersen behavioral model and its derivatives.

Need characteristics examined in this study in association with receipt of IBRS are clinical comorbidity score and an indicator for obesity. Higher number and severity of clinical comorbidities are associated with lower likelihood of receipt of IBRS as it increases the likelihood of complications after the surgery (Reuben et al., 2009). Similarly, obesity is associated with poor revascularization and wound healing and is considered to be a relative contraindication for IBRS (Beahm et al., 2006; Christian et al., 2006). In order to control for other relative contraindications, patients with metastasis and a history of previous breast cancer are excluded. The Aday Andersen framework modified for the purpose of this study is presented in Figure 2.

The predisposing, enabling and need characteristics at the patient-level are expected to be associated with the receipt of IBRS based on the Aday Andersen framework. The Aday Andersen framework does not include hospital and market-level factors that are associated with the receipt of health care services. Therefore, Resource Dependence Theory is used to derive the health system i.e. hospital and market-level characteristics that will be added to the Aday Andersen Framework to develop a conceptual framework for the current study. In the next section, RDT and the hypotheses derived using this theory are described followed by a combined conceptual framework used in this study.

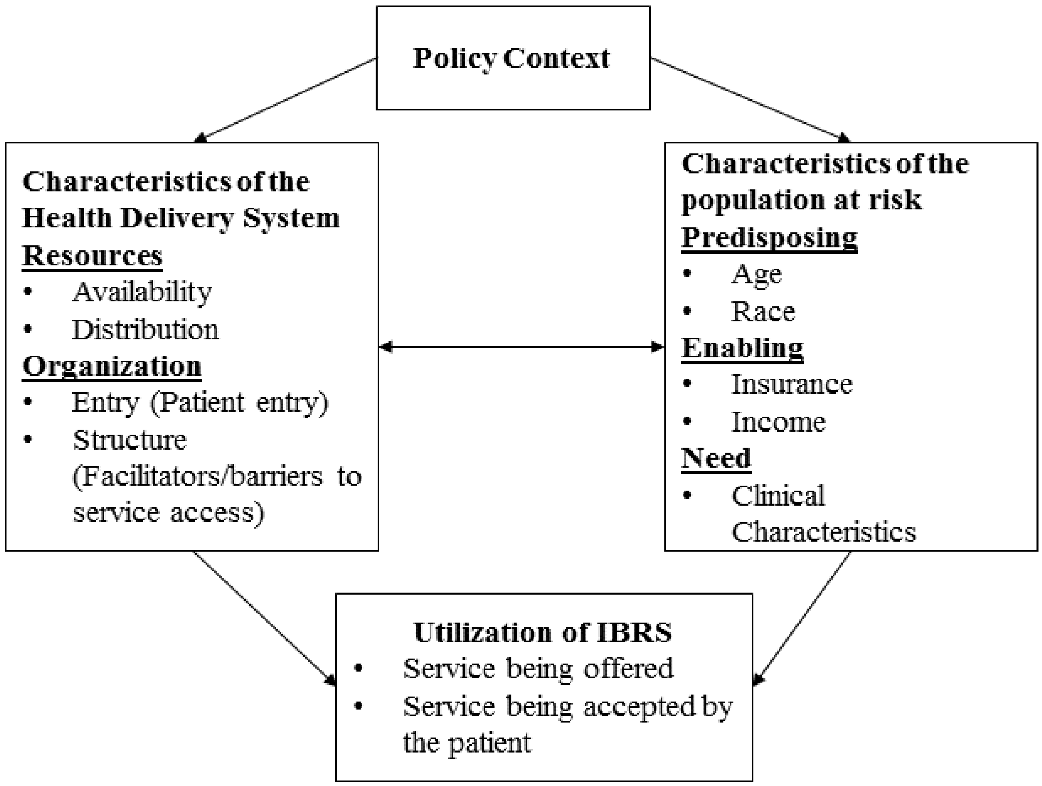

Figure 2. Aday Anderson Framework for Utilization of IBRS

Resource Dependence Theory

Overview.

Resource Dependence Theory was first described in Pfeffer and Salancik's "The External Control of Organizations: A Resource Dependence Perspective" (1978). Since then, RDT has become one of the most influential theories in organizational theory and strategic management (Hillman, Withers, & Collins, 2009). RDT characterizes the corporation as an open system, dependent on contingencies in the external environment. An open system includes "organizations with interdependent activities of linking and shifting coalitions of participants; the systems are embedded in dependent or continuing exchanges with and constituted by the environments in which they operate" (Scott & Davis, 2007). According to RDT, to understand an organization's behavior, one must look at its context or its environment (Pfeffer & Salancik, 1978).

RDT suggests that organizational survival is dependent on acquiring and maintaining access to certain resources from their environment. When organizations are dependent on resources from their environment, they are concerned with three main issues: 1) munificence of resources; 2) the concentration of resources among various stakeholders and lastly, 3) interconnectedness of organizations within the environment. Munificence is the abundance of resources available to the organization. Abundant critical resources reduce uncertainty whereas scarcity of critical resources increases uncertainty regarding the resource. Concentration of a resource by few stakeholders increases the stakeholders' power over the focal organization. The higher the concentration of the resource, the more power exerted by the stakeholder and higher the level of uncertainty experienced by the focal organization. Lastly, interconnectedness with organizations in the focal organization's environment may also increase uncertainty by increasing competition for the resource (Pfeffer & Salancik, 1978).

As uncertainty in an organization's environment increases, it becomes important for organizations to manage their dependence on external stakeholders. The higher an organization's dependence on a stakeholder, the higher the likelihood of the stakeholder making demands from the focal organization in exchange for providing resources. The focal organization has the discretion to either accommodate these stakeholder demands or to avoid them (Oliver, 1991). This discretion is dependent on 1) the importance of the resource; 2) the degree of discretion that the external stakeholder has regarding allocation and use of the resource which depends on the competition for consuming the resource provided by the external stakeholder and 3) the concentration of the resource, which depends on the relative magnitude of the exchange (i.e., the proportion of a vital resource provided by the particular stakeholder) (Pfeffer & Salancik, 1978). Thus, in cases where the stakeholder making demands of the focal organization controls an important resource that is not substitutable and there is high competition for the resource, the focal organization is likely to comply with the stakeholder's demands in order to ensure the focal organization's survival.

In spite of the importance of compliance for the focal organization's survival, Davis and Powell (1992) argue that compliance may not always be easy. Compliance may carry threats to the focal organization. Compliance may be costly in the short term and may constrain the organization's future adaptation. Thus, ceteris paribus, compliance is more likely when organizations can bear the costs of compliance (Davis & Powell, 1992). Thus, organizations with higher capital and labor are more likely to comply with the demands of the external stakeholders since they are able to bear the costs of such compliance. Since compliance may constrain an organization's future adaptation, compliance is more likely when the demands of the external stakeholder are in line with the focal organization's own vision and mission regarding their future (Banaszak-Holl et al., 1996).

Hypotheses.

For the purpose of research question 1 in this study, hospital-level and market-level factors that are likely to be associated with provision of IBRS are examined. Patients or consumers are an important resource for a hospital. Breast cancer patients are one such source of patients for a hospital. Assuming that breast cancer patients value access to IBRS services, hospitals are likely to offer this service and provide IBRS to the patient if certain conditions are met.

RDT postulates that higher the proportion of an important resource provided by a particular stakeholder group, the higher is the likelihood of complying with that group's demands. In this study, breast cancer patients serve as a stakeholder group that provides the hospital with an important resource i.e. consumers of their services. The higher the proportion of all patients in the hospital provided by this stakeholder group, the higher is the likelihood of the hospital complying with their demands and providing IBRS.

Hypothesis 1A. The higher the proportion of breast cancer patients admitted by a hospital, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.

RDT also postulates that compliance with a stakeholder's demand is dependent on the relative power of the focal organization as compared to the stakeholder. When there is higher competition for a resource, it increases the stakeholder's discretion over the organization they want to provide their resources to. This increases the stakeholder's power vis-à-vis that of the focal organization. Higher discretion of the stakeholder and a large number of competitive organizations in the focal organization's environment increase uncertainty for the focal organization. According to RDT, all things being equal, the higher the uncertainty regarding procurement of an important resource from a stakeholder, the higher is the likelihood of accommodating the stakeholder's demands. In markets with high competition, availability of patients as a resource becomes uncertain. In order to secure patients, a health care organization needs to provide the service demanded by the patients (Pfeffer & Salancik, 1978; J. S. Zinn, Weech, & Brannon, 1998) which in this case is IBRS demanded by breast cancer patients.

Hypothesis 1B. The higher the competition in a hospital's market, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.

Davis and Powell (1992) argue that complying with a stakeholder's demands is costly. Thus, compliance is more likely when organizations can bear the costs of compliance (Davis & Powell, 1992). In a number of papers where RDT was employed, authors have argued that organizations are more likely to meet the demands of key resource providers like patients if they have the necessary capital and labor to provide the service demanded by the patients (Kraatz & Zajac, 2001; J. Zinn & Flood, 2009; J. S. Zinn et al., 1998). Capital resources include bed size and indicators of financial performance of the hospital whereas labor resources include the density of plastic surgeons in the hospital market (Banaszak-Holl et al., 1996; Greening & Gray, 1994). Hospital beds are the most common capital investment made by a hospital. Thus, larger bed size represents higher capital resources (Ginsburg, 1972). Total margin of a hospital is a commonly used broad indicator of the hospital's financial performance (Needleman, 2003; Pink et al., 2006). Total margin is defined as a ratio of net income to total revenue from all sources. Better financial performance allows a hospital to bear the cost of complying with patient demands. Thus, it can be hypothesized that all else being equal, the higher the bed size and the higher the total margin, the higher the likelihood of provision of IBRS.

Hypothesis 1C. The higher the number of beds in a hospital, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.

Hypothesis 1D. Higher the total margin of a hospital, higher is the likelihood of mastectomy patients receiving IBRS at the hospital.

Labor resources associated with provision of IBRS include plastic surgeons. A hospital will be unable to provide IBRS unless there is an availability of plastic surgeons in the hospital. Easy availability of labor resources allows a hospital to bear the labor costs of complying with patient demands. Thus, it can be hypothesized that all else being equal, the higher the availability of plastic surgeons in the hospital market, the higher the likelihood of provision of IBRS.

Hypothesis 1E. The higher the density of plastic surgeons in a hospital's market, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital. Certain other hospital and market characteristics are associated with capital and labor resources of a hospital.

For instance, hospitals located in an urban region are more likely than those in rural areas to have a higher capital and labor availability (Weisgrau, 1995). According to the Hall and Owings (2014), patients hospitalized in urban hospitals were generally more likely to have surgical procedures performed during their hospitalization than those hospitalized in rural hospitals. This could be due to the shortage of specialty physicians in rural areas, the lack of other staff skilled in surgery, or the absence of costly equipment needed for specialized surgical procedures in rural hospitals. Because of economies of scale, rural hospitals may forego offering many procedures and instead choose to focus on patients needing basic inpatient surgical care, and on patients needing medical, rather than surgical, treatment (Hall & Owings, 2014). Thus, it can be hypothesized that all else being equal, hospitals located in an urban market will be associated with a higher likelihood of provision of IBRS as compared to hospitals located in a rural market.

Hypothesis 1F. Patients receiving mastectomy at hospitals located in urban counties are more likely to receive IBRS compared to patient receiving mastectomy at hospitals located in rural counties.

Hospitals that predominantly serve Medicaid patients have a higher burden of providing care to vulnerable populations. Such hospitals are usually strained for resources with high wait times for surgical procedures (Bradley, Dahman, Shickle, & Lee, 2012). Higher wait time is associated with lower likelihood of receipt of IBRS (Greenberg et al., 2011). Breast surgeons in such hospitals may be too overburdened to be able to discuss reconstruction options with their patients or refer them to a plastic surgeon. Additionally, plastic surgeons and other specialists are less likely to accept Medicaid patients for IBRS. Thus, plastic surgeons may be less likely to perform IBRS at hospitals with a large proportion of Medicaid patients (Paradise & Garfield, 2013). Thus, it can be hypothesized that all else being equal, hospitals with a lower proportion of

Medicaid patients will be associated with a higher likelihood of provision of IBRS as compared to hospitals with a higher proportion of Medicaid patients.

Hypothesis 1G. The lower the proportion of Medicaid patients admitted by a hospital, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.

According to Hasnain-Wynia et al. (2007), minority patients receive care at under-resourced low performing hospitals. A number of factors can characterize low-performing hospitals as under-resourced including nurse staffing shortages, inadequate budgets, lack of technical support such as health information systems, and lack of capital (Hasnain-Wynia et al., 2007). Schatzkin (1984) argues that poor political representation of minority-serving hospitals may lead to lesser philanthropic contributions (Schatzkin, 1984). Thus, hospitals with a high proportion of racial and ethnic minorities may not be able to bear the cost of complying with patient demands for IBRS. It can be hypothesized that all else being equal, hospitals with lower proportion of racial and ethnic minority patients will be associated with a higher likelihood of provision of IBRS as compared to hospitals with a higher proportion of minority patients.

Hypothesis 1H. The lower the proportion of racial and ethnic minority patients admitted by a hospital, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.

Davis and Powell (1992) state that complying with a stakeholder’s demands is not always easy for an organization since it may constrain the organization’s future adaptation. Hence, compliance is more likely when the demands of the external stakeholder are in line with the focal organization’s own vision and mission regarding their future (Kraatz & Zajac, 2001; J. Zinn & Flood, 2009; J. S. Zinn et al., 1998). Teaching hospitals are known to provide a wide variety of innovative surgical procedures (Banaszak-Holl et al., 1996). Thus, providing sophisticated but costly service like IBRS aligns with the mission of teaching hospitals. It can be hypothesized that all else being equal; teaching hospitals are more likely to provide IBRS as compared to non-teaching hospitals.

Hypothesis 1I. Patients receiving mastectomy at teaching hospitals are more likely to receive IBRS as compared to patients receiving mastectomy at non-teaching hospitals.

Not-for-profit hospitals are known to provide services needed by the community irrespective of the financial gain from providing such services (Newhouse, 1970). Horwitz (2005) argues that for-profit hospitals are less likely to provide services that are not known to be profitable. Horwitz (2005) in her study of 30 health care services found that not-for-profit hospitals are more likely than for-profit hospitals at providing services that are not highly profitable to the hospital. Similarly, the study also found that non-federal public hospitals are more likely than for-profit and not-for-profit hospitals to provide services that may not be profitable (Horwitz, 2005). Eiland (2015) cites the Stewardship theory as an explanation for not-for-profit and non-federal public hospitals' provision of services that are of broad interest to the community in spite of the financial gain (Eiland, 2015). Thus, providing a costly service like IBRS that may not be highly profitable but meets community needs aligns with the mission and vision of not-for-profit hospitals and non-federal public hospitals. It can be hypothesized that all else being equal, not-for-profit hospitals and non-federal public hospitals are more likely to provide IBRS as compared to investor-owned for-profit hospitals.

Hypothesis 1J. Patients receiving mastectomy at private not-for-profit hospitals are more likely to receive IBRS compared to patients receiving mastectomy at private investor-owned for-profit hospitals.

Hypothesis 1K. Patients receiving mastectomy at non-federal public hospitals are more likely to receive IBRS compared to patients receiving mastectomy at private investor-owned for-profit hospitals.

The hypothesis 1A to 1K are related to research question 1 wherein the hospital and market-level factors associated with receipt of IBRS are examined. The hospital and market-level factors derived from RDT in this section are incorporated into the Aday Andersen framework as health system characteristics. The patient-level characteristics included in the framework are the predisposing, enabling and need characteristics. In addition, indicators for states in which patients receive care serve as the health policy context. The conceptual framework for Research Question 1 thus incorporates Resource Dependence Theory into the Aday Andersen framework. This combined framework is presented in Figure 3.

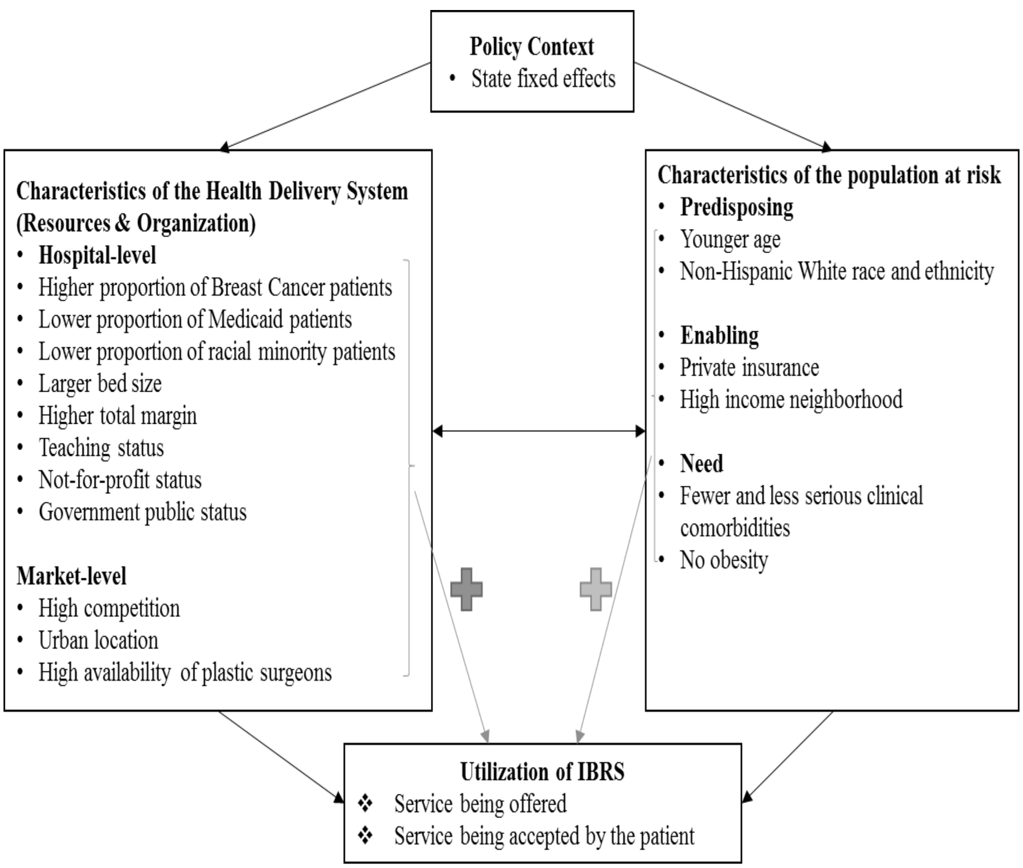

Figure 3. Combined Conceptual Framework for Utilization of IBRS

In the second research question, the hospital and market characteristics associated with lower likelihood of receipt of IBRS for stratified samples of racial and ethnic minority women after controlling for patient-level predisposing, enabling and need characteristics are examined. Not much is known about how hospital and market characteristics influence provision of IBRS services for racial and ethnic minorities. Therefore, no directional hypotheses for research question 2 are stated. Research question 3 focuses on the magnitude of contribution of the patient, hospital and market-level characteristics, derived from the Aday Andersen framework and RDT, to the racial and ethnic differences in IBRS. Since research question 3 examines the magnitude rather than the direction of relationships, no directional hypotheses are specified for it.

Chapter 4: Methodology

Overview of Chapter Structure

This chapter begins with a description of the data sources and the study population. This is followed by measurement of the dependent and independent variables. Next, the analytical approaches used to address the research questions are presented, including a detailed description of the decomposition method used to address research question 3.

Data Sources

This study uses data extracted from nationally recognized databases at the patient-level, hospital-level and area (market)-level. Patient-level data is obtained from State Inpatient Databases (SIDs) that are part of the Healthcare Cost and Utilization Project (HCUP) sponsored by the Agency for Healthcare Research and Quality (AHRQ). HCUP databases are derived from administrative data and contain all-payer encounter-level, clinical and nonclinical information including all listed diagnoses and procedures, discharge status, patient demographics, and hospital charges for all patients (Healthcare Cost and Utilization Project, 2016b). The states included in this study are Arizona, Florida, Kentucky, Maryland, New Jersey, New York, North Carolina and Washington. In addition, data for the State of California is obtained from California Office of Statewide Health Planning and Development (OSHPD) (Office of Statewide Health Planning and Development, 2015). The OSHPD data is also administrative data and is similar to the format of the HCUP SID. The data used in this study are from 2010, 2011 and 2012. Using three years of data provides a sufficient sample size and ensures that the findings are not confounded by year-specific history effects. The nine states included in this study are selected due to the diversity in racial mix of their population. For example, the states of Arizona (37% of the population is Hispanic), Florida (26% of the population is Hispanic) and California (38% of the population is Hispanic) have a higher proportion of Hispanic population than the national average (18% of the population is Hispanic) whereas the states of Maryland (30% of the population is Black) and North Carolina (21% of the population is Black) have a higher proportion of Black population than the national average (12% of the population is Black). On the other hand, Kentucky has a higher proportion of White population than the national average (The Henry J. Kaiser Family Foundation, 2015). The time period 2010 to 2012 is selected to ensure that the results are not affected by policy changes mandated by the Affordable Care Act.

Hospital-level characteristics are obtained from the American Hospital Association (AHA) Annual Survey database and the Center for Medicare and Medicaid Services Hospital Cost Report (HCR) Data. AHA Annual Survey database includes hospital-specific data on approximately 6,500 hospitals and 400-plus hospital systems, including as many as 1,000 data fields covering organizational structure, personnel, and hospital facilities and services (American Hospital Association, 2014). The HCR data contains hospital information such as facility characteristics and financial statement data that the hospital is required to report to the Medicare administrative contractor in order to receive Medicare reimbursement (Centers for Medicare and Medicaid Services, 2012). The hospital-level data are merged with the patient-level data using the unique AHA id assigned to each hospital.

The market-level variables are derived from the Area Health Resource File (AHRF). The AHRF database provides county-level information on a broad range of health resources and socioeconomic indicators which might impact demand for health care (U. S. Department of

Health and Human Services, 2016). The county in which the hospital is located is used as the definition of the market for merging with the AHRF. This is a common practice in literature (Garnick, Luft, Robinson, & Tetreault, 1987). The market-level data are merged with the hospital-level data using the unique Federal Information Processing Standards (FIPS) code assigned to each county (United States Census Bureau, 2010).

Study Population

The unit of analysis in this study is a discharge record of an individual patient. One discharge record represents one single patient because patient discharge records are not linked over time in this study. This is because only two (Florida and New York) of the nine states included in the study have patient link variables to link discharge records of patients over the study time period. Thus, the term patient-level is used to refer to discharge-level data henceforth. Patient-level data from the 9 states included in the study are queried for observations where patient sex is female and the primary diagnosis is breast cancer. Breast cancer diagnosis is ascertained by selecting patients for whom the Clinical Classification System (CCS) code is 24 which represents ‘Cancer of the Breast’ and includes observations with ICD-9 diagnosis codes for breast cancer diagnoses (174.0, 174.1, 174.2, 174.3, 174.4, 174.5, 174.6, 174.8, 174.9, 175.0, 175.9, 233.0, V103) (Healthcare Cost and Utilization Project, 2016a).

The sample is then restricted to women between 30-80 years of age. Although the median age for breast cancer diagnosis among women is 62 years, nearly 5% of all breast cancer patients are between 30 to 40 years of age (Zabicki et al., 2006). Additionally, Blacks are more likely to be diagnosed at a younger age than non-Hispanic Whites (Brinton, Sherman, Carreon, & Anderson, 2008). Hence, patients 30 years of age and older are included in this study. Patients older than 80 years of age are excluded since reconstruction rates are significantly lower among this population (less than 3% rate of reconstruction) (Kruper, Holt, et al., 2011). Next, patients who had a history of prior breast cancer as evident by their ICD-9 code for the primary diagnosis (ICD-9 code V103) are excluded from the sample since patients with recurrent cancer may have certain contraindications such as previous scarring or radiation therapy to the affected breast which may be contraindications for reconstruction surgery (Hu & Alderman, 2007). Next, patients with a secondary diagnosis of metastasis to lung, liver, brain, bone, lymph node (common sites for metastasis from breast cancer) (Weigelt, Peterse, & Van't Veer, 2005) are also excluded. Secondary metastases are usually a contraindication for breast reconstruction surgery (Hu & Alderman, 2007). Secondary metastases to these sites are identified using secondary diagnosis codes in the HCUP and OSHPD data. If any of the secondary diagnoses fields had an ICD-9 diagnosis code for metastases to these sites, the observation is excluded from the sample. The ICD-9 diagnosis code for metastases to these five sites are 1) Lung: 197.0, 2) Liver: 197.7, 3) Brain: 198.3, 4) Bone: 198.5, 5) Lymph node: 196.9 (Weigelt et al., 2005).

The sample is then restricted to only those observations where Mastectomy is one of the procedures conducted. The ICD-9 procedure codes used for identifying mastectomies are 85.33, 85.34, 85.35, 85.36, 85.40, 85.41, 85.42, 85.43, 85.44, 85.45, 85.46, 85.47, 85.48 (Jagsi et al., 2014). Lastly, the sample is restricted to non-Hispanic White, non-Hispanic Black and Hispanic patients. Patients with any other race/ethnicity are excluded from the sample.

The final sample consists of 58,429 patient observations with 43,469 observations of non-Hispanic White patients, 7,585 observations of non-Hispanic Black patients and 7,375 observations of Hispanic patients. Figure 4 presents the flow diagram for the sample with all the exclusion criteria and number of observations excluded at each step.

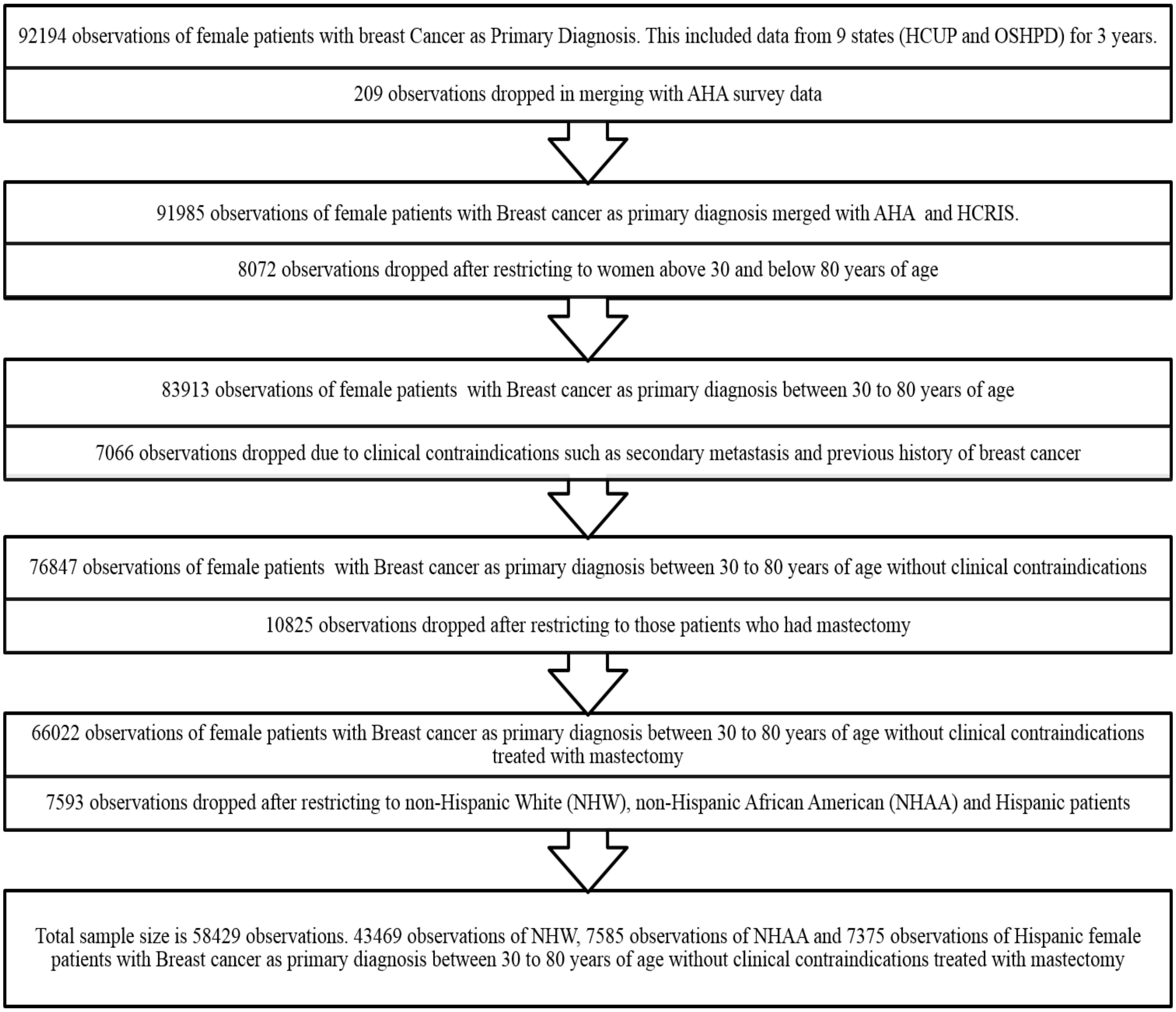

Figure 4. Flow Diagram for Sample

Variable Measurement

Dependent variable.

The dependent variable is constructed as a binary indicator for receipt of immediate or immediate-delayed breast reconstruction (IBRS) at the time of receipt of mastectomy. Patients are classified as undergoing immediate breast reconstruction based on the presence of ICD-9 procedure codes during the incident admission indicating autologous free or pedicled flap, implant-based reconstruction, or placement of tissue expander (for immediate-delayed reconstruction) (Immediate implant reconstruction: ICD-9 procedure code 85.33, 85.35, 85.53, 85.54; Immediate autologous reconstruction: ICD-9 procedure code 85.70, 85.71, 85.72, 85.73, 85.74, 85.75, 85.76, 85.79, 85.82, 85.83, 85.84, 85.85, 85.86; Tissue expander insertion for immediate-delayed reconstruction: ICD-9 procedure code 85.95) (Jagsi et al., 2014). In the absence of one of these codes, patients are classified as not receiving immediate breast reconstruction. Delayed reconstructions are not included in this study for two reasons. First, nearly 90 to 95% of all breast reconstructions are immediate (Eltahir et al., 2015; Kaplan et al., 2011). Second, HCUP and OSHPD data do not provide patient-level identifier variables for linking patient visits over time. This makes it difficult to identify delayed reconstructions.

In addition to the binary variable for receipt of immediate or immediate-delayed reconstruction, binary variables for receipt of immediate autologous reconstruction and immediate implant reconstruction are also constructed. This is done in order to conduct additional analyses with type of immediate reconstruction as the dependent variable.

Explanatory variables.

Hospital-level variables.

Hospital-level variables included in the model are percentage of breast cancer patients in the hospital, percentage of Medicaid patients in the hospital, percentage of racial and ethnic minorities in the hospital, bed size, financial performance, ownership and teaching status.

The percentage of breast cancer patients is measured using a ratio with all hospital discharges (without any exclusions) as the denominator, and all hospital discharges with a primary diagnosis of breast cancer determined using the ICD-9 diagnosis codes presented in the Study Population section as the numerator. The percentage of Medicaid patients is measured using a ratio with all hospital discharges (without any exclusions) as the denominator, and all hospital discharges with Medicaid as the primary payer as the numerator. The percentage of racial and ethnic minority patients also called racial/ethnic mix is measured using a ratio with all hospital discharges (without any exclusions) as the denominator, and all hospital discharges for Black and Hispanic patients as the numerator. None of the sample exclusions described in the Study Population section are applied to the numerator or denominator for these three variables. This is because the sample exclusions are made in the context of the dependent variable i.e. receipt of IBRS. On the other hand, these three variables are indicators of a hospital's overall resources and not those specific to breast cancer patients. All three of these variables are included in statistical models as continuous variables.

The financial performance of a hospital is measured using the total margin which is a ratio of net income to total revenue, as is commonly done in literature (Bazzoli, Chan, Shortell, & D'Aunno, 2000; Ehreth, 1994; Levitz & Brooke Jr, 1985; Mark, Evans, Schur, & Guterman, 1998). The total margin is derived from the Center for Medicare and Medicaid Services Hospital Cost Report data. The size of the hospital is measured as the number of beds in the hospital i.e. the bed size. The bed size of the hospital is obtained from the American Hospital Association (AHA) Annual Survey database. Total margin and bed size are continuous variables.

Hospital ownership is measured using three categories of not-for-profit, for-profit and non-federal public ownership status of a hospital. The ownership category is obtained from the American Hospital Association (AHA) Annual Survey database. Federal hospitals that serve only special populations (e.g. military, veterans, etc.) do not report administrative data to HCUP or OSHPD and are not included in this study.

Teaching status is measured using a binary variable. A hospital is classified as a teaching hospital if the AHA database identifies it as having one or more resident physician training programs accredited by the Accreditation Council for Graduate Medical Education, or if the hospital has a medical school affiliation (American Hospital Association, 2014).

Market-level variables.

The county where the hospital is located is used as the definition of market for this study as is commonly done in previous literature. Market-level variables included in the model are concentration, urbanicity, and density of plastic surgeons in the county.

Competition is measured as an inverse of the Herfindahl-Hirschman Index (HHI) of concentration (Rhoades, 1993). HHI is calculated as the sum of the squared market share of each hospital in the market. Market share of a particular hospital is measured as proportion with all inpatient admissions from that particular hospital as the numerator and all inpatient admissions in the market as the denominator. Inpatient admissions for each hospital and information on number of hospitals in a market are derived from the AHA database. The HHI ranges between zero and one with one representing the perfect monopoly or the most concentrated market and values approaching zero representing the most competitive market. For example, a market with only one hospital would have a squared market share i.e. HHI equal to one. Conversely, a market with a large number of hospitals would have a small sum of squared market shares, and thus an HHI near zero. HHI is included in the statistical model as a continuous variable as it can assume any value between zero and one.

Urbanicity is measured as a four-category urban-rural designation for the county in which the hospital is located. This categorization is a simplified adaptation of the 2013 version of the Urban Influence Codes (UIC). Urban Influence Codes developed by the United States Department of Agriculture Economic Research Service divide the 3,143 counties, county equivalents, and independent cities in the United States into twelve groups. Metro counties are divided into two groups according to the population size of the metro area-those in large areas have at least one million residents and those in small areas have fewer than one million residents. Non-metro counties include all counties outside metro areas and are delineated as micropolitan or noncore using Office of Management and Budget's classification. Non-metro micropolitan counties are divided into three groups distinguished by metro size and adjacency: adjacent to a large metro area, adjacent to a small metro area, and not adjacent to a metro area. Non-metro noncore counties are divided into seven groups distinguished by their adjacency to metro or micro areas and whether or not they contain a town of at least 2,500 residents (Parker, 2011). For the statistical models in this study, the twelve categories of the UIC are condensed into four broader categories that differentiate between large metropolitan, small metropolitan, micropolitan and rural counties. The large metropolitan category comprises of UIC 1 which represents large metropolitan area with more than one million residents. The small metropolitan category comprises UIC 2 which represents small metro area of less than one million residents. The micropolitan category comprises UIC 3 which represents micropolitan area adjacent to large metro area, UIC 5 which represents micropolitan area adjacent to small metro area or UIC 8 which represents micropolitan area not adjacent to a metro area. Lastly the rural category comprises UIC 4, 6, 7, 9, 10, 11, 12 which represent non-core areas (Healthcare Cost and Utilization Project, 2016b; Parker, 2011). Condensing the twelve UIC categories into four broader categories is commonly done in literature that utilizes HCUP data to study geographical differences in care (Barrett, Wier, & Washington, 2006; Torio & Andrews, 2006).

The density of plastic surgeons in the market is measured as number of plastic surgeons per hundred residents in the county in the year 2010. The number of plastic surgeons in the county as well as total population of the county is derived from the AHRF. The variable is included in the statistical models as a continuous variable.

Patient-level control variables.

The patient-level control variables included in the model are patient's age, clinical comorbidities, obesity, insurance type and income. Patient's age at admission is obtained from the HCUP and OSHPD databases and measured as patient-reported age in years, a continuous variable. Clinical comorbidities are measured using the Charlson comorbidity score. In order to compute the Charlson comorbidity score for a patient, each of the patient's comorbid conditions are assigned a score of one, two, three, or six, depending on the risk of dying associated with each comorbidity. Scores are then summed to provide a total score which is considered to be a good predictor of mortality (Charlson et al., 1987). Next, obesity is measured as binary variable. A patient is classified as obese if the binary variable for obesity as a comorbidity in the HCUP and OSHPD database is 1 (Elixhauser et al., 1998). Obesity is included as a separate measure because it is not included in the calculation of the Charlson comorbidity score and it is known to be a risk factor for complications after BRS and is an important determinant of whether a patient gets BRS and what type of BRS procedure they receive (Saha et al., 2013). Patient's insurance type is operationalized as three binary variables for Medicaid, Medicare and self-pay (uninsured) with private insurance as the reference group. This information is obtained from the primary payer variable in the HCUP and OSHPD databases.

HCUP and OSHPD databases do not provide information on patient-level income. However, HCUP provides quartiles of median household income in the zip code where the patient lives. This is considered as a proxy for patient income in past literature (Hanley & Morgan, 2008; Michalski & Nattinger, 1997). This information is obtained from the median income in zip code of the patient quartiles variable in the HCUP SID. This variable is not available in the California OSHPD data. The zip-code level median household income for the state of California is obtained from the American Community Survey and is merged to the OSHPD database. The quartiles of this variable are then created so the format of the variable for California is similar to that of other states. This variable is included in the statistical model as three binary variables for income quartiles two, three and four with income quartile one, the lowest quartile of median household income in the patient's zip code, as the reference group.

Patient-level race and ethnicity variables.

Patient race and ethnicity is represented by two separate binary variables for non-Hispanic Black and Hispanics with non-Hispanic Whites as the reference group. This information is derived from the HCUP and OSHPD databases. The ethnicity data takes precedence over the race data for those with a Hispanic ethnicity. Thus, anyone with a Hispanic ethnicity is classified as a Hispanic and their race is not considered for the purpose of this study (Nerenz, McFadden, & Ulmer, 2009). Therefore, White means non-Hispanic White and Black means non-Hispanic Black in these databases. Henceforth in this study, the term White refers to Non-Hispanic Whites and the term Black refers to Non-Hispanic Black. The definitions and sources of the variables in the model are presented in Table 1.

Table 1

Variable Definitions and Sources

Variable	Definition	Source
Dependent Variable		
Receipt of Immediate BRS	Binary 0/1 variable. 1 if the patient received IBRS based on ICD-9 Procedure codes identified from literature.	HCUP SID
Independent variables		
Patient-level		

(Table 1: Continued)

Variable	Definition	Source
Black race	Binary 0/1 variable. 1 if the patient race/ethnicity is non-Hispanic Black.	HCUP SID
Hispanic ethnicity	Binary 0/1 variable. 1 if the patient ethnicity is Hispanic regardless of race.	HCUP SID
Age	Continuous variable. Patient age in years.	HCUP SID
Clinical Comorbidities	Measured using Charlson Score. Continuous variable.	HCUP SID
Obesity	Binary 0/1 variable. 1 if the patient is classified as obese.	HCUP SID
Insurance	Three separate binary variables for Medicare, Medicaid and Self-pay (Uninsured) payer type with Private Insurance as the omitted reference category.	HCUP SID
Income	Measured as median household income at the patient's zip code level and then converted to quartiles with quartile 1 (the lowest income group) being the omitted reference category.	HCUP SID
Hospital-level		
Percentage of breast cancer patients	Continuous variable measured as number of discharges from a hospital with breast cancer as primary diagnosis*100/number of total discharges from a hospital.	HCUP SID
Bed size	Total number of beds in the facility that are set up and staffed.	AHA
Total margin	Continuous variable measured as ratio of net income to total revenue.	CMS HCR
Racial/ethnic mix	Continuous variable measured as number of discharges from a hospital for non-Hispanic Black and Hispanic patient*100/number of total discharges from a hospital.	HCUP SID
Medicaid mix	Continuous variable measured as number of discharges from a hospital with Medicaid as the primary payer*100/number of total discharges from a hospital.	HCUP SID
Ownership	Two separate binary variables for not-for-profit ownership and non-federal public ownership with for-profit as the omitted reference category.	AHA
Teaching status	Binary 0/1 variable. 1 if the hospital is a teaching hospital.	AHA
Market-Level		
Competition	Continuous variable measured as inverse of Herfindahl-Hirschman Index. HHI ranges	AHA

(Table 1: Continued)

Variable	Definition	Source
	between 0 (perfect competition) to 1 (no competition). Thus, competition ranges between 1 to infinity.	
Plastic surgeon density	Continuous variable measured as number of plastic surgeons in the county per 100 total population.	AHRF
Urbanicity	Measure using 4 categories of Urban Influence Codes (UIC). 3 separate binary variables for small metropolitan areas with less than 1 million residents (UIC 2), micropolitan areas (UIC3), rural areas that are not metropolitan or micropolitan (UIC4) with large metropolitan areas with at least 1 million residents as the omitted reference category (UIC1).	HCUP SID

Note: HCUP SID is Healthcare Cost and Utilization Project State Inpatient Databases for the 8 states except California included in the model, OSHPD is Office of Statewide Health Planning and Development Inpatient database for the state of California, AHA is American Hospital Association Survey Database, CMS HCR is Center for Medicare and Medicaid Services Hospital Cost Report data, AHRF is Area Health Resource File.

Analytical Approach

A pooled cross-sectional retrospective non-experimental design is used to address the research questions. The analysis is performed in multiple steps: descriptive statistics, logistic regression with patient-level clinical variables, mixed effects logistic regression without and with interactions between race/ethnicity and place of care characteristics and lastly, Fairlie decomposition.

Descriptive statistics.

The first step is to conduct descriptive analyses for the full sample and then separately for the Blacks, Whites and Hispanics. The descriptive statistics for the dependent variable and all independent variables are then compared across race/ethnicity (Blacks compared to Whites and Hispanic compared to Whites) in order to determine whether the dependent variable and the independent variables at the patient, hospital and market level variables included in the model differ significantly across race and ethnicity.

Paired t-tests are used for continuous variables wherein variable means for Blacks and Hispanics are compared to variable means for Whites. For binary variables, the percentage of observations where the variable=1 is compared across race and ethnicity and Chi-square tests are used to test whether differences in the variables across race and ethnicity are significant.

Logistic regression.

Next, logistic regression with receipt of IBRS as the dependent variable is estimated in order to examine if racial and ethnic differences in receipt of IBRS persist after controlling for patients' clinical characteristics. No hospital or market-level variables are included in the model at this step. Black race and Hispanic ethnicity are the two explanatory variables along with patient-level clinical variables such as age, comorbidities and obesity as control variables. Since, all the variables are measured at the patient-level, mixed effects regression is not used for this step. The empirical specification for this model is presented in *Equation 1*.

$$logit\{Pr(Y=1)\} = \beta_0 + \beta_1 * Black\ race + \beta_2 * Hispanic\ ethnicity + \beta_3 * Age + \beta_4 * Charlson\ score + \beta_5 * Obesity + \mu \quad (1)$$

where Y is a binary indicator of receipt of breast reconstruction and μ is the error term.

Odds ratios are used to present the results of the regression. Odds ratio represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure. If odds ratios for Black race and Hispanic ethnicity are less than one and are significant at P-value less than 0.05, it means that Blacks and Hispanics respectively are less likely to receive IBRS than Whites even after controlling for clinical characteristics.

Mixed effects logistic regression for research question 1.

Next, the relationship between hospital and market characteristics included in the conceptual model and receipt of IBRS is examined to address research question 1. Hypotheses 1A to 1K are tested using a mixed effect logistic regression model. Mixed effects (multi-level) regression is used since the data is nested in nature. Patient discharges are nested within the hospital which in turn is nested in the market (county) and finally, the state. The empirical specification for this model is presented in *Equation 2*.

$$logit\{Pr(Y_{ijkl} = 1)\} = \beta_0 + \beta_1 * Black\ race_{ijkl} + \beta_2 * Hispanic\ ethnicity_{ijkl} + \beta_3 * P_{ijkl} + \beta_4 * H_{jkl} + \beta_5 * M_{kl} + \beta_6 * S_l + \zeta_{jkl} + \zeta_{kl} + \mu_{ijkl} \quad (2)$$

where Y is a binary indicator of receipt of breast reconstruction and $i = (1,2, \ldots . n_{jkl})$ patients in $j = (1,2, \ldots . n_{kl})$ hospitals in $k = (1,2, \ldots . n_l)$ markets in $l = (1,2 \ldots 9)$ states. P is a vector of patient-level variables, H is a vector of hospital-level variables, M is a vector of market-level variables and S is a vector of state fixed effects. ζ_{jkl} is the hospital-level random effect and ζ_{kl} is the market-level random effect. Error term μ_{ijkl} is the composite error term and it incorporates random error at the patient, hospital and market-level. In order to test hypotheses 1A to 1K, significance of β_4 and β_5 in *Equation 2* are examined.

Mixed effects logistic regression with interaction terms for research question 2.

Next, a mixed effects model with interaction terms between race/ethnicity and hospital and market variables is used to examine whether hospital and market characteristics moderate the relationship between race/ethnicity and receipt of IBRS. The empirical specification for this model is presented in *Equation 3*.

$$logit\{Pr(Y_{ijkl} = 1)\} = \beta_0 + \beta_1 * Black\ race_{ijkl} + \beta_2 * Hispanic\ ethnicity_{ijkl} + \beta_3 * P_{ijkl} + \beta_4 * H_{jkl} + \beta_5 * M_{kl} + \beta_6 * S_l + \beta_7 * Black\ race_{ijkl} * H_{jkl} + \beta_8 * Black\ race_{ijkl} * M_{kl} + \beta_9 * Hispanic\ ethnicity_{ijkl} * H_{jkl} + \beta_{10} * Hispanic\ ethnicity_{ijkl} * M_{kl} + \zeta_{jkl} + \zeta_{kl} + \mu_{ijkl} \quad (3)$$

To address research question 2, the significance of β_7, β_8, β_9 and β_{10} in *Equation 3* are examined.

Fairlie decomposition for research question 3.

The decomposition approach used in this paper is Fairlie decomposition (Fairlie, 2005) which is a non-linear modification of the more popular Blinder-Oaxaca decomposition (Blinder, 1973; R. Oaxaca, 1973). The Blinder Oaxaca method is commonly used in economics to study the gender wage gap (R. Oaxaca, 1973; R. L. Oaxaca & Ransom, 1994). The Fairlie decomposition method has been used in a number of health disparities studies including a study on disparity in breast cancer screening (Jadav, Rajan, Abughosh, & Sansgiry, 2015).

The basic concept of decomposition is that inequality in receipt of breast reconstruction reflects at the minimum, inequalities in the various factors associated with it. The decomposition technique provides a way of assessing the relative contribution of each associated factor in explaining the inequality. The contribution of a factor could be due to inequality in its level or due to inequality in its effect (O'Donnell, Van Doorslaer, & Wagstaff, 2006). For example, racial difference in the receipt of IBRS may be due to racial difference in access to a hospital that performs such a procedure or it may be due to racial differences in the ability to take advantage of such access. The first component represents endowments i.e. the contribution of differences in explanatory variables across racial groups and the second component represents group differences in the coefficients or the slope of the explanatory variables and interaction between coefficients and endowments (Hlavac, 2014).

Blinder Oaxaca decomposition is meant to be applied to linear regressions with continuous dependent variables. Consider Y to represent a hypothetical variable, % of women receiving IBRS in a county, and Group A to represent Whites and Group B to represent Blacks. The difference in mean outcome for group A and B can be represented as:

$$\Delta\bar{Y} = \overline{Y_A} - \overline{Y_B} \tag{4}$$

$$\Delta\bar{Y} = \hat{\beta}_A \overline{X'}_A - \hat{\beta}_B \bar{X}'_B \tag{5}$$

Y is the % of women receiving IBRS in a county. $\Delta\bar{Y}$ is the racial difference in the % of women receiving IBRS in a county. $\overline{Y_A}$ is the % of White women receiving IBRS in a county and $\overline{Y_B}$ is the % of Black women receiving IBRS in a county. $\bar{X}'_A$ is the value of explanatory variable X for White women and $\hat{\beta}_A$ is the coefficient of the explanatory variable for White women and $\bar{X}'_B$ is the value of the explanatory variable for Black women and $\hat{\beta}_B$ is the coefficient of the explanatory variable for Black women.

This expression can, in turn, be written as the sum of the following three terms:

$$\Delta\bar{Y} = \left\{(\overline{X'}_A - \overline{X'}_B)\hat{\beta}_B\right\} + \left\{\left(\hat{\beta}_A - \hat{\beta}_B\right)\overline{X'}_B\right\} + \left\{(\overline{X'}_A - \overline{X'}_B)\left(\hat{\beta}_A - \hat{\beta}_B\right)\right\} \tag{6}$$

This is the three-fold Oaxaca Blinder decomposition of the mean outcome difference. The first term is called endowments, the second is coefficients and the third is interaction. The interaction term accounts for the fact that cross-group differences in explanatory variables and coefficients can occur at the same time. This decomposition is from the point of view of Group B i.e. the Black women as is evident from the first and second term of *Equation 6*. This means that Black women are considered to be the disadvantaged group in this case. If the point of view are to be reversed to that of Whites, the results would be different (Jann, 2008a). This is a limitation of the original Blinder-Oaxaca model that can be addressed using a two-fold approach as is done in Fairlie decomposition. The twofold approach decomposes the mean outcome difference with respect to a vector of reference coefficients $\hat{\beta}_R$. In the research literature on labor market discrimination, the reference coefficient vector has typically been interpreted to be non-discriminatory – in other words, as the set of regression coefficients that would emerge in a world of no labor market discrimination (Hlavac, 2014).

$$\Delta\bar{Y} = \{(\overline{X'}_A - \overline{X'}_B)\hat{\beta}_R\} + \{(\hat{\beta}_A - \hat{\beta}_R)\overline{X'}_A + \overline{X'}_B(\hat{\beta}_R - \hat{\beta}_B)\} \quad (7)$$

Explained *Unexplained A* *Unexplained B*
Unexplained

As seen in *Equation 7*, the twofold decomposition divides the difference in mean outcomes into a portion that is explained by cross-group differences in the explanatory variables, and a part that remains unexplained by these differences. The unexplained portion of the mean outcome gap has often been attributed to discrimination, but may also result from the influence of unobserved variables. It can be further decomposed into two sub-components, labeled “Unexplained A” and “Unexplained B” in *Equation 7*. If one interprets the reference coefficient vector to be non-discriminatory, these sub-components measure the part of the mean difference in outcomes that originates from discrimination in favor of Group A and the part that comes from discrimination against Group B, respectively. The choice of the reference coefficients is generally up to the researcher. A commonly used method is the one proposed by Oaxaca and Ransom (1994) and Jann (2008) to use coefficient estimates from a regression that pools observations from both Groups A and B, and include the group indicator variable (race) as an additional regressor (Jann, 2008a; R. L. Oaxaca & Ransom, 1994). Fairlie decomposition addresses the limitation of Blinder Oaxaca method by using reference coefficients from the pooled regression. In addition to the unexplained A and unexplained B components, there is a third component in the unexplained portion that represents difference in intercept for group A and group B i.e. $\hat{\beta}_{0_A}$-$\hat{\beta}_{0_B}$. This difference in intercepts could be due to unobserved omitted variables (Frank L Jones & Kelley, 1984).

Decomposition methods not only decompose the outcome differential into an explained and an unexplained portion, but also estimate the detailed contributions of the single predictors or sets of predictors included in the model. The total explained component is a simple sum of the contributions of differences in individual predictor variables. Jones and Kelley (1984) pointed out that the contribution of differences in individual variables to the 'unexplained' portion are not easily interpretable unless they have a natural zero point and their scale does not shift (Frank L Jones & Kelley, 1984). Thus, for the purpose of this paper, the focus is on the contribution of variables to the explained portion, as is common in the literature that uses this method.

A known issue with using the Blinder-Oaxaca decomposition is that the decomposition results depend on the choice of omitted category for categorical independent variables (Gardeazabal & Ugidos, 2004; Frank Lancaster Jones, 1983; Frank L Jones & Kelley, 1984; Yun, 2005). Categorical variables are usually modeled by including 0/1 dummy variables for the different categories in the regression such that one of the categories (base category) is omitted to avoid collinearity. If the base category changes, the decomposition results also change since the differences in associated coefficients are quantified with respect to the base category. To address this, Gardeazabal and Ugidos (2004) and Yun (2005) recommend transforming the dummy variables before model estimation (Gardeazabal & Ugidos, 2004; Yun, 2005). The idea is to express effects as deviations from the grand mean. This ensures that results of Blinder–Oaxaca decomposition are independent of the choice of omitted category (Jann, 2008a; Yun, 2005). Fairlie decomposition addresses this limitation of the Blinder Oaxaca method.

There are two other issues with Blinder Oaxaca decomposition that are addressed in the Fairlie method. The first issue is that the decomposition using this technique is dependent on the relative sample size of the two groups (e.g. Whites and Blacks). It assumes that both groups have equal sample size and 1:1 matching. Since that is rarely the case in data, a random sample of Whites to match the number of Blacks needs to be used for the decomposition (assuming there are more Whites in the data than Blacks). The results of decomposition are dependent on the sample chosen. Hence, Fairlie (2005) proposed to draw at least 1000 multiple random samples from the White population and rerun the decomposition to obtain standard errors (Fairlie, 2005).

The second issue with using the non-linear modification is that results of decomposition are dependent on the order in which variables are entered into the model. Fairlie (2005) proposed experimenting with different orders of variables to confirm the robustness of results. Fairlie (2005) suggested that the best solution may be randomizing the order of variables. The ordering of variables could be randomized at the same time as drawing the random subsample of whites (Fairlie, 2005). In this paper, Fairlie decomposition is conducted using the user written command 'fairlie' in Stata 14 using 1000 pooled random samples along with the option for random ordering of variables in order to address the limitations of the traditional decomposition model (Jann, 2008b).

Sensitivity Analyses

For all the analyses in the study up to this point, observations of patients who receive care at hospitals that do not provide any IBRS services are included in the sample. However, hospitals that do not provide any IBRS services are different from hospitals that have the ability to provide these services but have a lower likelihood of providing IBRS; either to all patients or especially to racial and ethnic minorities. Thus, including hospitals that do not provide any reconstruction services to all patients may bias the results and reduce racial and ethnic differences. Including these hospitals may also lower the contribution of the included hospital and market-level characteristics to racial and ethnic differences. Hence, sensitivity analyses are conducted after excluding all hospitals that do not provide any IBRS services i.e. if the average number of IBRS procedures in the hospital over 2010 to 2012 is zero.

Next, sensitivity analyses are conducted after combining Blacks and Hispanic into one minority group. The idea of separating Blacks and Hispanics in the main analyses of the paper is that Blacks and Hispanics face different cultural and linguistic barriers in access to health care services (Conklin, 2008). Thus, separating the analyses helps generate specific practice and policy recommendations. However, there are also a number of similarities in the socioeconomic barriers in access to health care services faced by Blacks and Hispanics (Centers for Disease Control and Prevention, 2005; Saloner & Lê Cook, 2013; Ward et al., 2004). Thus, sensitivity analyses are conducted with the combined minority group compared to Whites for all the analyses.

Additional Analyses

Immediate breast reconstruction surgery can be done either using implants, patient’s own tissue (autologous), or tissue expanders that serve as temporary prosthesis until the time the patient is fit to receive a reconstruction in a second stage surgery (this second stage surgery reconstruction can be done using implants or patient’s own tissue. Not much is known about the factors associated with the receipt of a particular type of reconstruction. Given the nature of the data, the type of reconstruction (autologous or implant) procedure subsequently chosen by women receiving immediate tissue expanders during their mastectomy cannot be determined. Thus, all observations with receipt of tissue expanders are excluded so the factors associated with receipt of immediate autologous reconstruction (AR) vs. immediate implant reconstruction (IR) can be examined. AR and IR have relative advantages and disadvantages as explained in Chapter 2, and no single surgery is preferred over the other. These additional analyses serve as a first step towards understanding racial/ethnic difference in type of reconstruction and the hospital and market factors associated with autologous reconstruction. For this analysis, the sample is restricted to only those patients who received a breast reconstruction. Next, all patients who received a tissue expander as part of the two-step reconstruction process are excluded. Thus, the final sample included only those patients who received an immediate autologous reconstruction (AR) or an immediate implant reconstruction (IR). The entire set of analyses (descriptive statistics, patient-level logistic regression, mixed effects logistic regression, mixed effects logistic regression with interactions and Fairlie decomposition) are repeated for this sample in order to understand the hospital and market-level factors associated with the type of reconstruction received (immediate autologous reconstruction vs immediate implant reconstruction) and to understand the contribution of patient, hospital and market-level variables to racial and ethnic differences in receipt of immediate autologous reconstruction (AR).

Chapter 5: Results

Overview of Chapter Structure

In this chapter, the results of the analyses described in Chapter 4 are presented. In the first section, the descriptive statistics for the dependent as well as explanatory variables for the full sample and by race/ethnicity are reported. This is followed by the results of the patient-level logistic regression which examines whether racial and ethnic differences in immediate breast reconstruction surgery (IBRS) persist after controlling for patient's clinical characteristics. Next, the results from the multilevel mixed effects logistic regression are presented which examines the hospital and market-level characteristics associated with receipt of IBRS in order to address research question 1. Next, results from the mixed effects logistic regression which includes interactions between hospital and market-level variables and race/ethnicity to address research question 2 are presented. This is followed by presentation of results from the Fairlie decomposition to address research question 3. In the next section, the results from the sensitivity analyses are presented followed by results for the additional analyses. The chapter concludes with a brief summary of the results.

Results for Descriptive Statistics

The descriptive statistics for the dependent variable and the explanatory variables at the patient-level, hospital-level and market-level for the full sample and by race and ethicity are presented in Table 2. Chi-square tests are used for binary and categorical variables and simple student t-tests for continuous variables at a significance level of $\alpha = 0.05$.

Table 2

Variable Means and Percentage

Variable	Full Sample	White	Black	Hispanic
Receipt of Immediate Breast Reconstruction Surgery (%)	52.77	55.60	44.96**	44.12**
Patient-level				
Age	56.88	57.48	55.83**	54.45**
	(11.84)	(11.75)	(11.85)	(11.97)
Charlson score	3.09	3.04	3.27**	3.23**
	(2.06)	(2.04)	(2.16)	(2.04)
Obese (%)	6.65	6.13	12.13**	4.08**
Insurance (%)				
Medicare	29.49	30.74	28.83**	22.70**
Medicaid	10.83	6.52	18.59**	28.61**
Uninsured	1.39	0.93	2.41**	3.07**
Private Insurance	58.29	61.80	50.18**	45.63**
Median household income in the zip code (%)				
Quartile 1 (lowest income)	19.07	14.19	38.27**	28.64**
Quartile 2	21.60	21.03	22.83**	23.72**
Quartile 3	26.22	27.06	22.75**	24.74**
Quartile 4 (highest income)	33.12	37.71	16.15**	22.91**
Hospital-level				
Percentage of breast cancer patients	0.70	0.75	0.49**	0.65**
	(1.98)	(2.203	(1.07)	(1.11)
Bed size/10	44.76	43.59	49.52**	46.73**
	(34.75)	(33.76)	(35.74)	(38.79)
Total margin	5.15	5.77	3.93**	2.68**
	(14.37)	(14.23)	(11.77)	(17.11)
Racial/ethnic mix	27.20	22.22	39.66**	43.73**
	(19.77)	(15.75)	(21.93)	(23.70)
Medicaid mix	19.08	17.41	23.08**	24.79**
	(13.86)	(12.52)	(15.15)	(17.20)
Ownership (%)				
For profit	7.42	7.28	6.62**	9.13**
Not-for-profit	79.73	81.44	76.55**	72.94**
Nonfederal public	12.84	11.28	16.84**	17.94**
Teaching status (%)	61.52	60.51	68.94**	59.87
Market-Level				
Competition (1/HHI)	10.31	9.25	10.00**	16.87**
	(14.27)	(12.95)	(14.031)	(19.32)
Plastic surgeons/100 population	0.43	0.44	0.42*	0.44

(Table 2: Continued)

Variable	Full Sample	White	Black	Hispanic
	(0.38)	(0.38)	(0.36)	(0.38)
Urbanicity (%)				
UIC1 (most urban)	78.72	76.15	86.28**	86.09**
UIC2	18.08	20.20	11.21**	12.69**
UIC3	2.53	2.85	2.04**	1.15**
UIC4 (most rural)	0.67	0.80	0.47**	0.07**
Sample Size	58,429	43,469	7,585	7,375

Note: Blacks are compared to Whites and Hispanics are also compared to Whites for significance testing. Standard deviations are in parentheses. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

Of the total sample (N=58,429), 74.4% are White (N=43,469), 13% are Black (N=7,585) and 12.6% are Hispanic (N=7,375). Overall, Blacks and Hispanics less often receive immediate breast reconstruction than Whites. Blacks and Hispanics are also younger than Whites. However, in spite of the younger age, Blacks and Hispanics on average have more comorbidities than Whites. Blacks are more often than Whites to be obese whereas Hispanics are less frequently obese than Whites. Relatively more Blacks and Hispanics are uninsured or have Medicaid as their primary payer and less frequently have private insurance or Medicare as their primary payer than Whites. Lastly, Blacks and Hispanics more often live in zip codes with the lowest median household income when compared to Whites.

There are a number of significant differences in hospital and market variables by race and ethnicity of the patient. Blacks and Hispanics receive a mastectomy at hospitals that serve a significantly lower percentage of breast cancer patients than hospitals where White patients receive mastectomy. On the other hand, Blacks and Hispanics receive a mastectomy at hospitals that serve a significantly higher percentage of racial and ethnic minorities (Blacks and Hispancis) and Medicaid patients than hospitals where White patients receive mastectomy. Blacks and Hispanics receive a mastectomy at hospitals with significantly lower financial performance than the hospitals where White patients receive mastectomy. Relatively more Blacks and Hispanics receive a mastectomy at larger hospitals in urban, competitive markets than Whites. Blacks and Hispanics more frequently receive a mastectomy at non-federal public hospitals and less often receive a mastectomy at not-for-profit hospitals compared to Whites. Compared to Whites, relatively fewer Blacks and relatively more Hispanics receive a mastectomy at a for-profit hospital. Blacks more often receive a matsectomy at teaching hospitals than Whites. Lastly, Blacks receive a mastectomy in markets that have higher density of plastic surgeons than markets where Whites receive a mastectomy.

Patient-level Logistic Regression

Next, it is examined whether racial and ethnic differences in the dependent variable persist after controlling for patient's clinical characteristics. The results from this patient-level logistic regression are presented in Table 3.

Table 3

Patient-level Logistic Regression

Variable	Odds Ratio	95% CI
Race and ethnicity		
Black race	0.549**	[0.520, 0.580]
Hispanic ethnicity	0.455**	[0.430, 0.481]
White (Reference)		
Age	0.926**	[0.924, 0.927]
Charlson score	0.836**	[0.828, 0.843]
Obesity		
Obese	0.742**	[0.690, 0.798]
Non-obese (Reference)		
Intercept	197.107**	[177.054, 219.431]

Note: CI=Confidence Interval. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

As can be seen from Table 3, Blacks and Hispanics are nearly 50% less likely than Whites to receive IBRS even after controlling for age, clinical comorbidities and obesity.

Empirical Analyses Results: Research Question 1

Next, it is examined whether hospital and market chracteristics are associated with receipt of IBRS while controlling for patient-level variables, in order to address Research Question 1. To recap the theoretical hypotheses discussed in Chapter 3, it is expected that patients receiving a mastectomy at hospitals with higher percentage of breast cancer patients, lower percentage of Black and Hispanic patients, lower percentage of Medicaid patients, not-for-profit or public ownership, teaching status, higher bed size, and higher total margin have higher likelihood of receiving IBRS based on Resource Dependence Theory (RDT), all else being equal. Similarly, based on RDT, it is also expected that patients receiving a mastectomy in markets that are urban, have higher hospital compeition, and higher plastic surgeon density have higher likelihood of receiving IBRS, all else being equal. Lastly, for patient-level control variables, it is expected that patients who are older, belong to a minority race or ethnicity, have a higher comorbidity score, are obese, are insured by Medicare, Medicaid or uninsured, and reside in low income neighborhoods have lower likelihood of receiving immediate breast reconstruction (IBRS), all else being equal, based on the Anderson behavioral model of utilization.

A multi-level mixed effects logistic regression is estimated for this step with patients being nested within hospitals and hospital being nested within county (market). Hospital and county random effects are included in the model along with state fixed effects. Apart from a correlation of 0.68 between age and Medicare insurance, 0.53 between Medicaid mix and racial/ethnic mix of the hospital, 0.57 between competition and large metropolitan market (UIC1), none of the other variables are highly correlated with each other. The results are presented in Table 4.

Table 4

Mixed Effects Logistic Regression

Variable	Odds Ratio	95% CI
Patient-level		
Race and ethnicity		
Black race	0.620**	[0.575, 0.668]
Hispanic ethnicity	0.718**	[0.663, 0.777]
White (Reference)		
Age	0.933**	[0.930, 0.935]
Charlson score	0.821**	[0.812, 0.831]
Obesity		
Obese	0.722**	[0.660, 0.790]
Non-obese (Reference)		
Insurance		
Medicaid	0.348**	[0.321, 0.378]
Medicare	0.486**	[0.455, 0.519]
Uninsured	0.322**	[0.265, 0.391]
Private Insurance (Reference)		
Quartiles of median household income in patient’s zip code		
Quartile 1 (lowest income)	0.603**	[0.559, 0.650]
Quartile 2	0.690**	[0.644, 0.739]
Quartile 3	0.790**	[0.742, 0.840]
Quartile 4 (Reference)		
Hospital-level		
Percentage of breast cancer patients	1.010	[0.992, 1.027]
Bed size/10	1.006**	[1.002, 1.010]
Total margin	1.000	[0.997, 1.002]
Racial/ethnic mix	0.994*	[0.989, 0.999]
Medicaid mix	0.997	[0.992, 1.002]
Ownership		
Not-for- profit	1.321*	[1.021, 1.709]
Non-federal public	0.893	[0.636, 1.253]
For-profit (Reference)		
Teaching status		
Teaching	1.375**	[1.154, 1.639]
Non-teaching (Reference)		
Market-level		
Competition (1/HHI)	0.970*	[0.948, 0.993]
Plastic surgeons/100 population	9.820**	[5.225, 18.455]
Urbanicity		
UIC 1 (most urban) (Reference)		
UIC2	0.555**	[0.403, 0.764]
UIC3	0.151**	[0.088, 0.261]

(Table 4: Continued)

Variable	Odds Ratio	95% CI
UIC4 (most rural)	0.061**	[0.019, 0.191]
State		
Arizona	0.775	[0.389, 1.546]
Florida	0.712	[0.463, 1.095]
Kentucky	0.327**	[0.174, 0.615]
Maryland	0.732	[0.389, 1.376]
North Carolina	0.848	[0.506, 1.422]
New Jersey	0.880	[0.517, 1.497]
New York	0.671	[0.425, 1.059]
Washington	0.218**	[0.115, 0.411]
California (Reference)		
Intercept	98.282**	[58.807, 164.25]

Note: CI=Confidence Interval. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

As can be seen from Table 4, Black patients have 38% lower likelihood of receiving IBRS and Hispanic patients have 28% lower likelihood of receiving IBRS than White patients, all else being equal. A one year increase in patient's age is associated with 7% lower likelihood of receiving IBRS, all else being equal. A one unit increase in Charlson comorbidity score is associated with 18% lower likelihood of receiving IBRS, all else being equal. Compared to non-obese patients, obese patients have 28% lower likelihood of receiving IBRS. Compared to patients insured with private insurance, patients insured with Medicaid, Medicare, or are uninsured have 65%, 51% and 68% lower likelihood respectively of receiving IBRS, all else being equal. Lastly, compared to patients who reside in zip codes with the highest quartile of median household income (fourth quartile), patients residing in zip codes with the lowest quartile (first quartile), second quartile and third quartile have 40%, 31% and 21% lower likelihood respectively of receiving IBRS, all else being equal.

Patients receiving a mastectomy at hospitals that are not-for-profit have 32% higher likelihood of receiving IBRS compared to the patients receiving a mastectomy at for-profit hospitals, all else being equal. Similarly, patients receiving a mastectomy at teaching hospitals have 38% higher likelihood of receiving IBRS compared to the patients receiving a mastectomy at non-teaching hospitals, all else being equal. A one percentage increase in the racial and ethnic mix (% of all hospital patients that are Black or Hispanic) of the hospital where the patient receives a mastectomy is associated with 0.6% lower likelihood of receipt of IBRS, all else being equal. An increase of one bed in the hospital where patient receives a mastectomy is associated with 6% higher likelihood of receiving IBRS, all else being equal. These results support the hypotheses 1C, 1H, 1I and 1J presented in Chapter 3.

For market variables, one unit increase in competition in the market where patient receives a mastectomy is associated with 3.1% lower likelihood of receiving IBRS, all else being equal. This result does not support the hypothesis 1B that higher competition in the market is associated with higher likelihood of receipt of IBRS. A one unit increase in number of plastic surgeons per 100 population in the market where patient receives a mastectomy is associated with nearly 800% higher likelihood of receiving IBRS, all else being equal. Lastly, compared to the most urban market (UIC1), patients receiving a mastectomy in small metropolitan markets (UIC2), micropolitan (UIC3) markets, and rural (UIC4) markets have 45%, 85% and 94% lower likelihood respectively of reciving IBRS, all else being equal. The results for density of plastic surgeons and urbanicity support the hypotheses 1E and 1F respectively. Compared to patients who receive a mastectomy in the state of California, patients receiving a mastectomy in Kentucky have 67% lower likelihood of receiving IBRS and patients receiving a mastectomy in Washington have 78% lower likelihood of receiving IBRS.

Empirical Analyses Results: Research Question 2

Interactions between race/ethnicity and hospital characteristics and race/ethnicity and market characteristics are added to the multi-level mixed effects logistic regression model estimated in the previous step in order to address research question 2. Research question 2 examines whether the relationship between race/ethnicity and likelihood of receipt of IBRS is moderated by hospital and market characteristics. No directional hypothesis for research question 2 are specified in Chapter 3. Separate statistical models are estimated for the White-Black and White-Hispanic samples. The results from these two models are presented in Table 5. Only the interaction terms that are significant at p-value<0.05 are presented.

Table 5

Mixed Effects Logistic Regression with Interaction Terms

	White-Black sample		White-Hispanic sample	
Variable	Coefficient	95% CI	Coefficient	95% CI
Patient-level				
Race and ethnicity				
Black race	−0.450**	[−0.822, −0.078]		
Hispanic ethnicity			−0.162	[−0.541, 0.271]
White (Reference)				
Hospital-level				
Racial/ethnic mix	−0.004	[−0.009, 0.001]		
Medicaid mix	−0.005	[0.991, 1.000]		
Market-level				
Competition			−0.029*	[−0.052, − 0.006]
Plastic surgeons/100 population	2.265**	[1.653, 2.878]	2.391**	[1.752-3.030]
Urbanicity				
UIC2			−0.522**	[−0.846, −0.198]
UIC1 (Reference)				
Interaction between Black/Hispanic and hospital variables				
Racial/ethnic mix	−0.006*	[−0.011, −0.001]		
Medicaid mix	0.007*	[0.000, 0.014]		
Interaction between Black/Hispanic race/and market variables				
Competition			−0.006*	[−0.012, −0.001]
Plastic surgeons/100 population	−0.246*	[−0.465, −0.027]	−0.368**	[−0.596, −0.141]
UIC2			−0.651**	[−0.914, −0.387]

Note: CI=Confidence Interval. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

For the White-Black model, interactions between Black race and Medicaid mix of the hospital, racial/ethnic mix of the hospital and density of plastic surgeons in the market are significant. Although the probability of receipt of IBRS decreases for both Blacks and Whites with increasing racial/ethnic mix of the hospital, the decrease in probability for Blacks is greater than for Whites. Thus, White-Black differences in receipt of IBRS within the hospital widen as the racial/ethnic mix of the hospital increases from the 1^{st} percentile to the 90^{th} percentile. Although the probability of receipt of IBRS decreases for both Blacks and Whites with increasing Medicaid mix of the hospital, the decrease in probability for Whites is greater than for Blacks. Thus, White-Black differences in receipt of IBRS within the hospital decrease as the Medicaid mix of the hospital increases from the 1^{st} percentile to the 90^{th} percentile. Although the probability of receipt of IBRS increases for both Blacks and Whites with increasing density of plastic surgeons in the market, the increase in probability for Whites is greater than for Blacks. Thus, White-Black differences in receipt of IBRS within the hospital widen as the density of plastic surgeons increases from the 1^{st} percentile to the 90^{th} percentile. Thus, Medicaid mix and racial/ethnic mix of the hospital, and density of plastic surgeons in the market moderate the relationship between Black race and receipt of IBRS.

For the White-Hispanic model, the interactions between Hispanic ethnicity and competition, plastic surgeon density, and urbanicity are significant. Although the probability of receipt of IBRS decreases for both Hispanics and Whites with increasing competition in the market, the decrease in probability for Hispanics is greater than for Whites. Thus, White-Hispanic differences in receipt of IBRS within the hospital widen as the competition in the market increases from the 1^{st} percentile to the 90^{th} percentile. On the other hand, although the probability of receipt of IBRS increases for both Hispanics and Whites with increasing density of plastic surgeons in the market, the increase in probability for Whites is greater than for Hispanics. Thus, White-Hispanic differences in receipt of IBRS within the hospital widen as the density of plastic surgeons in the market increases from the 1st percentile to the 90th percentile. Lastly, although the probability of receipt of IBRS for both Hispanics and Whites is lower in small metropolitan markets (UIC2) than large metropolitan markets (UIC1), the decrease in probability for Hispanics is greater than for Whites. Thus, White-Hispanic differences in receipt of IBRS in small metropolitan markets (UIC2) are significantly wider than those in large metropolitan markets (UIC1). Thus, competition, plastic surgeon density and small metropolitan (UIC2) status of the market moderate the relationship between Hispanic ethnicity and receipt of IBRS.

Empirical Analyses Results: Research Question 3

Fairlie decomposition is performed separately on the White-Black sample and the White-Hispanic sample to examine the contribution of independent variables to the racial/ethnic differences in receipt of IBRS. These analyses will address research question 3. No directional hypotheses are presented for research question 3 in Chapter 3. The results for the White-Black sample are presented first followed by the results for the White-Hispanic sample.

White-Black sample.

The predicted probability of receipt of IBRS is 0.571 for Whites and 0.465 for Blacks. Therefore, a gap or total difference of 0.106 or 10.6 percentage points exists between these two groups. Table 6 presents the decomposition results for all independent variables included in the decomposition model for the White-Black sample. The proportion of the total White-Black difference in receipt of IBRS explained by White-Black differences in independent variables is found to be 0.049 (46% of the total difference). Next, the contribution of the variable age is

Table 6

Decomposition Results for the White-Black Sample

Variable	Decomposition coefficient	Standard Error	% contribution to explained component (after subtracting contribution of age)
Patient-level			
Charlson score	0.006**	0.000	9.483
Obesity	0.004**	0.001	5.514
Insurance			
Medicaid	0.025**	0.001	37.911
Medicare	−0.000*	0.000	−0.665
Uninsured	0.003**	0.000	4.517
Private insurance (Reference)			
Median household income in patient's zip code	0.032**	0.002	48.729
Hospital-level			
Percentage of breast cancer patients	0.000	0.000	0.243
Bed size/10	−0.003**	0.001	−3.875
Total margin	0.001**	0.000	1.548
Racial/ethnic mix	0.021**	0.000	31.521
Medicaid mix	−0.002	0.000	−2.265
Ownership			
Not-for- profit	0.001	0.000	0.672
Non-federal public	0.000	0.000	0.446
For profit (Reference)			
Teaching status	−0.001	0.000	−1.170
Market-level			
Competition (1/HHI)	−0.001**	0.000	−0.569
Plastic surgeons/100 population	−0.000	0.000	−0.042
Urbanicity	−0.007**	0.001	−10.852
State	−0.014**	0.001	−21.256

Note: * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

subtracted from the total explained component since racial differences in receipt of IBRS due to racial differences in a factor like age does not merit any policy efforts. The coefficient for age (not presented in Table 6) is −0.017. After subtracting the coefficient of age from the explained component of the total difference [0.049− (−0.017)], the net explained component is 0.066 (62% of the total difference). Table 6 presents the decomposition coefficients, standard error and %

contribution to net explained component for all the independent variables at the patient, hospital and market level. The contribution of a variable is computed as a proportion of decomposition coefficient of the variable to the net explained component (after subtracting the decomposition coefficient for age). A positive decomposition coefficient implies that the variable contributes to increasing the racial difference whereas a negative decomposition coefficient implies that the variable contributes to decreasing the racial difference.

All patient-level variables contribute significantly to the White-Black difference in receipt of IBRs at p-value<0.05. At the patient-level, if Black patients had the same mean Charlson score as White patients, the explained component of the White-Black difference in receipt of IBRS would reduce by 9.5%. If Black patients have the same lower likelihood of obesity as Whites, the explained component of the White-Black difference in receipt of IBRS would reduce by 5.5%. In terms of insurance, if Black patients had the same lower likelihood of being on Medicaid as Whites, the explained component of the White-Black difference in receipt of IBRS would reduce by 37.8%. Similarly, if Black patients had the same lower likelihood of being uninsured as Whites, the explained component of the White-Black difference in receipt of IBRS would reduce by 4.5%. On the other hand, if Black patients had the same higher likelihood of being insured with Medicare as Whites, the explained component of the White-Black difference in receipt of IBRS would increase by 0.66% and this would consequently increase the total White-Black gap. Thus, the lower likelihood of being insured with Medicare among Black patients contributes to decreasing the racial gap in receipt of IBRS. In terms of income, if Black patients had the same likelihood of residing in high income neighborhoods as Whites, the explained component of the White-Black difference in receipt of IBRS would reduce by 48.73%.

Racial differences in hospital-level variables such as racial/ethnic mix, total margin and bed size contribute significantly to the racial difference in receipt of IBRS. If Black patients received a mastectomy at hospitals with the same mean racial/ethnic mix as the hospitals where White patients receive a mastectomy, the explained component of the White-Black difference in receipt of IBRS would reduce by 31.5%. Similarly, if Black patients received a mastectomy at hospitals with the same mean total margin as the hospitals where White patients receive a mastectomy, the explained component of the White-Black difference in receipt of IBRS would reduce by 1.6%. On the other hand, if Black patients received a mastectomy at hospitals with the same mean bed size as the hospitals where White patients receive a mastectomy, the explained component of the White-Black difference in receipt of IBRS would increase by 3.9% and this would consequently increase the total White-Black gap. Thus, Black patients receiving a mastectomy at hospitals with higher mean bed size than the hospitals where White patients receive a mastectomy contributes to decreasing the racial gap in receipt of IBRS.

Racial differences in market-level variables such as competition and urbanicity, contribute significantly to the racial difference in receipt of IBRS. If Black patients received a mastectomy in markets with the same mean competition as the markets where White patients receive a mastectomy, the explained component of the White-Black difference in receipt of IBRS would increase by 0.6% and this would consequently increase the total White-Black gap. Thus, Black patients receiving a mastectomy in markets with higher competition than the markets where White patients receive a mastectomy contributes to decreasing the racial gap in receipt of IBRS. Similarly, if Black patients had the same likelihood as Whites of receiving a mastectomy in markets that are small metropolitan, micropolitan and rural areas, the explained component of the White-Black difference in receipt of IBRS would increase by 10.9% and this would consequently increase the total White-Black gap. Thus, compared to White patients, the lower likelihood of Black patients receiving a mastectomy in markets that are small metropolitan, micropolitan and rural areas contributes to decreasing the racial gap in receipt of IBRS.

Lastly, if Black patients had similar distribution across states as Whites (for example if Black patients are as likely to live in states with predominantly large White populations such as Kentucky and Washington), the explained component of the White-Black difference in receipt of IBRS would increase by 21.3% and this would consequently increase the total White-Black gap. Thus, compared to White patients, the lower likelihood of Black patients of residing in certain states with predominantly White population contributes to decreasing the racial gap in receipt of IBRS.

Based on the results in Table 6, White-Black difference in the median household income of the zip code in which patients reside is the largest contributor (48.7%) to the explained component of the White-Black difference in receipt of IBRS. This is followed by the contribution (37.8%) of racial difference in the likelihood of being Medicaid-insured. Racial difference in the racial/ethnic mix of the hospital where mastectomy is received is the third largest contributor (31.5%) to the explained component of the White-Black difference in receipt of IBRS.

White-Hispanic sample.

The predicted probability of receipt of IBRS is 0.571 for Whites and 0.455 for Hispanics. Therefore, a gap or total difference of 0.116 or 11.6 percentage points exists between these two groups. Table 7 presents the decomposition results for all independent variables included in the decomposition model for the White-Hispanic sample. The proportion of the total White-Hispanic difference in receipt of IBRS explained by White-Hispanic differences in independent variables

Table 7

Decomposition Results for the White-Hispanic Sample

Variable	Decomposition coefficient	Standard Error	% contribution to explained component (after subtracting contribution of age)
Patient-level			
Charlson score	0.005**	0.000	5.055
Obesity	−0.001**	0.000	−1.318
Insurance			
Medicaid	0.055**	0.002	61.637
Medicare	−0.009**	0.001	−9.844
Uninsured	0.005**	0.000	5.836
Private insurance			
Median household income in patient’s zip code	0.020**	0.001	22.603
Hospital-level			
Percentage of breast cancer patients	−0.000	0.000	−0.035
Bed size/10	−0.002**	0.000	−1.734
Total margin	0.003**	0.001	3.513
Racial/ethnic mix	0.023**	0.003	25.573
Medicaid mix	0.003	0.002	3.155
Ownership			
Not-for- profit	0.004**	0.001	4.175
Non-federal public	0.000	0.001	0.441
For profit (Reference)			
Teaching status	−0.000	0.000	−0.012
Market-level			
Competition (1/HHI)	−0.008**	0.001	−8.600
Plastic surgeons/100 population	−0.001**	0.000	−0.938
Urbanicity	−0.009**	0.001	−9.770
State	−0.000	0.001	−0.100

Note: * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

is found to be 0.056 (48% of the total difference). After subtracting the coefficient of age from the explained component of the total difference, the net explained component is 0.089 (77% of the total difference). Table 7 presents the decomposition coefficients, standard error and % contribution to net explained component for all the independent variables at the patient, hospital and market level. The contribution of a variable is computed as a proportion of decomposition coefficient of the variable to the net explained component (after subtracting the decomposition coefficient for age). A positive decomposition coefficient implies that the variable contributes to increasing the ethnic difference whereas a negative decomposition coefficient implies that the variable contributes to decreasing the ethnic difference.

All patient-level variables contribute significantly to the White-Hispanic difference in receipt of IBRS. At the patient-level, if Hispanic patients had the same mean Charlson score as White patients, the explained component of the White-Black difference in receipt of IBRS would reduce by 5.1%. On the other hand, if Hispanic patients had the same higher likelihood of being obese as Whites, the explained component of the White-Hispanic difference in receipt of IBRS would increase by 1.3% and this would consequently increase the total White-Hispanic gap. Thus, the lower likelihood of being obese among Hispanic patients contributes to decreasing the ethnic gap in receipt of IBRS. In terms of insurance, if Hispanic patients had the same lower likelihood of being Medicaid-insured as Whites, the explained component of the White-Hispanic difference in receipt of IBRS would reduce by 61.6%. Similarly, if Hispanic patients had the same lower likelihood of being uninsured as Whites, the explained component of the White-Hispanic difference in receipt of IBRS would reduce by 5.8%. On the other hand, if Hispanic patients had the same higher likelihood of being Medicare-insured as Whites, the explained component of the White-Hispanic difference in receipt of IBRS would increase by 9.8% and this would consequently increase the total White-Hispanic gap. Thus, the lower likelihood of being Medicare-insured among Hispanic patients contributes to decreasing the ethnic gap in receipt of IBRS. In terms of income, if Hispanic patients had the same likelihood of residing in high income neighborhoods as Whites, the explained component of the White-Hispanic difference in receipt of IBRS would reduce by 22.6%.

Ethnic differences in hospital-level variables such as racial/ethnic mix, total margin, bed size and not-for-profit ownership contribute significantly to the ethnic difference in receipt of IBRS. If Hispanic patients received a mastectomy at hospitals with the same mean racial/ethnic mix as the hospitals where White patients receive a mastectomy, the explained component of the White-Hispanic difference in receipt of IBRS would reduce by 25.6%. Similarly, if Hispanic patients received a mastectomy at hospitals with the same mean total margin as the hospitals where White patients receive a mastectomy, the explained component of the White-Hispanic difference in receipt of IBRS would reduce by 3.5%. If Hispanic patients had the same higher likelihood of receiving a mastectomy at not-for-profit hospitals as White patients, the explained component of the White-Hispanic difference in receipt of IBRS would reduce by 4.2%. On the other hand, if Hispanic patients received a mastectomy at hospitals with the same mean bed size as the hospitals where White patients receive a mastectomy, the explained component of the White-Hispanic difference in receipt of IBRS would increase by 1.7% and this would consequently increase the total White-Hispanic gap. Thus, Hispanic patients receiving a mastectomy at hospitals with higher mean bed size than the hospitals where White patients receive a mastectomy contributes to decreasing the ethnic gap in receipt of IBRS.

Ethnic differences in market-level variables such as competition, density of plastic surgeons and urbanicity contribute significantly to the ethnic difference in receipt of IBRS. If Hispanic patients received a mastectomy in markets with the same mean competition as the markets where White patients receive a mastectomy, the explained component of the White-Hispanic difference in receipt of IBRS would increase by 8.6% and this would consequently increase the total White-Hispanic gap. Thus, Hispanic patients receiving a mastectomy in markets with higher competition than the markets where White patients receive a mastectomy contributes to decreasing the ethnic gap in receipt of IBRS. Similarly, if Hispanic patients had the same likelihood as Whites of receiving a mastectomy in markets that are small metropolitan, micropolitan and rural areas, the explained component of the White-Hispanic difference in receipt of IBRS would increase by 9.8% and this would consequently increase the total White-Hispanic gap. Thus, compared to White patients, the lower likelihood of Hispanic patients receiving a mastectomy in markets that are small metropolitan, micropolitan and rural areas contributes to decreasing the ethnic gap in receipt of IBRS. Ethnic difference in distribution of Hispanics and whites across states does not contribute significantly to the explained component of the White-Hispanic difference in receipt of IBRS.

Based on the results in Table 7, White-Hispanic difference in the likelihood of being Medicaid-insured is the largest contributor (61.6%) to the explained component of the White-Hispanic difference in receipt of IBRS. This is followed by the contribution (25.6%) of White-Hispanic difference in the racial/ethnic mix of the hospital where mastectomy is received. Ethnic difference in the median household income of the zip code in which patients reside is the third largest contributor (22.6%) to the explained component of the White-Hispanic difference in receipt of IBRS.

Sensitivity Analyses

Excluding hospitals that do not offer reconstruction.

In the first set of sensitivity analyses, all the observations where a mastectomy is received at a hospital that provided no breast reconstruction surgery during the study period, 2010 to 2012 are excluded. The original sample consisted of 58,429 total observations of patients who received a mastectomy from 992 hospitals. Of these, 286 hospitals provided zero reconstruction surgeries between 2010 and 2012. For the sensitivity analysis, 2,739 observations from these 286 hospitals are dropped. Thus, the sample size for this sensitivity analyses has 55,690 total observations from 706 hospitals. All the analyses are repeated on this sample. The descriptive statistics for this sample along with descriptive statistics by race/ethnicity are presented in Table 8.

Table 8

Sensitivity Analysis 1-Variable Means and Percentage

Variable	Restricted Sample	White	Black	Hispanic
Receipt of Immediate Breast Reconstruction Surgery (%)	55.37	58.25	46.84**	47.05**
Patient-level				
Age	56.62	57.20	55.65**	54.17**
	(11.80)	(11.71)	(11.84)	(11.88)
Charlson score	3.08	3.03	3.25**	3.22**
	(2.07)	(2.05)	(2.17)	(2.05)
Obese (%)	6.65	6.09	12.25**	4.15**
Insurance (%)				
Medicare	28.53	29.69	28.19**	21.78**
Medicaid	10.53	6.21	18.33**	28.63**
Uninsured	1.36	0.92	2.35**	3.03**
Private Insurance	59.58	63.18	51.13**	46.56**
Median household income in the zip code (%)				
Quartile 1 (lowest income)	18.11	13.05	37.66**	28.57**
Quartile 2	21.00	20.41	22.71**	22.80**
Quartile 3	26.61	27.46	23.15**	25.05**
Quartile 4 (highest income)	34.27	39.07	16.48**	23.58**
Hospital-level				
Percentage of breast cancer patients	0.73	0.78	0.50**	0.67**
	(2.03)	(2.25)	(1.09)	(1.14)
Bed size/10	46.18	45.01	50.70**	48.43**
	(34.89)	(33.85)	(35.82)	(39.33)
Total margin	5.23	5.87	4.01**	2.65**
	(14.58)	(14.42)	(11.89)	(17.46)
Racial/ethnic mix	27.17	22.38	39.54**	42.89**
	(19.49)	(15.62)	(21.95)	(23.32)
Medicaid mix	18.80	17.11	22.94**	24.56**
	(13.81)	(12.49)	(15.21)	(17.00)
Ownership (%)				
For profit	6.94	6.86	6.11**	8.31**

(Table 8: Continued)

Variable	Restricted Sample	White	Black	Hispanic
Not-for-profit	80.52	82.24	77.17**	73.79**
Nonfederal public	12.54	10.91	16.72**	17.90**
Teaching status (%)	63.98	62.85	71.37**	63
Market-Level				
Competition (1/HHI)	10.27	9.33	9.90**	16.30**
	(14.00)	(12. 80)	(13.73)	(18.79)
Plastic surgeons/100 population	0.45	0.45	0.44*	0.45
	(0.38)	(0.38)	(0.37)	(0.39)
Urbanicity (%)				
UIC1 (most urban)	80.96	78.64	87.93**	87.49**
UIC2	17.69	19.78	10.99**	12.25**
UIC3	1.24	1.44	1.06**	0.25**
UIC4 (most rural)	0.11	0.14	0.03*	0.01**
Sample size	55,690	41,494	7,280	6,916

Note: Blacks are compared to Whites and Hispanics are also compared to Whites for significance testing. Standard deviations are in parentheses. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

Compared to the original sample, this sample has higher reconstruction rates for all races and ethnicities. Other patient-level characteristics are similar to the original sample. In terms of hospital characteristics, the mean percentage of breast cancer patients in a hospital, mean bed size and mean total margin are higher in this sample compared to the original sample whereas the mean racial/ethnic mix and the mean Medicaid mix are lower than the original sample. Additionally, the percentage of for-profit and public hospitals is lower whereas the percentage of not-for-profit hospitals is higher in this sample than the original sample. These changes in hospital characteristics between the original sample and this sample are seen across all races and ethnicities.

Among market characteristics, mean competition for all race/ethnicities combined and for Whites is lower than the original sample while it is higher than the original sample for Blacks and Hispanics. Density of plastic surgeons is higher for this sample than the original sample for all races and ethnicities. The proportion of patients living in the large and small metropolitan counties is higher than the original sample whereas the proportion of patients living in micropolitan and rural counties is lower than the original sample.

The results for the patient-level logistic regression to examine whether racial and ethnic differences persist even after controlling for race and ethnicity are similar to the primary findings from the original sample and hence, have not been presented here. Next, results from the mixed effects logistic regression model to examine the association between hospital and market characteristics and the receipt of immediate breast reconstruction surgery are presented in Table 9.

Table 9

Sensitivity Analysis 1-Mixed Effects Logistic Regression

Variable	Odds Ratio	95% CI
Patient-level		
Race and ethnicity		
Black race	0.622**	[0.577, 0.670]
Hispanic ethnicity	0.723**	[0.668, 0.782]
White (Reference)		
Age	0.933**	[0.930, 0.935]
Charlson score	0.821**	[0.812, 0.831]
Obesity		
Obese	0.722**	[0.660, 0.789]
Non-obese (Reference)		
Insurance		
Medicaid	0.347**	[0.320, 0.376]
Medicare	0.488**	[0.456, 0.521]
Uninsured	0.325**	[0.267, 0.395]
Private insurance (Reference)		
Quartiles of median household income in patient’s zip code		
Quartile 1 (lowest income)	0.605**	[0.561, 0.652]
Quartile 2	0.692**	[0.646, 0.742]
Quartile 3	0.788**	[0.741, 0.839]
Quartile 4 (Reference)		
Hospital-level		
Percentage of breast cancer patients	1.010	[0.993, 1.028]
Bed size/10	1.002	[0.999, 1.006]
Total margin	1.000	[0.997, 1.002]

(Table 9: Continued)

Variable	Odds Ratio	95% CI
Racial/ethnic mix	0.995*	[0.991, 1.000]
Medicaid mix	0.997	[0.993, 1.002]
Ownership		
Not-for- profit	1.091	[0.855, 1.393]
Non-federal public	0.866	[0.631, 1.188]
For profit (Reference)		
Teaching status		
Teaching	1.135	[0.966, 1.334]
Non-teaching (Reference)		
Market-level		
Competition (1/HHI)	0.987	[0.970, 1.003]
Plastic surgeons/100 population	4.802**	[2.966, 7.776]
Urbanicity		
UIC1 (most urban) (Reference)		
UIC2	0.660**	[0.512, 0.851]
UIC3	0.513*	[0.296, 0.890]
UIC4 (most rural)	0.278	[0.070, 1.105]
State		
Arizona	0.842	[0.485, 1.464]
Florida	0.718	[0.509, 1.015]
Kentucky	0.436**	[0.248, 0.766]
Maryland	1.010	[0.605, 1.685]
North Carolina	0.953	[0.609, 1.490]
New Jersey	0.957	[0.628, 1.457]
New York	0.865	[0.600, 1.247]
Washington	0.294**	[0.174, 0.499]
California (Reference)		
Intercept	161.863**	[104.525, 250.654]

Note: CI=Confidence Interval. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

The magnitude of coefficients and p values for patient-level characteristics are similar to the primary findings. However, there are significant differences in the effect size and p-values for hospital-level and market-level characteristics. Hospital characteristics such as bed size, not-for-profit ownership and teaching status that are significant in the primary findings are no longer significantly associated with receipt of IBRS. Market characteristics such as competition and receiving care in rural markets (rather than large metropolitan markets) that are significant in the primary findings are no longer significantly associated with receipt of immediate breast reconstruction surgery. The percentage of total residual variance explained by county-level random effects and hospital-level random effects is also lower than the original analysis.

The results for the analyses including interactions between race/ethnicity and hospital and market characetristics are similar to the primary findings and are not being presented here. The only exception is that the interaction between Blacks and Medicaid mix of the hospital is no longer significant whereas it is significant in the primary findings.

Next, the results of Fairlie decomposition are repeated for this restricted sample. The predicted probability of receipt of IBRS is 0.595 for Whites and 0.483 for Blacks. Therefore, a gap or total difference of 0.112 or 11.2 percentage points exists between these two groups. Table 10 presents the decomposition results for all independent variables included in the decomposition model for the White-Black sample. The proportion of the total White-Black difference in receipt of IBRS explained by White-Black differences in independent variables is found to be 0.053 (47% of the total difference). Next, the contribution of the variable age is subtracted from the total explained component similar to the original analyses. After subtracting the coefficient of age, the net explained component is 0.069 (61% of the total difference). Table 10 presents the decomposition coefficients, standard error and % contribution to net explained component for all the independent variables at the patient, hospital and market level. The contribution of a variable is computed as a proportion of decomposition coefficient of the variable to the net explained component (after subtracting the decomposition coefficient for age). A positive decomposition coefficient implies that the variable contributes to increasing the racial difference whereas a negative decomposition coefficient implies that the variable contributes to decreasing the racial difference.

Table 10

Sensitivity Analysis 1-Decomposition Results for the White-Black Sample

Variable	Decomposition coefficient	Standard Error	% contribution to explained component (after subtracting contribution of age)
Patient-level			
Charlson score	0.007**	0.000	9.638
Obesity	0.004**	0.001	5.695
Insurance			
Medicaid	0.026**	0.001	37.980
Medicare	−0.001**	0.000	−1.158
Self-pay	0.003**	0.000	4.446
Private insurance (Reference)			
Median household income in patient's zip code	0.033**	0.002	47.495
Hospital-level			
Percentage of breast cancer patients	0.000	0.000	0.265
Bed size/10	−0.002**	0.001	−2.738
Total margin	0.001*	0.000	1.214
Racial/ethnic mix	0.020**	0.003	29.681
Medicaid mix	−0.003**	0.001	−4.985
Ownership			
Not-for- profit	0.000	0.000	0.261
Non-federal public	0.001	0.000	0.681
For profit (Reference)			
Teaching status	0.001	0.001	0.804
Market-level			
Competition (1/HHI)	−0.000*	0.000	−0.241
Plastic surgeons/100 population	0.000	0.000	0.353
Urbanicity	−0.005**	0.001	−7.482
State	−0.015	0.001	−21.701

Note: * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

The results presented in Table 10 are similar to the primary findings. The only notable difference is that racial difference in the Medicaid mix of the hospital where mastectomy is received now contributes significantly to the racial difference in receipt of IBRS. This means that if Black patients received a mastectomy at hospitals with the same mean Medicaid mix as the hospitals where White patients receive a mastectomy, the explained component of the White-Black difference in receipt of IBRS would increase by 5%. Thus, Black patients receiving a mastectomy at hospitals with higher mean Medicaid mix than the hospitals where White patients receive a mastectomy contributes to decreasing the racial gap in receipt of IBRS.

The results of Fairlie decomposition for the White-Hispanic sample after excluding observations from hospitals that did not provide any breast reconstruction surgery between 2010 and 2012 are similar to the primary findings and therefore are not presented here.

Combining Blacks and Hispanics into one group.

For the next sensitivity analysis, Blacks and Hispanics are combined into one minority race and ethnicity group, henceforth called minority. To recap Chapter 4, the idea of separating Blacks and Hispanics in the original analyses is to generate specific practice and policy recommendations. However, there are a number of similarities in the socioeconomic barriers in access to health care services faced by Blacks and Hispanics. Hence, sensitivity analyses with the combined minority group compared to Whites are conducted for all the research questions. The descriptive statistics for Whites and the combined minority group are presented in Table 11.

Table 11

Sensitivity Analysis 2-Variable Means and Percentage

Variable	White	Combined minority group
Receipt of Immediate Breast Reconstruction Surgery (%)	55.60	44.55**
Patient-level		
Age	57.48	55.15**
	(11.75)	(11.93)
Charlson score	3.04	3.25**
	(2.04)	(2.10)
Obese (%)	6.13	8.16**
Insurance (%)		
Medicare	30.74	25.81**
Medicaid	6.52	23.52**
Uninsured	0.93	2.73**
Private Insurance	61.80	47.94**
Median household income in the zip code (%)		
Quartile 1 (lowest income)	14.19	33.49**

(Table 11: Continued)

Variable	White	Combined minority group
Quartile 2	21.03	23.27**
Quartile 3	27.06	23.74**
Quartile 4 (highest income)	37.71	19.51**
Hospital-level		
Percentage of breast cancer patients	0.75	0.57**
	(2.20)	(1.10)
Bed size/10	43.59	48.14**
	(33.76)	(37.30)
Total margin	5.77	3.31**
	(14.23)	(14.64)
Racial/ethnic mix	22.22	41.66**
	(15.75)	(22.91)
Medicaid mix	17.41	23.93**
	(12.52)	(16.21)
Ownership (%)		
For profit	7.28	7.85**
Not-for-profit	81.44	74.77**
Nonfederal public	11.28	17.38**
Teaching status (%)	60.51	64.47**
Market-Level		
Competition (1/HHI)	9.25	13.39**
	(12.95)	(17.20)
Plastic surgeons/100 population	0.44	0.43
	(0.38)	(0.37)
Urbanicity (%)		
UIC1 (most urban)	76.15	86.18**
UIC2	20.20	11.94**
UIC3	2.85	1.60**
UIC4 (most rural)	0.80	0.27**
Sample size	43,469	14,960

Note: The combined minority group is compared to Whites for significance testing. Standard deviations are in parentheses. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

As can be seen from Table 11, the descriptive statistics for the combined minority group are similar to those for Blacks and Hispanics in the original sample. The results for the patient-level logistic regression and the mixed effects regression to examine the association between hospital and market characteristics and receipt of IBRS are similar to the primary findings and are therefore not presented here. Next, results from the mixed effects regression model that includes interactions between the combined minority group and hospital and market-level characteristics are presented in Table 12. Only the interactions that are significant at p-value<0.05 are presented.

Table 12

Sensitivity Analysis 2-Mixed Effects Logistic Regression with Interaction Terms

Variable	Coefficient	95% CI
Patient-level		
Minority	−0.316*	[−0.599, −0.033]
Hospital-level		
Racial/ethnic mix	−0.004	[−0.009, 0.001]
Market-level		
Plastic surgeons/100 population	2.371**	[1.739, 3.002]
Urbanicity		
UIC1 (most urban) (Reference)		
UIC2	−0.526**	[−0.847, −0.205]
Interaction between combined minority group and hospital variables		
Racial/ethnic mix	−0.005*	[−0.009, −0.001]
Interaction between combined minority group and market variables:		
Plastic surgeons/100 population	−0.303**	[−0.473, −0.133]
Urbanicity		
UIC1 (most urban) (Reference)		
UIC2	−0.378**	[−0.559, −0.197]

Note: CI=Confidence Interval. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

As can be seen from Table 12 the interactions between minority group and racial/ethnic mix, plastic surgeon density and urbanicity are significant. Although the probability of receipt of IBRS decreases for both minorities and Whites with increasing racial/ethnic mix in the market, the decrease in probability for minorities is greater than for Whites. Thus, White-minority differences in receipt of IBRS widen as the racial/ethnic mix increases from the 1st percentile to the 90th percentile. On the other hand, although the probability of receipt of IBRS increases for both minorities and Whites with increasing density of plastic surgeons in the market, the increase in probability for Whites is greater than for minorities. Thus, White-minority differences in receipt of IBRS within the hospital widen as the density of plastic surgeons in the market increases from the 1st percentile to the 90th percentile. Lastly, although the probability of receipt of IBRS for both minorities and Whites is lower in small metropolitan markets (UIC2) than large metropolitan markets (UIC1), the decrease in probability for minorities is greater than for Whites. Thus, White-minority differences in receipt of IBRS in small metropolitan markets (UIC2) are significantly wider than those in large metropolitan markets (UIC1). Thus, competition, plastic surgeon density and small metropolitan (UIC2) status of the market moderate the relationship between minority race and ethnicity and receipt of IBRS.

Next, the results of the Fairlie decomposition for the White-minority sample are presented in Table 13. The predicted probability of receipt of IBRS is 0.571 for Whites and 0.46 for minorities. Therefore, a gap or total difference of 0.111 or 11.1 percentage points exists between these two groups. Table 13 presents the decomposition results for all independent variables included in the decomposition model for the White-minority sample. The proportion of the total White-minority difference in receipt of IBRS explained by White-minority differences in independent variables is found to be 0.054 (49% of the total difference). After subtracting the coefficient of age from the explained component of the total difference, the net explained component is 0.08 (72% of the total difference). Table 13 presents the decomposition coefficients, standard error and % contribution to net explained component for all the independent variables at the patient, hospital and market level. The contribution of a variable is computed as a proportion of decomposition coefficient of the variable to the net explained component (after subtracting the decomposition coefficient for age). A positive decomposition coefficient implies that the variable contributes to increasing the racial and ethnic difference whereas a negative decomposition coefficient implies that the variable contributes to decreasing the racial and ethnic difference.

Table 13

Sensitivity Analysis 2-Decomposition Results for the White-minority Sample

Variable	Decomposition coefficient	Standard Error	% contribution to explained component (after subtracting contribution of age)
Patient-level			
Charlson score	0.006**	0.001	7.016
Obesity	0.001**	0.001	1.675
Insurance			
Medicaid	0.040**	0.002	50.156
Medicare	−0.005**	0.001	−6.272
Uninsured	0.004**	0.001	5.216
Private insurance (Reference)			
Median household income in patient's zip code	0.026**	0.001	32.774
Hospital-level			
Percentage of breast cancer patients	0.000	0.001	−0.014
Bed size/10	−0.002**	0.001	−2.711
Total margin	0.002**	0.001	2.823
Racial/ethnic mix	0.024**	0.003	29.843
Medicaid mix	0.002	0.001	2.713
Ownership			
Not-for- profit	0.003**	0.001	3.277
Non-federal public	0.000**	0.001	−0.042
For profit (Reference)			
Teaching status	−0.000**	0.000	−0.299
Market-level			
Competition (1/HHI)	−0.004**	0.001	−4.967
Plastic surgeons/100 population	−0.000	0.000	−0.088
Urbanicity	−0.008**	0.001	−10.183
State	−0.009**	0.001	−10.675

Note: * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

At the patient-level, if minority patients had the same mean Charlson score as White patients, the explained component of the White-minority difference in receipt of IBRS would reduce by 7%. If minority patients have the same lower likelihood of obesity as Whites, the explained component of the White-minority difference in receipt of IBRS would reduce by 1.7%. In terms of insurance, if minority patients had the same lower likelihood of being on Medicaid as

Whites, the explained component of the White-minority difference in receipt of IBRS would reduce by 50.16%. Similarly, if minority patients had the same lower likelihood of being uninsured as Whites, the explained component of the White-minority difference in receipt of IBRS would reduce by 5.2%. On the other hand, if minority patients had the same higher likelihood of being Medicare-insured as Whites, the explained component of the White-minority difference in receipt of IBRS would increase by 6.2% and this would consequently increase the total White-minority gap. Thus, the lower likelihood of being Medicare-insured among minority patients contributes to decreasing the racial and ethnic gap in receipt of IBRS. In terms of income, if minority patients had the same likelihood of residing in high income neighborhoods as Whites, the explained component of the White-minority difference in receipt of IBRS would reduce by 32.8%. All the patient-level variables contribute significantly to the White-minority difference in receipt of IBRS.

Racial differences in characteristics of the hospital where patient receives a mastectomy, such as racial/ethnic mix, total margin, bed size, and not-for-profit ownership contribute significantly to the racial and ethnic difference in receipt of IBRS at p-value less than 0.05. If minority patients received a mastectomy at hospitals with the same mean racial/ethnic mix as the hospitals where White patients receive a mastectomy, the explained component of the White-minority difference in receipt of IBRS would reduce by 29.84%. Similarly, if minority patients received a mastectomy at hospitals with the same mean total margin as the hospitals where White patients receive a mastectomy, the explained component of the White-minority difference in receipt of IBRS would reduce by 2.8%. On the other hand, if minority patients received a mastectomy at hospitals with the same mean bed size as the hospitals where White patients receive a mastectomy, the explained component of the White-minority difference in receipt of

IBRS would increase by 2.7% and this would consequently increase the total White-minority gap. Thus, minority patients receiving a mastectomy at hospitals with higher mean bed size than the hospitals where White patients receive a mastectomy contributes to decreasing the racial gap in receipt of IBRS. If minority patients had the same higher likelihood of receiving a mastectomy at not-for-profit hospitals as White patients, the explained component of the White-minority difference in receipt of IBRS would reduce by 3.3%.

Racial and ethnic differences in characteristics of the market where patient receives a mastectomy, such as competition and urbanicity, contribute significantly to the racial and ethnic difference in receipt of IBRS. If minority patients received a mastectomy in markets with the same mean competition as the markets where White patients receive a mastectomy, the explained component of the White-minority difference in receipt of IBRS would increase by 4.9% and this would consequently increase the total White-minority gap. Thus, minority patients receiving a mastectomy in markets with higher competition than the markets where White patients receive a mastectomy contributes to decreasing the racial and ethnic gap in receipt of IBRS. Similarly, if minority patients had the same likelihood as Whites of receiving a mastectomy in markets that are small metropolitan, micropolitan and rural areas, the explained component of the White-minority difference in receipt of IBRS would increase by 10.2% and this would consequently increase the total White-minority gap. Thus, compared to White patients, the lower likelihood of minority patients receiving a mastectomy in markets that are small metropolitan, micropolitan and rural areas contributes to decreasing the racial and ethnic gap in receipt of IBRS. Lastly, if minority patients had similar distribution across states as Whites (for example if minority patients are as likely to live in states with predominantly large White populations such as Kentucky and Washington), the explained component of the White-minority difference in receipt of IBRS would increase by 10.7% and this would consequently increase the total White-minority gap. Thus, compared to White patients, the lower likelihood of minority patients of residing in certain states with predominantly White population contributes to decreasing the racial and ethnic gap in receipt of IBRS.

Based on the results in Table 13, White-minority difference in the likelihood of being Medicaid-insured is the largest contributor (50.2%) to the explained component of the White-minority difference in receipt of IBRS. This is followed by the contribution (32.8%) of racial and ethnic difference in the median household income of the zip code in which patients reside. Racial and ethnic difference in the racial/ethnic mix of the hospital where mastectomy is received is the third largest contributor (29.8%) to the explained component of the White-minority difference in receipt of IBRS.

Additional Analyses

Additional analyses are performed to understand the hospital and market-level factors associated with the type of reconstruction received (immediate autologous reconstruction vs immediate implant reconstruction) and to understand the contribution of patient, hospital and market-level variables to racial and ethnic differences in receipt of immediate autologous reconstruction. The additional analyses are conducted for immediate autologous reconstruction (AR) as the dependent variable for a sample restricted to those patients who received either an immediate autologous reconstruction (AR) or immediate implant reconstruction (IR). All patients who receive mastectomy but do not receive reconstruction are dropped from this sample. Descriptive statistics for this restricted sample by race and ethnicity are presented in Table 14.

Table 14

Additional Analysis-Variable Means and Percentage

Variable	Restricted Sample	White	Black	Hispanic
Receipt of Immediate Autologous Reconstruction (%)	72.17	71.43	80.29**	67.63**
Patient-level				
Age	52.97	53.54	51.33**	50.82**
	(9.89)	(9.79)	(9.81)	(10.23)
Charlson score	2.56	2.53	2.63	2.71**
	(1.86)	(1.84)	(1.97)	(1.88)
Obese (%)	6.58	5.77	12.88**	4.75**
Insurance (%)				
Medicare	14.69	15.17	13.54	12.6**
Medicaid	6.98	4.12	13.33**	20.16**
Uninsured	1.18	0.81	2.23**	2.61**
Private Insurance	77.14	79.90	70.89**	64.64**
Median household income in the zip code				
Quartile 1 (lowest income) (%)	13.46	9.27	29.99**	23.84**
Quartile 2 (%)	17.91	17.16	21.55**	18.95
Quartile 3 (%)	26.05	25.85	26.70	26.72
Quartile 4 (highest income) (%)	42.58	47.72	21.76**	30.48**
Hospital-level				
Percentage of breast cancer patients	0.69	0.72	0.53	0.65
	(2.52)	(2.77)	(0.05)	(0.98)
Bed size/10	50.17	49.24	53.98**	52.27**
	(36.61)	(36.27)	(34.52)	(40.92)
Total margin	5.62	6.21	3.60**	3.75**
	(11.20)	(10.37)	(13.16)	(13.74)
Racial/ethnic mix	27.07	23.21	37.09**	42.78**
	(19.07)	(16.10)	(20.76)	(23.65)
Medicaid mix	17.74	16.62	20.87**	22.05**
	(12.54)	(11.84)	(13.34)	(14.75)
Ownership (%)				
For profit	4.07	4.28	2.99**	3.9**
Not-for-profit	84.20	85.21	80.15**	81.86**
Nonfederal public	11.72	10.51	16.85**	14.24**
Teaching status (%)	66.21	65.32	74.65**	62.37
Market-Level				
Competition (1/HHI)	10.52	10.18	9.18**	14.60**
	(13.72)	(13.49)	(12.01)	(16.37)
Plastic surgeons/100 population	0.50	0.49	0.54*	0.53
	(0.37)	(0.36)	(0.42)	(0.41)

(Table 14: Continued)

Variable	Restricted Sample	White	Black	Hispanic
Urbanicity				
UIC1 (most urban) (%)	86.29	84.14	91.78**	95.08**
UIC2 (%)	13.15	15.19	7.8**	4.92**
UIC3 (%)	0.54	0.65	0.35	0**
UIC4 (most rural) (%)	0.03	0.02	0.07	0
Sample size	11,142	8,526	1,436	1,180

Note: Blacks are compared to Whites and Hispanics are also compared to Whites for significance testing. Standard deviations are in parentheses. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

Table 14 presents the descriptive results for the dependent variable i.e. receipt of immediate autologous surgery and independent variables at the patient-level, hospital-level and market-level for the entire restricted sample and by race and ethnicity. Of the total sample for this analysis (N=11,142), 76.5% are White (N=8,526), 12.9% are Black (N=1,436) and 10.6% are Hispanic (N=1,180). Overall, Blacks more often receive immediate autologous reconstruction (AR) than Whites whereas Hispanics less often receive AR than Whites. The distribution of all other patient-level, hospital-level and market-level variables by race/ethnicity is similar to the descriptives for the main analyses. The only exception is that there are no significant racial and ethnic differences in the percentage of breast cancer patients at the hospital where reconstruction is received.

Next, it is examined whether racial and ethnic differences in receipt of AR persist even after controlling for clinical characteristics using a logistic regression. This is similar to the patient-level logistic regression step for the main analyses. The results for the logistic regression with AR as the dependent variable (IR as reference group) are presented in Table 15.

As can be seen from Table 15, Black patients are more likely to receive an AR whereas Hispanic patients are less likely to receive an AR than Whites even after controlling for clinical

Table 15

Additional Analysis-Patient-level Logistic Regression

Variable	Odds Ratio	95% CI
Race and ethnicity		
Black race	1.58**	[1.375, 1.816]
Hispanic ethnicity	0.841*	[0.738, 0.96]
White (Reference)		
Age	1.002	[0.998, 1.006]
Charlson score	1.011	[0.989, 1.034]
Obesity		
Obese	1.781**	[1.463, 2.167]
Non-obese (Reference)		
Intercept	2.149**	[1.695, 2.724]

Note: CI=Confidence Interval. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

characteristics. Age and clinical comorbidities are not significantly associated with receipt of AR. Obesity is associated with higher likelihood of AR vs IR.

Next, hospital and market characteristics associated with receipt of AR vs IR are examined while controlling for patient-level variables. The results for this step of the analyses are presented in Table 16.

Table 16

Additional Analysis-Mixed Effects Logistic Regression

Variable	Odds Ratio	95% CI
Patient-level		
Race and ethnicity		
Black race	1.379**	[1.141, 1.666]
Hispanic ethnicity	1.119	[0.922, 1.358]
White (Reference)		
Age	1.018**	[1.011, 1.025]
Charlson score	1.032*	[1.003, 1.062]
Obesity		
Obese	1.578**	[1.246, 2.015]
Non-obese		
Insurance		
Medicaid	1.011	[0.802, 1.275]
Medicare	0.653**	[0.544, 0.785]
Uninsured	0.795	[0.431, 1.467]
Private insurance (Reference)		

(Table 16: Continued)

Variable	Odds Ratio	95% CI
Quartiles of median household income in patient's zip code		
Quartile 1 (lowest income)	1.219*	[1.008, 1,473]
Quartile 2	1.255**	[1.064, 1.480]
Quartile 3	1.005	[0.877, 1.152]
Quartile 4 (Reference)		
Hospital-level		
Percentage of breast cancer patients	1.019	[0.992, 1.046]
Bed size/10	1.001	[0.995, 1.008]
Total margin	1.000	[0.993, 1.007]
Racial/ethnic mix	0.992	[0.983, 1.000]
Medicaid mix	1.006	[0.995, 1.016]
Ownership		
Not-for- profit	2.144**	[1.277, 3.599]
Non-federal public	3.576**	[1.859, 6.882]
For profit (Reference)		
Teaching status		
Teaching	1.150	[0.850, 1.557]
Non-teaching (Reference)		
Market-level		
Competition (1/HHI)	1.009	[0.989, 1.030]
Plastic surgeons/100 population	2.643**	[1.284, 5.440]
Urbanicity		
UIC1 (most urban) (Reference)		
UIC2	0.778	[0.510, 1.187]
UIC3	1.847	[0.525, 6.491]
UIC4 (most rural)	0.171	[0.007, 4.388]
State		
Arizona	0.671	[0.290, 1.550]
Florida	1.017	[0.580, 1.783]
Kentucky	2.148	[0.741, 6.232]
Maryland	2.178	[0.975, 4.866]
North Carolina	1.969	[0.882, 4.393]
New Jersey	3.190**	[1.630, 6.245]
New York	1.478	[0.841, 2.598]
Washington	1.598	[0.633, 4.032]
California (Reference)		
Intercept	0.167*	[0.074, 0.375]

Note: CI=Confidence Interval. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

As can be seen from Table 16, Black patients have 38% higher likelihood of receiving AR than Whites, all else being equal. The likelihood of AR for Hispanic patients are not significantly different than those for Whites. A one year increase in a patient's age is associated with 1.7% higher likelihood of receiving AR, all else being equal. A one unit increase in Charlson comorbidity score is associated with 3% higher likelihood of receiving AR, all else being equal. Compared to non-obese patients, obese patients have 58% higher likelihood of receiving AR. Compared to patients with private insurance, Medicare patients have 35% lower likelihood of receiving AR, all else being equal. Lastly, compared to patients who reside in zip codes with the highest quartile of median household income (fourth quartile), patients residing in zip codes with the lowest quartile (first quartile) and second quartile have 22% and 25% higher likelihood respectively of receiving AR, all else being equal.

Ownership of the hospital and density of plastic surgeons in the market are the only hospital and market-level variables significantly associated with receipt of AR. Patients receiving a reconstruction at hospitals that are not-for-profit have more than 100% higher likelihood of receiving AR compared to the patients receiving a reconstruction at for-profit hospitals, all else being equal. Similarly, patients receiving a reconstruction at public hospitals have more than 200% higher likelihood of receiving AR compared to the patients receiving a reconstruction at for-profit hospitals, all else being equal. For market variables, a one unit increase in number of plastic surgeons per 100 total population in the market where patient receives reconstruction is associated with nearly 100% higher likelihood of receiving AR, all else being equal. Next, significant interactions between race/ethnicity and hospital and market variables are presented in Table 17.

For the White-Black model, the interaction between Black race and urbanicity of the market is significant. Although the probability of receipt of AR for both Blacks and Whites is lower in small metropolitan markets (UIC2) than large metropolitan markets (UIC1), the

Table 17

Additional Analysis-Mixed Effects Logistic Regression with Interaction Terms

	White-Black sample		White-Hispanic sample	
Variable	Coefficient	95% CI	Coefficient	95% CI
Patient-level				
Race and ethnicity				
Black race	0.391	[−0.155, 0.937]		
Hispanic ethnicity			−0.446	[−1.126, 0.234]
White (Reference)				
Market-level				
Competition			0.003	[−0.019, 0.025]
Urbanicity				
UIC2	−0.265	[−0.623, 0.092]	−0.250	[−0.604, 0.105]
UIC1 (Reference)				
Interaction between Black/Hispanic and market variables				
Competition			−0.007*	[−0.014, 0.001]
UIC2	−0.387*	[−0.717, −0.057]	−0.490**	[−0.959, −0.021]

Note: CI=Confidence Interval. * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

decrease in probability for Blacks is greater than for Whites. Thus, White-Black differences in receipt of AR in small metropolitan markets (UIC2) are narrower than those in large metropolitan markets (UIC1).

For the White-Hispanic model, the interactions between Hispanic ethnicity, and competition and urbanicity are significant. Although the probability of receipt of AR decreases for both Hispanics and Whites with increasing competition in the market, the decrease in probability for Hispanics is greater than for Whites. Thus, White-Hispanic differences in receipt of AR within the hospital widen as the competition in the market increases from the 1st percentile to the 90th percentile. Similarly, although the probability of receipt of AR for both Hispanics and Whites is lower in small metropolitan markets (UIC2) than large metropolitan markets (UIC1), the decrease in probability for Hispanics is greater than for Whites. Thus, White-Hispanic differences in receipt of AR in small metropolitan markets (UIC2) are significantly wider than those in large metropolitan markets (UIC1). Thus, competition and small metropolitan (UIC2) status of the market moderate the relationship between Hispanic ethnicity and receipt of AR.

The decomposition results for this additional analyses are conducted separately for the White-Black sample and the White-Hispanic sample. The results for the White-Black sample are presented first. The White-Black difference in receipt of AR is −0.081 which means that Black patients have 8.1 percentage points higher predicted probability of receiving AR than White patients. The proportion of the total White-Black difference/gap in receipt of AR explained by White-Black differences in independent variables is found to be −0.035 (43% of the total difference). The total difference and explained component have a negative sign since Black patients have higher likelihood than White patients of receiving AR. Since this is the first study analyzing factors associated with racial and ethnic differences, the contribution of age for this analyses is not excluded in order to understand the contribution of all factors including age. Table 18 presents the decomposition coefficients, standard error and % contribution to explained component for variables that significantly contributed to racial differences in receipt of AR. A negative sign on the decomposition coefficients indicates that these variables contribute to increasing the White-Black gap either by contributing to increasing the likelihood of AR for Black patients or decreasing the likelihood of AR for White patients.

Black patients are more likely to be obese and obesity is associated with higher likelihood of receipt of AR. This contributes to increasing the explained component of White-Black differences in receipt of AR by 13.69%. White patients are more likely to be Medicare-insured and being Medicare-insured is associated with lower likelihood of receipt of AR. This

Table 18

Additional Analysis-Decomposition Results for the White-Black Sample

Variable	Decomposition coefficient	Standard Error	% contribution to explained component
Patient-level			
Obesity	−0.005**	0.001	13.619
Insurance			
Medicare	−0.001**	0.000	4.134
Private insurance (Reference)			
Hospital-level			
Bed size/10	−0.002*	0.001	6.056
Ownership			
Non-federal public	−0.006**	0.002	16.153
For profit (Reference)			
Teaching status	−0.005**	0.001	14.718
Market-level			
Plastic surgeons/100 population	−0.003**	0.001	9.245
State	−0.018**	0.003	51.876

Note: * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

contributes to increasing the explained component of White-Black differences in receipt of AR by 4.1%.

In terms of hospital characteristics, Black patients are more likely than White patients to receive a reconstruction at hospitals with higher bed size. This contributes to increasing the explained component of White-Black differences in receipt of AR by 6%. Similarly, Black patients are more likely than White patients to receive a reconstruction at public hospitals and teaching hospitals which contributes to increasing the explained component of BlackWhite differences in receipt of AR by 16% and 15% respectively. Black patients are more likely than White patients to receive a reconstruction in markets with a higher density of plastic surgeons which contributes to increasing the explained component of White-Black differences in receipt of AR by 9%. Lastly, the distribution of Black and White patients across states contributes to increasing the explained component of BlackWhite differences in receipt of AR by 52%.

Next, the decomposition results for the White-Hispanic sample are presented. The White-Hispanic difference in receipt of AR is 0.051 which means that Hispanic patients have 5.1 percentage points lower predicted probability of receiving AR than White patients. The proportion of the total White-Hispanic difference/gap in receipt of AR explained by White-Hispanic differences in independent variables is found to be 0.038 (75% of the total difference). The total difference and explained component have a positive sign since Hispanic patients have lower likelihood than White patients of receiving AR. Table 19 presents the decomposition coefficients, standard error and % contribution to explained component for variables that significantly contributed to ethnic differences in receipt of AR. A positive sign on the decomposition coeffiecients indicates that these variables contribute to increasing the White-Hispanic gap either by contributing to increasing the likelihood of AR for White patients or decreasing the likelihood of AR for Hispanic patients.

Table 19

Additional Analysis-Decomposition Results for the White-Hispanic Sample

Variable	Decomposition coefficient	Standard Error	% contribution to explained component
Patient-level			
Age	0.007**	0.002	18.492
Insurance			
Medicare	−0.002**	0.001	−4.088
Private insurance (Reference)			
Hospital-level			
Bed size/10	−0.001*	0.001	−2.899
Ownership			
Non-federal public	−0.004**	0.001	−10.153
For profit (Reference)			
Teaching status	0.003**	0.001	6.524
Market-level			
Plastic surgeons/100 population	−0.002**	0.001	−5.708
State	0.032**	0.003	82.763

Note: * represents p-value less than 0.05 whereas ** represents p-value less than 0.01.

Hispanic patients are more likely to be younger. However, higher age is associated with higher likelihood of receipt of AR. This contributes to increasing the explained component of White-Hispanic difference in receipt of AR by 18.5%. White patients are more likely to be Medicare-insured and being Medicare-insured is associated with lower likelihood of receipt of AR. This contributes to decreasing the explained component of White-Hispanic difference in receipt of AR by 4.1%.

In terms of hospital characteristics, Hispanic patients are more likely than White patients to receive a reconstruction at hospitals with higher bed size. This contributes to decreasing the explained component of White-Hispanic difference in receipt of AR by 3%. Similarly, Hispanic patients are more likely than White patients to receive a reconstruction at public hospitals. Patients receiving reconstruction at public hospitals have higher likelihood of receivng AR. This contributes to decreasing the explained component of White-Hispanic difference in receipt of AR by 10%. On the other hand, Hispanic patients are less likely than White patients to receive a reconstruction at teaching hospitals. This contributes to increasing the explained component of White-Hispanic difference in receipt of AR by 6.5%. Hispanic patients are more likely than White patients to receive a reconstruction in markets with a higher density of plastic surgeons. This contributes to decreasing the explained component of White-Hispanic differences in receipt of AR by 6%. Lastly, the distribution of Hispanic and White patients across states contributes to increasing the explained component of White-Hispanic differences in receipt of AR by 83%.

Overall Summary of Results

This chapter began with descriptive statistics followed by empirical analyses for the three research questions. This is followed by results for sensitivity analyses and additional analyses. The descriptive statistics indicate that Black and Hispanic women in the sample are less likely to receive IBRS than White women. Additionally, Black and Hispanic women have significantly different patient-level characteristics than White women. Black and Hispanic women are more likely to be younger, have higher comorbidities, be obese (Blacks only), be Medicaid-insured or be uninsured, and reside in low-income neighborhoods than White women. Racial and ethnic differences in receipt of IBRS persisted even after controlling for clinical characteristics such as age, comorbidities and obesity in the patient-level logistic regression. These results are similar for both the sensitivity analyses.

Black and Hispanic women receive care at hospitals with significantly different characteristics than the hospitals where White women receive care. The descriptive statistics show that Black and Hispanic women are more likely to receive a mastectomy at hospitals with for-profit or public ownership, higher bed size but fewer breast cancer patients, higher racial and ethnic mix and higher Medicaid mix with a smaller total margin than White women. Black and Hispanic women are also more likely to receive a mastectomy at hospitals located in urban markets with higher competition than White women. The descriptive statistics results are similar for both the sensitivity analyses.

In order to address research question 1, a mixed effects logistic regression model is used to examine the hospital and market-level variables associated with receipt of IBRS after controlling for patient characteristics. The results of this empirical analyses show that higher bed size, lower racial and ethnic mix, not-for-profit ownership, teaching status, higher market concentration, higher density of plastic surgeons in the market, and large metropolitan status of the market are all significantly associated with higher likelihood of receipt of IBRS.

In the sensitivity analyses, after excluding hospitals that did not provide any breast reconstruction between 2010 and 2012, racial/ethnic mix of the hospital where mastectomy is received is the only hospital-level variable significantly associated with receipt of IBRS whereas density of plastic surgeons and urbanicity are the market-level variables associated with receipt of IBRS. In the second sensitivity analyses where Black and Hispanic women are combined into one minority group, the results of the mixed effects logistic regression model are similar to the original analysis.

In order to address research question 2, mixed effects logistic regression models with interactions between race/ethnicity and hospital and market variables are used to examine whether hospital and market variables moderated the relationship between race/ethnicity and receipt of IBRS. The results from the White-Black model show that hospitals with higher racial mix have a larger White-Black gap in receipt of IBRS whereas hospitals with higher Medicaid mix have a smaller White-Black gap in receipt of IBRS. Similarly, markets with higher density of plastic surgeons have a larger White-Black gap in receipt of IBRS. Results from the White-Hispanic model show that markets with a higher density of plastic surgeons have a larger White-Hispanic gap in receipt of IBRS. Additionally, small metropolitan markets and markets with higher competition have a larger White-Hispanic gap in receipt of IBRS. After excluding hospitals that did not provide any breast reconstruction between 2010 and 2012 in the sensitivity analyses, the results of the mixed effects multilevel logistic regression models with interactions between race/ethnicity and hospital and market variables are similar to the original analysis with one exception: the interaction between Black race and Medicaid mix is no longer significant.

In the second sensitivity analyses after combining Black and Hispanic women into one minority group, the interaction terms between the combined minority group and racial/ethnic mix of the hospital, density of plastic surgeons in the market and urbanicity of the market are significant. The results from the White-minority model show that hospitals with higher racial/ethnic mix have a larger White-minority gap in receipt of IBRS. Similarly, small metropolitan markets with higher density of plastic surgeons have a larger White-minority gap in receipt of IBRS.

In order to address research question 3, decomposition analyses are used to examine the patient-level, hospital-level and market-level variables that contribute to racial and ethnic differences in receipt of IBRS. The results show that racial and ethnic differences in type of insurance and median household income of residential zip codes are the largest contributors to racial and ethnic differences in receipt of IBRS at the patient-level. At the hospital-level, a racial and ethnic difference in the racial/ethnic mix of the hospital where mastectomy is received is the largest contributor to racial and ethnic differences in receipt of IBRS. Additionally, racial and ethnic differences in total margin and ownership of the hospital where mastectomy is received also contribute to racial and ethnic differences in receipt of IBRS. On the other hand, racial and ethnic differences in the bed size of the hospital where mastectomy is received, market competition, density of plastic surgeons in the market and urbanicity of the market contribute towards reducing the racial and ethnic differences in receipt of IBRS for Blacks and Hispanics. Lastly, distribution of Black patients across states contributes towards decreasing the White-Black difference in receipt of IBRS. These results are similar for the sensitivity analyses where hospitals that did not provide any reconstruction between 2010 and 2012 are excluded. The only notable difference is that racial difference in the Medicaid mix of the hospital where mastectomy is received contributes significantly to the racial difference in receipt of IBRS in the sensitivity analyses. The results are similar to the original analyses for the sensitivity analyses where Black and Hispanic women are combined into one minority category.

In the additional analyses for type of breast reconstruction, Black women are more likely to receive immediate autologous reconstruction (AR) and less likely to receive immediate implant reconstruction (IR) than Whites whereas it is the opposite for Hispanic women. These racial and ethnic differences persisted after controlling for clinical characteristics. Factors associated with higher likelihood of AR and lower likelihood of IR are higher age, obesity, higher clinical comorbidities, private insurance, residence in lower income neighborhoods, not-for-profit or public ownership of hospital where reconstruction is received and higher density of plastic surgeons in the market where mastectomy is received.

For the additional analysis for type of reconstruction, the interaction between Black race and urbanicity of the market is significant. Although the probability of receipt of AR for both Blacks and Whites is lower in small metropolitan markets (UIC2) than large metropolitan markets (UIC1), the decrease in probability for Blacks is greater than for Whites. Thus, White-Black differences in receipt of AR in small metropolitan markets (UIC2) are narrower than those in large metropolitan markets (UIC1). For the White-Hispanic model, the interactions between Hispanic ethnicity, and competition and urbanicity are significant.

In the decomposition analysis for AR, White-Black differences in likelihood of obesity and Medicaid insurance and White-Black differences in hospital and market characteristics where reconstruction is received such as bed size, ownership, teaching status and density of plastic surgeons in the market and the state in which the market is located contribute to increasing the White-Black gap in receipt of AR either by increasing the likelihood of receipt of AR for Blacks or decereasing it for Whites. On the other hand, White-Hispanic differences in age, teaching status of the hospital where reconstruction is received and the state in which the market is located contribute to increasing the White-Hispanic gap either by increasing the likelihood of receipt of AR for Whites or decereasing it for Hispanics. Whereas, White-Hispanic differences in Medicare insurance, bed size and ownership of the hospital where reconstruction is received and density of plastic surgeons in the market where reconstruction is received contribute to decreasing the White-Hispanic gap in receipt of AR either by increasing the likelihood of receipt of AR for Hispanics or decereasing it for Whites.

Chapter 6: Discussion

Overview of Chapter Structure

This chapter begins with a summary of results of the empirical analyses presented in Chapter 5 followed by the unique contribution of the study and implications of these results for practice and policy. This is followed by a summary of results of the additional analyses and its implications. The chapter concludes with a discussion regarding the limitations of this study and avenues for further research.

Summary and Interpretation of Empirical Results

Research question 1.

Research question 1 is 'Which characteristics of the hospital and hospital market where mastectomy is received are associated with higher likelihood of receipt of immediate breast reconstruction surgery (IBRS)?' Hospital and market-level variables examined in this analysis are derived using a conceptual framework based on Resource Dependence Theory and the patient-level control variables are derived using a conceptual framework based on the Aday Anderson healthcare utilization model. The analyses are conducted using a mixed effects logistic regression model. Sensitivity analyses are performed after excluding hospitals that did not provide any reconstruction services between 2010 and 2012. Another sensitivity analysis is performed after combining Blacks and Hispanics into one minority category.

Table 20 presents the list of hypotheses for research question 1 and whether they are supported in the empirical analysis and the sensitivity analysis after excluding hospitals that did

Table 20

Summary of Results for Research Question 1

Hypothesis	Full sample	Sample after excluding hospitals that did not provide any reconstruction
1A: The higher the proportion of breast cancer patients admitted by a hospital, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.	Not supported	Not Supported
1B: The higher the competition in a hospital's market, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.	Reverse supported	Not Supported
1C: The higher the number of beds in a hospital, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.	Supported	Not Supported
1D: The higher the total margin of a hospital, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.	Not supported	Not Supported
1E: The higher the density of plastic surgeons in a hospital's market, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.	Supported	Supported
1F: Patients receiving mastectomy at hospitals located in urban counties are more likely to receive IBRS compared to patient receiving mastectomy at hospitals located in rural counties.	Supported	Supported
1G: The lower the proportion of Medicaid patients admitted by a hospital, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.	Not supported	Not Supported
1H: The lower the proportion of racial and ethnic minority patients (racial and ethnic mix) admitted by a hospital, the higher is the likelihood of mastectomy patients receiving IBRS at the hospital.	Supported	Supported
1I: Patients receiving mastectomy at teaching hospitals are more likely to receive IBRS as compared to patients receiving mastectomy at non-teaching hospitals.	Supported	Not Supported
1J: Patients receiving mastectomy at not-for-profit hospitals are more likely to receive IBRS compared to patients receiving mastectomy at private investor-owned for-profit hospitals.	Supported	Not Supported
1K: Patients receiving mastectomy at non-federal public hospitals are more likely to receive IBRS compared to patients receiving mastectomy at private investor-owned for-profit hospitals.	Not supported	Not Supported

not provide any reconstruction services between 2010 and 2012. The results for the sensitivity analyses after combining Blacks and Hispanics into one minority group are similar to those for the full sample and hence, are not presented in Table 20.

Hospital-level variables associated with higher likelihood of receipt of IBRS are higher bed size, lower proportion of racial and ethnic minority patients admitted by the hospital, teaching status and not-for-profit ownership. Thus, hypotheses 1C, 1H, 1I and 1J are supported whereas hypotheses 1A, 1D, 1G and 1K are not supported. Higher bed size and teaching status are indicators of capital and labor resources (Banaszak-Holl et al., 1996). Since providing IBRS services require capital and specialized labor, patients receiving a mastectomy at hospitals with a higher bed size or teaching status have a higher likelihood of receiving IBRS. This finding is similar to previous literature (In et al., 2013; Shippee et al., 2014). Patients receiving a mastectomy at hospitals with a lower proportion of racial and ethnic minority patients have a higher likelihood of receiving IBRS. A lower proportion of racial and ethnic minority patients admitted by the hospital is associated with higher resources even after controlling for financial performance and payer mix of the hospital (Hasnain-Wynia et al., 2007). Lastly, not-for-profit ownership is also associated with access to capital and labor resources (Devereaux et al., 2002). In addition, not-for-profit hospitals have a mission to provide services required by the community (Eiland, 2015; Horwitz, 2005; Newhouse, 1970).

Market-level variables associated with higher likelihood of receipt of IBRS are lower market competition, urbanicity and higher density of plastic surgeons in the market. Thus, hypotheses 1E and 1F are supported whereas the results contradict hypothesis 1B. The results of the empirical analyses show that lower, not higher, market competition is associated with higher likelihood of receipt of IBRS. An explanation could be that hospitals in competitive markets are more likely to provide services that are more profitable (Cunningham, Bazzoli, & Katz, 2008). Reconstruction surgeries are not considered to be profitable for the hospital and require considerable capital and labor resources (Claudia R Albornoz et al., 2014). Hospitals prefer to offer cosmetic surgeries which have higher margins than reconstruction surgeries with lower profit margins (Krieger & Lee, 2004). Hospitals in concentrated markets may have more slack to provide services such as IBRS which are more resource intensive and have lower financial returns (A. M. Jones, 2012). The results also show that compared to patients who receive a mastectomy in large metropolitan markets, patients receiving a mastectomy in small metropolitan, micropolitan and rural markets have a lower likelihood of receiving IBRS. This finding is similar to previous literature (Agarwal et al., 2011; Hershman et al., 2012; W. H. Tseng et al., 2010). Hospitals located in large metropolitan regions have better access to capital and labor resources (Hall & Owings, 2014; Weisgrau, 1995). Lastly, the results show that higher density of plastic surgeons in the markets is associated with higher likelihood of receipt of IBRS. This finding is similar to previous literature (Jagsi et al., 2014; Kaplan et al., 2011). Plastic surgeons are the labor resource required by hospitals to provide IBRS services. A higher density of plastic surgeons may ensure better access and shorter waiting times (Jagsi et al., 2014; Kaplan et al., 2011). A higher density of plastic surgeons in the county also increases the likelihood of breast surgeons referring their patients to plastic surgeons. Referrals to plastic surgeons are an important determinant of receipt of IBRS in the literature (Preminger et al., 2012).

In the first sensitivity analysis, hospitals that do not offer any reconstruction services between 2010 and 2012 are excluded. The purpose of this sensitivity analysis is to ascertain whether the hospital and market-level variables included in the study only determine provision of IBRS services or they also determine the likelihood of receiving IBRS in a hospital that provides these services. The second column of Table 20 presents only those variables that are significantly associated with a hospital providing IBRS services whereas the variables that are significant in both columns two and three are also associated with likelihood of receiving IBRS in a hospital that offers it. The only hospital-level variable significant in both the columns is proportion of racial and ethnic minority patients admitted by the hospital. This means that proportion of racial and ethnic minority patients admitted by the hospital is associated not only with a hospital providing IBRS services at all but also with the likelihood of a patient receiving IBRS in a hospital that provides these services. This could be because hospitals serving a higher proportion of racial and ethnic minorities have lower volume of breast reconstructions and poor surgical outcomes (Breslin et al., 2009) which may discourage breast surgeons from recommending, and patients from receiving IBRS. Additionally, hospitals that predominantly serve racial and ethnic minority patients tend to have longer surgical wait times and this may dissuade patients from receiving IBRS (Hsia et al., 2012). Thus, patients who wish to receive IBRS need to choose hospitals not just based on whether they offer IBRS services but also based on other factors such as volume of reconstructions performed, surgical outcomes and wait times. All the market-level variables are significant in both the columns.

The two columns in Table 20 show the hospital and market characteristics associated with provision of IBRS by a hospital and receipt of IBRS by patients in hospitals that provide IBRS respectively. It is important to understand both of these factors so that policymakers can not only focus on providing resources to certain hospitals to provide IBRS but also address the issues that restrict patients from availing IBRS services where available.

Research question 2.

Research question 2 is ‘Is the relationship between race/ethnicity and likelihood of receipt of IBRS moderated by hospital and market characteristics?’ To address this research question, interactions between race/ethnicity and hospital and market variables are added to the model used to address research question 1. The results of research question 2 add to those of research question 1 by examining the hospital and market variables that moderate the relationship between race/ethnicity and receipt of IBRS. Table 21 presents the list of hospital and market variables that significantly moderate the relationship between race/ethnicity and receipt of IBRS along with the direction of the moderation effect in the original analyses and both the sensitivity analyses. Negative moderation indicates that increasing the value of the hospital or market variable (for continuous variables) or change in level as compared to the reference group (for categorical and binary variables) increases the racial/ethnic gap in receipt of IBRS while the reverse is true for positive moderation.

No a priori hypotheses are specified for research question 2. Only one previous study examines interactions between Black race and hospital and market variables and found no significant interactions between Black race and variables such as breast cancer surgery volume, teaching status, National Cancer Institute designated cancer center status, disproportionate share hospital status and urbanicity of the market in relation to receipt of IBRS (Onega et al., 2014). The current study has a number of additional variables that were not included in Onega et al. (2014) study.

White-Black sample.

In the White-Black sample, although, like Onega et al. (2014), most of the interaction terms are not significant, three variables do have a significant moderating effect. Higher proportion of

Table 21

Summary of Results for Research Question 2

Variable	Full sample		Sample after excluding hospitals that do not provide reconstruction		Combined minority sample
	White-Black	White-Hispanic	White-Black	White-Hispanic	
Hospital-level					
Percentage of breast cancer patients	NS	NS	NS	NS	NS
Bed size/10	NS	NS	NS	NS	NS
Total margin	NS	NS	NS	NS	NS
Racial/ethnic mix	Negatively moderates	NS	Negatively moderates	NS	Negatively moderates
Medicaid mix	Positively moderates	NS	NS	NS	NS
Ownership					
Not-for- profit	NS	NS	NS	NS	NS
Non-federal public	NS	NS	NS	NS	NS
For profit (Reference)					
Teaching status	NS	NS	NS	NS	NS
Market-level					
Competition (1/HHI)	NS	Negatively moderates	NS	Negatively moderates	NS
Plastic surgeons/100 population	Negatively moderates	Negatively moderates	Negatively moderates	Negatively moderates	Negatively moderates
Urbanicity					
UIC1 (most urban) (Reference)					
UIC2	NS	Negatively moderates	NS	Negatively moderates	Negatively moderates
UIC3	NS	NS	NS	NS	NS
UIC4 (most rural)	NS	NS	NS	NS	NS

Note: NS represents coefficients of interaction terms that are not significant at p-value<0.05

racial and ethnic minority patients admitted by the hospital and higher density of plastic surgeons in the market negatively moderate the relationship between Black race and receipt of IBRS whereas higher proportion of Medicaid patients admitted by the hospital positively moderates the relationship between Black race and receipt of IBRS.

A higher proportion of racial and ethnic minority patients admitted by the hospital and density of plastic surgeons in the market negatively moderate the relationship between Black race and receipt of IBRS—that is, the gap between White and Black reconstruction rates increases. Hospitals with a high proportion of racial and ethnic minority patients are under-resourced. They have nurse staffing shortages, inadequate budgets, lack of technical support such as health information systems, and lack of capital (Hasnain-Wynia et al., 2007). Given the under-resourced nature of these hospitals, they may find it difficult to provide culturally competent care to racial and ethnic minority patients since such services require resources (Weech-Maldonado et al., 2012). Cultural competency is the ability of health care institutions to effectively deliver health care services that meet the social, cultural, and linguistic needs of patients (Weech-Maldonado et al., 2012).On the other hand, hospitals with higher Medicaid mix have a narrower White-Black gap in receipt of IBRS. Hospitals with a high Medicaid mix are more likely to be disproportionate share hospitals (DSH) (Mitchell, 2013). DSH have better political representation and higher access to resources which may enable them to provide culturally competent care to Black patients (Moy, Valente Jr, Levin, & Griner, 1996). It could also be that hospitals with a high Medicaid mix are located in more racially segregated areas where there may be greater social support and information networks for Black patients (Darrell J Gaskin & Hadley, 1999). These support mechanisms may encourage Black patients to be more involved in their care and demand reconstruction services.

At the market-level, markets with higher density of plastic surgeons have a wider White-Black gap in receipt of IBRS. While density of plastic surgeons is associated with increased likelihood of receipt of IBRS, racial and ethnic minority patients may be unable to enjoy the benefits of higher density of plastic surgeons. According to Greenberg et al. (2008), this could be due to racial/ethnic differences in referral to a plastic surgeon, quality of communication between patient and breast surgeon or patient and plastic surgeon (Caprice C. Greenberg et al., 2008). 92% of patients who are referred to a plastic surgeon receive IBRS (Preminger et al., 2012). However, breast surgeons are less likely to refer Black patients to plastic surgeons than White patients (J. F. Tseng et al., 2004). Even if minority patients are referred to plastic surgeons, the quality of that communication may not be the same as with a White patient due to cultural or language barriers or due to provider biases (Bird & Bogart, 2000; Gordon, Street Jr, Sharf, Kelly, & Souchek, 2006; Johnson, Roter, Powe, & Cooper, 2004; Keating, Weeks, Borbas, & Guadagnoli, 2003). Another explanation could be that racial and ethnic minorities are underrepresented among the plastic surgery workforce in United States (Silvestre, Serletti, & Chang, 2016). Studies show that minority physicians provide culturally competent care (Komaromy et al., 1996) and lack of minority plastic surgeons may be affecting the provision of culturally competent plastic surgery services to racial and ethnic minority patients. All of these factors may explain the moderation effect of density of plastic surgeons in the market on the relationship between race/ethnicity and receipt of IBRS.

The results after excluding hospitals that did not provide any reconstruction between 2010 and 2012 are largely similar with the exception that the interaction between proportion of Medicaid patients admitted by the hospital and Black race is not significant in the sensitivity analysis.

White-Hispanic sample.

For the White-Hispanic sample, higher proportion of racial and ethnic minority patients admitted by the hospital, higher density of plastic surgeons and higher competition in the market along with small metropolitan status of the market negatively moderate the relationship between

Hispanic ethnicity and receipt of IBRS. These results are similar to the sensitivity analyses after excluding hospitals that did not provide any reconstruction between 2010 and 2012. Providing culturally competent services requires resources (Weech-Maldonado et al., 2012) and hospitals in highly competitive markets may be unable to divert their limited resources from providing services which offer a competitive advantage to providing culturally competent care (Hadley, Zuckerman, & Iezzoni, 1996). Markets located in small metropolitan areas have a larger White-Hispanic gap as compared to markets in large metropolitan areas. Hospitals in large metropolitan areas have better access to capital and labor resources as compared to small metropolitan areas (Hall & Owings, 2014; Weisgrau, 1995). Hence, the lack of resources may hinder hospitals in small metropolitan areas to provide culturally competent services. Additionally, Hispanic patients are largely concentrated in the most urban markets and hospitals located in small metropolitan regions may not have the experience to provide culturally competent care to Hispanic patients. Lastly, in the combined White-minority sample, higher proportion of racial and ethnic minority patients admitted by the hospital, higher density of plastic surgeons in the market along with small metropolitan status of the market negatively moderate the relationship between combined racial and ethnic minority status and receipt of IBRS.

The findings from Table 21 suggest that minority serving hospitals and hospitals located in markets with high density of plastic surgeons provide disparate care for Black and Hispanic patients. Thus, providing resources to such hospitals so they can offer IBRS services may not be enough in order to ensure equitable access to IBRS for Black and Hispanic patients. In spite of offering IBRS, these hospitals may have fewer providers who accept Medicaid and uninsured patients, which may in turn lead to longer wait times for these patients. Longer wait times combined with race/ethnicity based selection of patients for IBRS due to provider biases may explain the disparate likelihood of receiving IBRS for minorities at these hospitals. The disparate care for minority patients could also be due to lack of resources and training for providing culturally appropriate care in these hospitals.

Hospitals located in small metropolitan markets and markets with high competition provide disparate care for Hispanic patients (and for combined minority sample only in small metropolitan markets) but not for Black patients. The experience of Hispanic patients in the health care system differs from Black patients since they face not only the cultural barriers faced by Black patients but also language barriers. Although most hospitals provide interpreter services to a certain extent, hospitals may be less likely to make investments towards strengthening interpreter services if they are located in markets with fewer Hispanic patients as in small metropolitan markets. In competitive markets, hospitals may be forced to divert their limited resources towards providing services that generate higher revenue streams rather than strengthening their interpreter services which may not yield any competitive advantage in the short term. Thus, findings from table 21 suggest that Hispanic patients are at a greater risk for receiving disparate care than Black patients in certain markets due to additional language barriers.

Research question 3.

Research question 3 is ‘Which patient, hospital and market-level characteristics contribute the most to the racial and ethnic differences in receipt of IBRS?’

At the patient-level**,** the results of the decomposition analysis show that racial and ethnic differences in type of insurance (Racial and ethnic minorities are more often Medicaid insured) and median household income in the zip code (Racial and ethnic minorities more often reside in low income neighborhoods) are the largest contributors to the racial and ethnic difference in receipt of IBRS. Although IBRS is covered by Medicaid, Medicaid patients have a lower awareness regarding availability and coverage of IBRS services. It could also be because of low availability of plastic surgeons who accept Medicaid patients or it could be because breast surgeons and/or plastic surgeons may not discuss IBRS with Medicaid patients given the low Medicaid reimbursement for IBRS (Alderman, Atisha, et al., 2011; Alderman, Storey, et al., 2009). Racial and ethnic minorities are disproportionally more likely to reside in lower income neighborhoods. These neighborhoods concentrate poverty and lack of education. Patients residing in these neighborhoods may not have the health literacy to seek IBRS, or may not have access to plastic surgeons who accept Medicaid, or may be unable to afford the out of pocket expenses of IBRS, or may be employed in jobs where it may not be possible for them to take time away from work to recuperate from a complex and intensive IBRS surgery (D. J. Gaskin, Dinwiddie, Chan, & McCleary, 2012; D. J. Gaskin et al., 2011). The results for the patient-level variables are robust to the sensitivity analyses wherein hospitals that did not provide any reconstruction services between 2010 and 2012 are excluded.

Among hospital characteristics, proportion of racial and ethnic minority patients admitted by the hospital is the largest hospital-level contributor to increasing the racial and ethnic difference in IBRS. Racial and ethnic minorities are disproportionately more likely to receive care at hospitals with a high racial/ethnic mix. Such hospitals may be unable to access the necessary capital and labor resources required for provision of IBRS services (Hasnain-Wynia et al., 2007). This result is robust to the sensitivity analyses wherein hospitals that did not provide any reconstruction services between 2010 and 2012 are excluded.

Racial and ethnic differences in other hospital-level characteristics such as total margin, Medicaid mix and not-for-profit ownership also contribute to increasing racial and ethnic differences in receipt of IBRS to a lesser extent. Racial and ethnic minority patients often receive care at under-resourced hospitals with low total margin and high Medicaid mix whereas they don't often receive a mastectomy at over-resourced not-for-profit hospitals. At the market-level, racial and ethnic minority patients often receive a mastectomy in large metropolitan markets with high competition and this contributes to decreasing the racial and ethnic differences in receipt of IBRS.

Unique Contribution of the Study

This study makes several important contributions to the literature on factors associated with receipt of immediate breast reconstruction surgery, especially for racial and ethnic minorities. Previous research has focused largely on the association between patient characteristics and receipt of IBRS. This study shows that hospital and market characteristics are also related to receipt of IBRS. Not only does this study support the evidence regarding existence of racial and ethnic differences in receipt of IBRS, but also adds to this literature by showing the hospital and market factors that moderate the relationship between race/ethnicity and receipt of IBRS. Additionally, the results of this study also show that characteristics of the hospital and market where racial and ethnic minority patient receive care contribute to the racial and ethnic gap in receipt of IBRS. Understanding how hospital and market characteristics influence the receipt of IBRS among racial and ethnic minority patients offer implications for policy and practice.

Implications for Policy and Practice

The results of this study offer multiple implications for policy and practice. The results add to the evidence regarding racial and ethnic differences in receipt of IBRS. It is important for patients, surgeons, practitioners and policy makers to be aware that this is an important issue and that steps need to be taken at multiple levels to mitigate these differences.

Research Question 1.

First, because certain hospital and market characteristics are associated with higher likelihood of receipt of IBRS, directing patients who wish to receive reconstruction to the hospitals where they have a higher likelihood of receipt of IBRS is important. However, directing patients to the hospitals where they have a higher likelihood of receipt of IBRS may be difficult due to certain access limitations faced by vulnerable racial and ethnic minority patients. In such cases, it is important to ensure that the hospitals where racial and ethnic minority patients are most likely to receive care can offer these services to them. Racial and ethnic minority patients are more likely to receive a mastectomy at hospitals that predominantly serve racial and ethnic minority patients and Medicaid insured patients. However, such hospitals typically have poor access to capital and labor resources and, thus, may not have the resources to provide IBRS, which is not considered to be a profitable service.

Policy makers need to focus their efforts on improving availability of resources for hospitals that predominantly serve vulnerable patients in order to improve delivery and quality of IBRS services. In order to do so, it is important to understand the structural constraints faced by hospitals in providing complex care services such as IBRS. Understanding the structural constraints will help policy makers design innovative value-based payment models that incentivize hospitals in a way that helps them address these structural constraints (Lewis, Fraze, Fisher, Shortell, & Colla, 2017). While many minority-serving hospitals are also disproportionate share hospitals and receive DSH payments, it is important to note that reduction in DSH payments under health reform may further affect the ability of these hospitals to provide complex IBRS services (Lasser et al., 2016). Another option to lower the cost of providing IBRS services is to establish breast reconstruction centers of excellence where a higher volume of IBRS services can be concentrated and economies of scale can be achieved to reduce costs (Alderman, Storey, et al., 2009). Lastly, in order to ensure availability of plastic surgeons who accept Medicaid patients, hospitals need to incentivize plastic surgeons by increasing their share of the reimbursement. Aldermen et al. (2009) found that hospitals receive a higher financial margin for providing IBRS services to Medicaid patients due to facility charges alone as compared to plastic surgeons who receive a comparatively lower financial margin for providing IBRS (Alderman, Storey, et al., 2009). Thus, in order to ensure provision of IBRS services to Medicaid patients within their hospitals, hospital administrators may need to revisit the payment arrangements with the plastic surgeons.

Research Question 2.

Certain hospital and market characteristics negatively moderate the relationship between race/ethnicity and receipt of IBRS. Blacks and Hispanics are disproportionately less likely than Whites to receive IBRS at minority serving hospitals and hospitals located in markets with higher density of plastic surgeons. Providing culturally competent care has been proposed as a way to mitigate racial and ethnic difference in care. Griffith et al. (2007) identify cultural competency as an important tool to reduce institutional racism (Griffith et al., 2007). Cultural competency allows health care institutions to provide services that are socially and culturally appropriate for racial and ethnic minority patients. Cultural competency includes training providers to recognize, acknowledge and address their implicit biases towards patients of racial and ethnic minorities. Weech-Maldonado et al. (2012) argue that providing culturally competent care requires resources and hospitals with better access to resources will be able to provide culturally competent care. Thus, it is important to ensure that hospitals where racial and ethnic minorities are disproportionately less likely to receive IBRS have the knowledge and resources to provide culturally competent care in order to mitigate racial and ethnic differences in receipt of IBRS. Diversifying the plastic surgery workforce in order to increase the numbers of minority plastic surgeons is another long-term strategy to address cultural discordance between patients and providers (Silvestre, Serletti, & Chang, 2017).

In addition, Hispanic patients are disproportionately less likely than Whites to receive IBRS at hospitals located in competitive markets and hospitals located in small metropolitan markets. In addition to cultural barriers faced by all minority patients, Hispanic patients also face significant language barriers. Hospitals located in competitive and small metropolitan markets may not have access to resources to provide interpreter services. While states are not obligated to reimburse hospitals for the cost of language services, states do have the option of claiming Medicaid and/or the State Children's Health Insurance Program (SCHIP) reimbursement for the cost of interpreting services, either as an administrative expense or optional covered service. However, currently only 15 states directly reimburse providers for language services under Medicaid. States like Arizona, California and Florida included in this study that have a high proportion of Hispanic patients do not offer direct reimbursement for language services to their providers (Youdelman, 2007). Policymakers in these states should focus on seeking federal matching to provide reimbursement for language services under public programs. It is also important to make hospital administrators aware of the costs arising due to inadequate care in absence of interpreter services in order to make a case for providing interpreter services even in the absence of third party reimbursement (Timmins, 2002).

Research Question 3.

Patient-level factors.

The results of the decomposition suggest that although certain hospital and market-characteristics are important contributors, patient-level factors such as type of insurance and income are the largest contributors to racial and ethnic differences in receipt of IBRS. Black and Hispanic patients are more often Medicaid insured than Whites. This explains nearly 30 to 40% of the racial and ethnic gap in receipt of IBRS. Although Medicaid offers coverage for IBRS, the reimbursements provided by Medicaid are very low compared to Medicare or private insurance (Alderman, Storey, et al., 2009). Thus, plastic surgeons are less likely to accept Medicaid patients for IBRS (Alderman, Atisha, et al., 2011). Additionally, Medicaid patients are often unaware that Medicaid provides coverage for IBRS (Shippee et al., 2014). Thus, Medicaid patients may not initiate the discussion regarding IBRS with their surgeon. Thus, it is important to raise awareness regarding IBRS coverage among Medicaid patients. Several states such as New York and Texas mandate breast surgeons to discuss breast reconstruction with patients and offer a referral to a plastic surgeon. Expanding such policies to other states under the recently passed Breast Cancer Patient Education Act of 2015 is another way to increase awareness of IBRS among Medicaid patients. It is necessary to ensure that these mandates are enacted across hospitals and providers. Given that Medicaid reimbursement for IBRS is very low and dissuades plastic surgeons from accepting Medicaid payments, increasing the Medicaid reimbursement for IBRS may be a potential area of focus for policy makers.

Another patient-level factor that contributes nearly 30-40% to racial and ethnic differences in receipt of IBRS is income. Although the Women's Health Care Right Act of 1998 mandates insurance providers to offer coverage for IBRS, certain states such as Florida have enacted riders that allow insurance companies to impose additional out-of-pocket costs for patients (Centers for Disease Control and Prevention, 2000). Thus, reducing out-of-pocket expenditures for IBRS can be another focus area for policymakers. Some ways to implement this may be restricting states like Florida from imposing riders that permit insurance companies to impose additional out-of-pocket costs for IBRS. Another option may be to offer subsidies to cover out-of-pocket expenses for IBRS services to low income women via public programs or grants. Lastly, private insurers should ensure that they have plastic surgeons that provide breast reconstruction within their network. Women residing in certain regions in the country may not have access to IBRS services by in-network providers and may be forced to pay higher out-of-pocket costs to receive IBRS by an out-of-network provider (Nance-Nash, 2011).

Hospital and market-level factors.

Of all the place of care factors included in the model, receiving care at hospitals that predominantly serve racial and ethnic minorities i.e. minority serving hospitals contribute the most to the racial and ethnic gap in receipt of IBRS (32% to the White-Black gap and 26% to the White-Hispanic gap). Thus, hospital managers and policy makers need to focus on these hospitals. There may be several avenues for intervention. The first would be training breast surgeons in these hospitals to discuss reconstruction with their patients. The second avenue for intervention is to provide cultural competency training to surgeons and other staff so that there are no language or cultural barriers to receiving IBRS. Another issue with minority serving hospitals is that they are usually associated with poor access to resources so providing these hospitals with the required capital and labor resources through innovative payment models is another potential are of focus for policy makers. Lastly, if these hospitals are unable to provide these services, there is a need for strengthening referral networks to plastic surgeons in the community or other hospitals.

Additional Analyses for Type of Reconstruction

Not much is known about the factors associated with receipt of immediate autologous reconstruction (AR) vs immediate implant reconstruction (IR). This study addresses this gap by examining the factors associated with receipt of AR. This study specifically focuses on the relationship between race/ethnicity and receipt of AR including factors that modify this relationship and factors that contribute to the racial and ethnic differences in receipt of AR. Although this is not the main finding of this study, these additional analyses provide a baseline exploration which can help guide future research in this area.

The results of the additional analysis examining factors associated with receipt of AR show that Black race, older age, higher clinical comorbidity score, obesity and residing in low income neighborhoods are patient-level variables associated with higher likelihood of receipt of AR. The result for the relationship between Black race and receipt of AR is similar to the results found by Alderman et al. (2003) and Offodile et al. (2015). The result for the relationship between income and receipt of AR is similar to the results found by Jagsi et al. (2014). None of the other patient-level variables included in the study were previously examined in relation to receipt of AR. Hospital and market-level variables associated with receipt of AR are not-for-profit and public ownership, and density of plastic surgeons in the market. The result for the relationship between density of plastic surgeons in the market and receipt of AR is similar to that found by Jagsi et al. (2014).

The results from the interaction model show that Black and Hispanics are disproportionately less likely than Whites to receive AR in small metropolitan markets than large metropolitan markets. These results are similar to those seen for IBRS. Lastly, decomposition results show that higher incidence of obesity and receiving care at public, teaching hospitals in markets with high density of plastic surgeons contributes to higher likelihood of AR for Black patients. For Hispanic patients, receiving care at public, teaching hospitals in markets with high density of plastic surgeons increases the likelihood of receiving AR whereas being younger and receiving a reconstruction at non-teaching hospitals contributes to lower likelihood of receiving AR. Thus, the results of this additional analyses show that Black patients are more likely whereas Hispanic patients are less likely to receive AR. It is difficult to conclude whether these racial and ethnic differences are driven by patient preferences or patient characteristics such as obesity (obese women are usually recommended to have AR) or by place of care characteristics such as public ownership, teaching status and higher plastic surgeon density. It is interesting to note that type of insurance does not play a role in the type of reconstruction received despite significant differences in reimbursement for AR vs IR by type of insurance (Alderman et al., 2009). Thus, although low reimbursement by Medicaid may affect overall receipt of IBRS, it does not affect receipt of AR specifically. There is no clear clinical consensus about preference of AR over IR or vice versa since AR provides better aesthetic results but IR is a safer procedure (Benditte-Klepetko, Lutgendorff, Kastenbauer, Deutinger, & van der Horst, 2014; Yueh et al., 2010). Hence, this study does not provide any practice or policy implications of these results but merely explores these relationships.

Limitations

This study has several limitations. The first limitation is the inability to control for unobserved characteristics such as patient preferences and provider bias. IBRS is an elective procedure and patient preference is one of the most important determinants of receiving this procedure. However, several studies suggest that patients who did not receive IBRS were not given appropriate information regarding IBRS options and that these patients also suffer from higher decisional regret after foregoing reconstructiom (Alderman, Hawley, et al., 2011). Thus, even though IBRS is an elective procedure, it is important to understand factors that can increase likelihood of receiving IBRS, especially for the vulnerable racial and ethnic minority patients. Provider bias is another important unobserved factor since provider recommendation is an important detreminant of receipt of IBRS (J. Y. Chen et al., 2009). It is expected that adding a measure of provider bias would help explain a larger proportion of the White-minority difference in receipt of IBRS.

The second limitation is the inability to control for observed characteristics such as grade and stage of the tumor, patient income and referral to plastic surgeons due to the nature of the data. Black patients are known to be diagnosed at a higher stage and grade of breast cancer. Hence, the inability to control for these tumor characteristics may bias the results. Although quartiles of median household at the zipcode level is included in this study as a proxy for patient income, this measure is imprecise. Given that the zip code level income is a very significant determinant of receipt of IBRS and a significantly large contributor to the racial and ethnic differences in receipt of IBRS, it is important to include a more precise measure of patient income. Lastly, since this study uses administrative data, there is no way to determine if the breast surgeon referred the patient to a plastic surgeon since referral to a plastic surgeon is an important step in receipt of IBRS.

The third limitation is using county to measure market-level effects since the county is a larger geographical area and county-level average of hospital competition and plastic surgeon availability may not apply to the immediate hospital environment. The fourth limitation is that the results may be biased due to high correlation between hospital-level variables such as racial and ethnic mix and Medicaid mix and between market-level variables such as competition and large metropolitan status of the market. The fifth limitation is the inability to observe delayed breast reconstruction due to the nature of the data. Patients who receive delayed reconstruction for any reason are combined with patients who do not receive any reconstruction. This may bias the results of the analyses especially since racial and ethnic minority patients are more likely to receive delayed reconstruction as compared to Whites (Alderman, Hawley, et al., 2011).

The sixth limitation is that the study is restricted to inpatient mastectomies while 20% of all mastectomies are performed in the outpatient setting and this number is on the rise (Kruper et al., 2013). White patients are disproportionately more likely to receive a mastectomy and IBRS in an outpatient setting (Kruper et al., 2013). Excluding outpatient observations may therefore underestimate the racial and ethnic difference in receipt of IBRS in this study. The seventh limitation is the inability to account for the nested structure of the data in the decomposition model since Fairlie command in Stata does not allow for a mixed effects model. Lastly, the generalizability of the results of this study is limited since this study is restricted to a convenience sample of 9 states and may not be generalizable to the entire country.

Implications for Future Research

This study opens up multiple avenues for future research. This study is retricted to quantitive methods and a secondary, administrative dataset. Given that breast reconstruction is an elective procedure that is primarily driven by shared decision making between the patient and the provider, qualitative studies using primary data collection would yield insights to better understand patients' decision making process regarding breast reconstruction. Understanding the decision making process of the patient will help practitioners and policy makers understand where efforts need to be targetted in order to incease receipt of IBRS. Additionally, individual patient charts could be reviewed to find out if breast surgeons referred patients to plastic surgeons and whether plastic surgeons recommended IBRS to patients. Qualitative studies are also needed to understand patient decision making regarding the type of reconstruction received i.e. autologous or implant reconstruction.

Future studies using claims datasets such as the SEER-Medicare may address certain limitations of this study. Such datasets may allow for examination of delayed reconstructions and outpatient reconstructions. It may also allow for inclusion of tumor characteristics in the analysis. Using a finer measure of hospital markets such as zip codes or census tracts may also help address the issue of using county to define markets. Using a nationally representative dataset may help improve the generalizability of the findings of this study. Lastly, statistical analyses that allow for estimating decomposition models that take into account the nested structure of the data may help to reduce the bias in the results of this study.

References

Aday, L. A., & Andersen, R. (1974). A framework for the study of access to medical care. *Health services research, 9*(3), 208.

Agarwal, S., Kidwell, K. M., Farberg, A., Kozlow, J. H., Chung, K. C., & Momoh, A. O. (2015). Immediate reconstruction of the radiated breast: recent trends contrary to traditional standards. *Annals of surgical oncology, 22*(8), 2551-2559.

Agarwal, S., Pappas, L., Neumayer, L., & Agarwal, J. (2011). An analysis of immediate postmastectomy breast reconstruction frequency using the surveillance, epidemiology, and end results database. *The breast journal, 17*(4), 352-358.

Al-Ghazal, S. K., Fallowfield, L., & Blamey, R. W. (2000). Comparison of psychological aspects and patient satisfaction following breast conserving surgery, simple mastectomy and breast reconstruction. *European journal of cancer, 36*(15), 1938-1943.

Al-Ghazal, S. K., Sully, L., Fallowfield, L., & Blamey, R. W. (2000). The psychological impact of immediate rather than delayed breast reconstruction. *European Journal of Surgical Oncology (EJSO), 26*(1), 17-19.

Albornoz, C. R., Bach, P. B., Mehrara, B. J., Disa, J. J., Pusic, A. L., McCarthy, C. M., . . . Matros, E. (2013). A paradigm shift in U.S. Breast reconstruction: increasing implant rates. *Plastic and Reconstructive Surgery, 131*(1), 15-23. doi:10.1097/PRS.0b013e3182729cde [doi]

Albornoz, C. R., Cordeiro, P. G., Mehrara, B. J., Pusic, A. L., McCarthy, C. M., Disa, J. J., & Matros, E. (2014). Economic implications of recent trends in US immediate autologous breast reconstruction. *Plastic and Reconstructive Surgery, 133*(3), 463-470.

Alderman, A. K., Atisha, D., Streu, R., Salem, B., Gay, A., Abrahamse, P., & Hawley, S. T. (2011). Patterns and correlates of postmastectomy breast reconstruction by U.S. Plastic surgeons: results from a national survey. *Plastic and Reconstructive Surgery, 127*(5), 1796-1803. doi:10.1097/PRS.0b013e31820cf183 [doi]

Alderman, A. K., Hawley, S. T., Janz, N. K., Mujahid, M. S., Morrow, M., Hamilton, A. S., . . . Katz, S. J. (2009). Racial and ethnic disparities in the use of postmastectomy breast reconstruction: results from a population- based study. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology, 27*(32), 5325-5330. doi:10.1200/JCO.2009.22.2455 [doi]

Alderman, A. K., Hawley, S. T., Morrow, M., Salem, B., Hamilton, A., Graff, J. J., & Katz, S. (2011). Receipt of delayed breast reconstruction after mastectomy: do women revisit the decision? *Annals of surgical oncology, 18*(6), 1748-1756.

Alderman, A. K., McMahon, L., & Wilkins, E. G. (2003). The national utilization of immediate and early delayed breast reconstruction and the effect of sociodemographic factors. *Plastic and Reconstructive Surgery, 111*(2), 695-705.

Alderman, A. K., Storey, A. F., Nair, N. S., & Chung, K. C. (2009). Financial impact of breast reconstruction on an academic surgical practice. *Plastic and Reconstructive Surgery, 123*(5), 1408-1413. doi:10.1097/PRS.0b013e3181a0722d [doi]

Alderman, A. K., Wei, Y., & Birkmeyer, J. D. (2006). Use of breast reconstruction after mastectomy following the Women's Health and Cancer Rights Act. *JAMA, 295*(4), 383-388.

American Cancer Society. (2014, 05/20/2016). Women's Health and Cancer Rights Act. Retrieved from http://www.cancer.org/treatment/findingandpayingfortreatment/understandinghealthinsurance/womens-health-and-cancer-rights-act

American Cancer Society. (2016). Breast cancer facts & figures 2016-2017. *American Cancer Society INC.* Retrieved from http://www.cancer.org/research/cancerfactsstatistics/breast-cancer-fa

American Hospital Association. (2014). AHA Annual Survey Database. Retrieved from http://www.ahadataviewer.com/book-cd-products/AHA-Survey/

Andersen, R. (1968). *A behavioral model of families' use of health services* (Vol. Research Series No. 25). Chicago, IL: Center for Health Administration Studies, University of Chicago.

Andersen, R., & Newman, J. F. (1973). Societal and Individual Determinants of Medical Care Utilization in the United States. *Milbank Memorial Fund Quarterly Journal, 51*, 95-124.

Banaszak-Holl, J., Zinn, J. S., & Mor, V. (1996). The impact of market and organizational characteristics on nursing care facility service innovation: a resource dependency perspective. *Health services research, 31*(1), 97-117.

Barrett, M., Wier, L., & Washington, R. (2006). Trends in Pediatric and Adult Hospital Stays for Asthma, 2000–2010: Statistical Brief# 169: Agency for Health Care Policy and Research (US), Rockville (MD).

Bazzoli, G. J., Chan, B., Shortell, S. M., & D'Aunno, T. (2000). The financial performance of hospitals belonging to health networks and systems. *Inquiry*, 234-252.

Beahm, E. K., Walton, R. L., & Chang, D. W. (2006). 18: Breast Reconstruction in the Obese Patient. *Plastic and Reconstructive Surgery, 118*(4), 15-16.

Benditte-Klepetko, H. C., Lutgendorff, F., Kastenbauer, T., Deutinger, M., & van der Horst, C. M. (2014). Analysis of patient satisfaction and donor-site morbidity after different types of breast reconstruction. *Scandinavian journal of surgery : SJS : official organ for the Finnish Surgical Society and the Scandinavian Surgical Society, 103*(4), 249-255. doi:10.1177/1457496913512829 [doi]

Bird, S. T., & Bogart, L. M. (2000). Perceived race-based and socioeconomic status (SES)-based discrimination in interactions with health care providers. *Ethnicity & Disease, 11*(3), 554-563.

Blinder, A. S. (1973). Wage discrimination: reduced form and structural estimates. *Journal of Human resources*, 436-455.

Bradley, C. J., Dahman, B., Shickle, L. M., & Lee, W. (2012). Surgery wait times and specialty services for insured and uninsured breast cancer patients: does hospital safety net status matter? *Health services research, 47*(2), 677-697.

Brandberg, Y., Sandelin, K., Erikson, S., Jurell, G., Liljegren, A., Lindblom, A., . . . Arver, B. (2008). Psychological reactions, quality of life, and body image after bilateral prophylactic mastectomy in women at high risk for breast cancer: a prospective 1-year follow-up study. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology, 26*(24), 3943-3949. doi:10.1200/JCO.2007.13.9568 [doi]

BreastCancer.org (2015a). [Autologous or "Flap" Reconstruction]. Web Page.

BreastCancer.org (2015b). [Fat Grafting]. Web Page.

BreastCancer.org (2015c). [Types of Breast Reconstruction]. Web Page.

Brennan, M. E., & Spillane, A. J. (2013). Uptake and predictors of post-mastectomy reconstruction in women with breast malignancy–systematic review. *European Journal of Surgical Oncology (EJSO), 39*(6), 527-541.

Breslin, T. M., Morris, A. M., Gu, N., Wong, S. L., Finlayson, E. V., Banerjee, M., & Birkmeyer, J. D. (2009). Hospital factors and racial disparities in mortality after surgery for breast and colon cancer. *Journal of Clinical Oncology, 27*(24), 3945-3950.

Brinton, L. A., Sherman, M. E., Carreon, J. D., & Anderson, W. F. (2008). Recent trends in breast cancer among younger women in the United States. *Journal of the National Cancer Institute, 100*(22), 1643-1648.

Centers for Disease Control and Prevention. (2000). *State Laws Relating to Breast Cancer* Retrieved from http://www.cdc.gov/cancer/breast/pdf/BClaws.pdf

Centers for Disease Control and Prevention. (2005). Health disparities experienced by black or African Americans--United States. *MMWR: Morbidity and mortality weekly report, 54*(1), 1-3.

Centers for Medicare and Medicaid Services. (2012). Cost Reports. Retrieved from https://www.cms.gov/Research-Statistics-Data-and-Systems/Downloadable-Public-Use-Files/Cost-Reports/

Charlson, M. E., Pompei, P., Ales, K. L., & MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *Journal of chronic diseases, 40*(5), 373-383.

Chen, J. Y., Malin, J., Ganz, P. A., Ko, C., Tisnado, D., Tao, M. L., . . . Kahn, K. L. (2009). Variation in physician-patient discussion of breast reconstruction. *Journal of general internal medicine, 24*(1), 99-104.

Chen, S. A., Hiley, C., Nickleach, D., Petsuksiri, J., Andic, F., Riesterer, O., . . . Torres, M. A. (2013). Breast reconstruction and post-mastectomy radiation practice. *Radiation Oncology, 8*(1), 1.

Chevray, P. M. (2008). Timing of breast reconstruction: immediate versus delayed. *Cancer journal (Sudbury, Mass.), 14*(4), 223-229. doi:10.1097/PPO.0b013e3181824e37 [doi]

Christian, C. K., Niland, J., Edge, S. B., Ottesen, R. A., Hughes, M. E., Theriault, R., . . . Weeks, J. C. (2006). A multi-institutional analysis of the socioeconomic determinants of breast reconstruction: a study of the National Comprehensive Cancer Network. *Annals of Surgery, 243*(2), 241-249.

Conklin, W. (2008). LATINOS AND BLACKS: What Unites and Divides Us? *The Diversity Factor, 16*(1), 20-28.

Cunningham, P. J., Bazzoli, G. J., & Katz, A. (2008). Caught in the competitive crossfire: safety-net providers balance margin and mission in a profit-driven health care market. *Health affairs, 27*(5), w374-w382.

Davis, G. F., & Powell, W. W. (1992). Organization-environment relations. *Handbook of industrial and organizational psychology, 3*, 315-375.

Devereaux, P. J., Choi, P. T., Lacchetti, C., Weaver, B., Schünemann, H. J., Haines, T., . . . Bhandari, M. (2002). A systematic review and meta-analysis of studies comparing mortality rates of private for-profit and private not-for-profit hospitals. *Canadian Medical Association Journal, 166*(11), 1399-1406.

Dragun, A. E., Huang, B., Tucker, T. C., & Spanos, W. J. (2012). Increasing Mastectomy Rates Among all Age Groups for Early Stage Breast Cancer: A 10-Year Study of Surgical Choice. *The breast journal, 18*(4), 318-325.

Dragun, A. E., Pan, J., Riley, E. C., Kruse, B., Wilson, M. R., Rai, S., & Jain, D. (2013). Increasing use of elective mastectomy and contralateral prophylactic surgery among breast conservation candidates: a 14-year report from a comprehensive cancer center. *American journal of clinical oncology, 36*(4), 375-380.

Ehreth, J. L. (1994). The development and evaluation of hospital performance measures for policy analysis. *Medical care, 32*(6), 568-587.

Eiland, M. R. (2015). Differences Between For-Profit and Nonprofit Hospitals: Perceived Quality and Access.

Elixhauser, A., Steiner, C., Harris, D. R., & Coffey, R. M. (1998). Comorbidity measures for use with administrative data. *Medical care*, *36*(1), 8-27.

Eltahir, Y., Werners, L. L. C. H., Dreise, M. M., van Emmichoven, I. A. Z., Werker, P. M. N., & de Bock, G. H. (2015). Which breast is the best? Successful autologous or alloplastic breast reconstruction: patient-reported quality-of-life outcomes. *Plastic and Reconstructive Surgery, 135*(1), 43-50.

Enewold, L. R., McGlynn, K. A., Zahm, S. H., Poudrier, J., Anderson, W. F., Shriver, C. D., & Zhu, K. (2014). Breast reconstruction after mastectomy among Department of Defense beneficiaries by race. *Cancer*, *120*(19), 3033-3039.

Fairlie, R. W. (2005). An extension of the Blinder-Oaxaca decomposition technique to logit and probit models. *Journal of economic and social measurement, 30*(4), 305-316.

Fischer, J. P., Nelson, J. A., Kovach, S. J., Serletti, J. M., Wu, L. C., & Kanchwala, S. (2013). Impact of obesity on outcomes in breast reconstruction: analysis of 15,937 patients from the ACS-NSQIP datasets. *Journal of the American College of Surgeons, 217*(4), 656-664.

Gardeazabal, J., & Ugidos, A. (2004). More on identification in detailed wage decompositions. *Review of Economics and Statistics, 86*(4), 1034-1036.

Garnick, D. W., Luft, H. S., Robinson, J. C., & Tetreault, J. (1987). Appropriate measures of hospital market areas. *Health services research, 22*(1), 69.

Gaskin, D. J., Dinwiddie, G. Y., Chan, K. S., & McCleary, R. (2012). Residential segregation and disparities in health care services utilization. *Medical care research and review : MCRR, 69*(2), 158-175. doi:10.1177/1077558711420263 [doi]

Gaskin, D. J., & Hadley, J. (1999). Population characteristics of markets of safety-net and non-safety-net hospitals. *Journal of Urban Health, 76*(3), 351-370.

Gaskin, D. J., Spencer, C. S., Richard, P., Anderson, G., Powe, N. R., & LaVeist, T. A. (2011). Do minority patients use lower quality hospitals? *Inquiry : a journal of medical care organization, provision and financing, 48*(3), 209-220.

Ginsburg, P. B. (1972). Resource allocation in the hospital industry: the role of capital financing. *Soc. Sec. Bull., 35*, 20.

González, E. G. (2013). Delayed Reconstruction After Breast-Conserving Surgery *Oncoplastic and Reconstructive Breast Surgery* (pp. 177-191): Springer.

Gordon, H. S., Street Jr, R. L., Sharf, B. F., Kelly, P. A., & Souchek, J. (2006). Racial differences in trust and lung cancer patients' perceptions of physician communication. *Journal of Clinical Oncology, 24*(6), 904-909.

Greenberg, C. C., Lipsitz, S. R., Hughes, M. E., Edge, S. B., Theriault, R., Wilson, J. L., . . . Weeks, J. C. (2011). Institutional variation in the surgical treatment of breast cancer: a study of the NCCN. *Annals of Surgery, 254*(2), 339-345. doi:10.1097/SLA.0b013e3182263bb0 [doi]

Greenberg, C. C., Schneider, E. C., Lipsitz, S. R., Ko, C. Y., Malin, J. L., Epstein, A. M., . . . Kahn, K. L. (2008). Do variations in provider discussions explain socioeconomic disparities in postmastectomy breast reconstruction? *Journal of the American College of Surgeons, 206*(4), 605-615.

Greening, D. W., & Gray, B. (1994). Testing a model of organizational response to social and political issues. *Academy of Management journal, 37*(3), 467-498.

Griffith, D. M., Mason, M., Yonas, M., Eng, E., Jeffries, V., Plihcik, S., & Parks, B. (2007). Dismantling institutional racism: theory and action. *American Journal of Community Psychology, 39*(3-4), 381-392.

Grover, R., Padula, W. V., Van Vliet, M., & Ridgway, E. B. (2013). Comparing five alternative methods of breast reconstruction surgery: a cost-effectiveness analysis. *Plastic and Reconstructive Surgery, 132*(5), 709e-723e.

Gurunluoglu, R., Gurunluoglu, A., Williams, S. A., & Tebockhorst, S. (2013). Current trends in breast reconstruction: survey of American Society of Plastic Surgeons 2010. *Annals of Plastic Surgery, 70*(1), 103-110. doi:10.1097/SAP.0b013e31822ed5ce [doi]

Hadley, J., Zuckerman, S., & Iezzoni, L. I. (1996). Financial pressure and competition: changes in hospital efficiency and cost-shifting behavior. *Medical care, 34*(3), 205-219.

Hall, M. J., & Owings, M. (2014). Rural and urban hospitals' role in providing inpatient care, 2010. *Population, 17,* 12.

Hanley, G. E., & Morgan, S. (2008). On the validity of area-based income measures to proxy household income. *BMC health services research, 8*(1), 1.

Hasnain-Wynia, R., Baker, D. W., Nerenz, D., Feinglass, J., Beal, A. C., Landrum, M. B., . . . Weissman, J. S. (2007). Disparities in health care are driven by where minority patients seek care: examination of the hospital quality alliance measures. *Archives of Internal Medicine, 167*(12), 1233-1239.

Hawley, S. T., Jagsi, R., Morrow, M., Janz, N. K., Hamilton, A., Graff, J. J., & Katz, S. J. (2014). Social and clinical determinants of contralateral prophylactic mastectomy. *JAMA surgery, 149*(6), 582-589.

Healthcare Cost and Utilization Project (2016a). [Appendix A - Clinical Classification Software-DIAGNOSES (January 1980 through September 2015)]. Web Page.

Healthcare Cost and Utilization Project (2016b). [Overview of the State Inpatient Databases-SID]. Web Page.

Heidari, M., Shahbazi, S., & Ghodusi, M. (2015). Evaluation of body esteem and mental health in patients with breast cancer after mastectomy. *Journal of Mid-life Health, 6*(4), 173.

Hernandez-Boussard, T., Zeidler, K., Barzin, A., Lee, G., & Curtin, C. (2013). Breast reconstruction national trends and healthcare implications. *The breast journal, 19*(5), 463-469.

Hershman, D. L., Richards, C. A., Kalinsky, K., Wilde, E. T., Lu, Y. S., Ascherman, J. A., . . . Wright, J. D. (2012). Influence of health insurance, hospital factors and physician volume on receipt of immediate post-mastectomy reconstruction in women with invasive and non-invasive breast cancer. *Breast cancer research and treatment, 136*(2), 535-545.

Hillman, A. J., Withers, M. C., & Collins, B. J. (2009). Resource dependence theory: A review. *Journal of management*.

Hlavac, M. (2014). oaxaca: Blinder-Oaxaca Decomposition in R. *Available at SSRN 2528391*.

Hoffman, C. (2008). *The uninsured: A primer: Key facts about Americans without health insurance*: Henry J. Kaiser Family Foundation.

Horwitz, J. R. (2005). Making profits and providing care: Comparing nonprofit, for-profit, and government hospitals. *Health affairs, 24*(3), 790-801.

Howard-McNatt, M., Forsberg, C., Levine, E. A., DeFranzo, A., Marks, M., & David, L. (2011). Breast cancer reconstruction in the elderly. *The American Surgeon, 77*(12), 1640-1643.

Hsia, R. Y.-J., Asch, S. M., Weiss, R. E., Zingmond, D., Liang, L.-J., Han, W., . . . Sun, B. C. (2012). California hospitals serving large minority populations were more likely than others to employ ambulance diversion. *Health affairs, 31*(8), 1767-1776.

Hu, E., & Alderman, A. K. (2007). Breast reconstruction. *Surgical clinics of north America, 87*(2), 453-467.

In, H., Jiang, W., Lipsitz, S. R., Neville, B. A., Weeks, J. C., & Greenberg, C. C. (2013). Variation in the utilization of reconstruction following mastectomy in elderly women. *Annals of surgical oncology, 20*(6), 1872-1879.

Iskandar, M. E., Dayan, E., Lucido, D., Samson, W., Sultan, M., Dayan, J. H., . . . Smith, M. L. (2015). Factors influencing incidence and type of postmastectomy breast reconstruction in an urban multidisciplinary cancer center. *Plastic and Reconstructive Surgery, 135*(2), 270e-276e.

Jacobson, J. A., Danforth, D. N., Cowan, K. H., d'Angelo, T., Steinberg, S. M., Pierce, L., . . . Okunieff, P. (1995). Ten-year results of a comparison of conservation with mastectomy in the treatment of stage I and II breast cancer. *New England Journal of Medicine, 332*(14), 907-911.

Jadav, S., Rajan, S. S., Abughosh, S., & Sansgiry, S. S. (2015). The role of socioeconomic status and health care access in breast cancer screening compliance among Hispanics. *Journal of Public Health Management and Practice, 21*(5), 467-476.

Jagsi, R., Jiang, J., Momoh, A. O., Alderman, A., Giordano, S. H., Buchholz, T. A., . . . Smith, B. D. (2014). Trends and variation in use of breast reconstruction in patients with breast cancer undergoing mastectomy in the United States. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology, 32*(9), 919-926. doi:10.1200/JCO.2013.52.2284 [doi]

Jann, B. (2008a). The Blinder-Oaxaca decomposition for linear regression models. *The Stata Journal, 8*(4), 453-479.

Jann, B. (2008b). Fairlie: Stata module to generate nonlinear decomposition of binary outcome differentials. *Statistical Software Components*.

Johnson, R. L., Roter, D., Powe, N. R., & Cooper, L. A. (2004). Patient race/ethnicity and quality of patient–physician communication during medical visits. *American Journal of Public Health, 94*(12), 2084-2090.

Jones, A. M. (2012). *The Elgar companion to health economics*: Edward Elgar Publishing.

Jones, F. L. (1983). On decomposing the wage gap: a critical comment on Blinder's method. *The Journal of human resources*, *18*(1), 126-130.

Jones, F. L., & Kelley, J. (1984). Decomposing differences between groups a cautionary note on measuring discrimination. *Sociological Methods & Research, 12*(3), 323-343.

Kaplan, C. P., Karliner, L. S., Hwang, E. S., Bloom, J., Stewart, S., Nickleach, D., . . . Nápoles, A. M. (2011). The effect of system-level access factors on receipt of reconstruction among Latina and white women with DCIS. *Breast cancer research and treatment, 129*(3), 909-917.

Katz, S. J., & Hofer, T. P. (1994). Socioeconomic disparities in preventive care persist despite universal coverage: breast and cervical cancer screening in Ontario and the United States. *JAMA, 272*(7), 530-534.

Keating, N. L., Weeks, J. C., Borbas, C., & Guadagnoli, E. (2003). Treatment of early stage breast cancer: do surgeons and patients agree regarding whether treatment alternatives were discussed? *Breast cancer research and treatment, 79*(2), 225-231.

Khoo, A., Kroll, S. S., Reece, G. P., Miller, M. J., Evans, G. R., Robb, G. L., . . . Schusterman, M. A. (1998). A comparison of resource costs of immediate and delayed breast reconstruction. *Plastic and Reconstructive Surgery, 101*(4), 964-968.

Kilbourne, A. M., Switzer, G., Hyman, K., Crowley-Matoka, M., & Fine, M. J. (2006). Advancing health disparities research within the health care system: a conceptual framework. *American Journal of Public Health, 96*(12), 2113-2121.

Komaromy, M., Grumbach, K., Drake, M., Vranizan, K., Lurie, N., Keane, D., & Bindman, A. B. (1996). The role of black and Hispanic physicians in providing health care for underserved populations. *New England Journal of Medicine, 334*(20), 1305-1310.

Kraatz, M. S., & Zajac, E. J. (2001). How organizational resources affect strategic change and performance in turbulent environments: Theory and evidence. *Organization Science, 12*(5), 632-657.

Krieger, L. M., & Lee, G. K. (2004). The economics of plastic surgery practices: Trends in income, procedure mix, and volume. *Plastic and Reconstructive Surgery, 114*(1), 192-199.

Kroll, S. S., Miller, M. J., Schusterman, M. A., Reece, G. P., Singletary, S. E., & Ames, F. (1994). Rationale for elective contralateral mastectomy with immediate bilateral reconstruction. *Annals of surgical oncology, 1*(6), 457-461.

Kronowitz, S. J., & Robb, G. L. (2009). Radiation therapy and breast reconstruction: a critical review of the literature. *Plastic and Reconstructive Surgery, 124*(2), 395-408. doi:10.1097/PRS.0b013e3181aee987 [doi]

Kruper, L., Holt, A., Xu, X. X., Duan, L., Henderson, K., Bernstein, L., & Ellenhorn, J. (2011). Disparities in reconstruction rates after mastectomy: patterns of care and factors associated with the use of breast reconstruction in Southern California. *Annals of surgical oncology, 18*(8), 2158-2165.

Kruper, L., Xu, X., Henderson, K., & Bernstein, L. (2011). Disparities in reconstruction rates after mastectomy for ductal carcinoma in situ (DCIS): patterns of care and factors associated with the use of breast reconstruction for DCIS compared with invasive cancer. *Annals of surgical oncology, 18*(11), 3210-3219.

Kruper, L., Xu, X. X., Henderson, K., Bernstein, L., & Chen, S. L. (2013). Utilization of mastectomy and reconstruction in the outpatient setting. *Annals of surgical oncology, 20*(3), 828-835.

Kulkarni, A. R., Sears, E. D., Atisha, D. M., & Alderman, A. K. (2013). Use of autologous and microsurgical breast reconstruction by US plastic surgeons. *Plastic and Reconstructive Surgery, 132*(3), 534-541.

Kurian, A. W., Lichtensztajn, D. Y., Keegan, T. H., Nelson, D. O., Clarke, C. A., & Gomez, S. L. (2014). Use of and mortality after bilateral mastectomy compared with other surgical treatments for breast cancer in California, 1998-2011. *JAMA, 312*(9), 902-914.

Lang, J. E., Summers, D. E., Cui, H., Carey, J. N., Viscusi, R. K., Hurst, C. A., . . . Vijayasekaran, A. (2013). Trends in post-mastectomy reconstruction: A SEER database analysis. *Journal of surgical oncology, 108*(3), 163-168.

Lasser, K. E., Hanchate, A. D., McCormick, D., Chu, C., Xuan, Z., & Kressin, N. R. (2016). Massachusetts health reform's effect on hospitals' racial mix of patients and on patients' use of safety-net hospitals. *Medical care, 54*(9), 827.

Lazovich, D., Solomon, C. C., Thomas, D. B., Moe, R. E., & White, E. (1999). Breast conservation therapy in the United States following the 1990 National Institutes of Health Consensus Development Conference on the treatment of patients with early stage invasive breast carcinoma. *Cancer, 86*(4), 628-637.

Lee, C. N., Belkora, J., Chang, Y., Moy, B., Partridge, A., & Sepucha, K. (2011). Are patients making high-quality decisions about breast reconstruction after mastectomy? [outcomes article. *Plastic and Reconstructive Surgery, 127*(1), 18-26. doi:10.1097/PRS.0b013e3181f958de [doi]

Levitz, G. S., & Brooke Jr, P. P. (1985). Independent versus system-affiliated hospitals: a comparative analysis of financial performance, cost, and productivity. *Health services research, 20*(3), 315.

Lewis, V. A., Fraze, T., Fisher, E. S., Shortell, S. M., & Colla, C. H. (2017). ACOs Serving High Proportions Of Racial And Ethnic Minorities Lag In Quality Performance. *Health affairs, 36*(1), 57-66.

Mahmood, U., Hanlon, A. L., Koshy, M., Buras, R., Chumsri, S., Tkaczuk, K. H., . . . Feigenberg, S. J. (2013). Increasing national mastectomy rates for the treatment of early stage breast cancer. *Annals of surgical oncology, 20*(5), 1436-1443.

Mahmoudi, E., Giladi, A. M., Wu, L., & Chung, K. C. (2015). Effect of federal and state policy changes on racial/ethnic variation in immediate postmastectomy breast reconstruction. *Plastic and Reconstructive Surgery, 135*(5), 1285-1294. doi:10.1097/PRS.0000000000001149 [doi]

Major, M., Devulapalli, C., Bello, R. J., Baltodano, P. A., Reinhardt, M. E., Manahan, M. A., . . . Rosson, G. D. (2016). The Effect of Timing on Breast Reconstruction Outcomes in Diabetic Women. *Plastic and Reconstructive Surgery Global Open, 4*(10).

Makadia, R., & Ryan, P. B. (2014). Transforming the Premier Perspective® Hospital Database into the Observational Medical Outcomes Partnership (OMOP) Common Data Model. *eGEMs, 2*(1).

Maly, R. C., Liu, Y., Kwong, E., Thind, A., & Diamant, A. L. (2009). Breast reconstructive surgery in medically underserved women with breast cancer. *Cancer, 115*(20), 4819-4827.

Mark, T. L., Evans, W. N., Schur, C. L., & Guterman, S. (1998). Hospital-physician arrangements and hospital financial performance. *Medical care*, 67-78.

Matros, E., Albornoz, C. R., Razdan, S. N., Mehrara, B. J., Macadam, S. A., Ro, T., . . . Pusic, A. L. (2015). Cost-effectiveness analysis of implants versus autologous perforator flaps using the BREAST-Q. *Plastic and Reconstructive Surgery, 135*(4), 937-946.

Mead, H., & Fund, C. (2008). *Racial and ethnic disparities in US health care: A chartbook*: Commonwealth Fund New York.

Meyer, L., & Aspegren, K. (1989). Long-term psychological sequelae of mastectomy and breast conserving treatment for breast cancer. *Acta Oncologica, 28*(1), 13-18.

Michalski, T. A., & Nattinger, A. B. (1997). The influence of black race and socioeconomic status on the use of breast-conserving surgery for medicare beneficiaries. *Cancer, 79*(2), 314-319.

Miller, A., & Chandru Kowdley, G. (2012). Breast reconstruction after mastectomy at an urban community-based program. *The American Surgeon, 78*(11), 1281-1284.

Mitchell, A. (2013). Medicaid disproportionate share hospital payments. *Washington, DC: Congressional Research Service*.

Morrow, M., Mujahid, M., Lantz, P. M., Janz, N. K., Fagerlin, A., Schwartz, K., . . . Lakhani, I. (2005). Correlates of breast reconstruction. *Cancer, 104*(11), 2340-2346.

Morrow, M., Scott, S. K., Menck, H. R., Mustoe, T. A., & Winchester, D. P. (2001). Factors influencing the use of breast reconstruction postmastectomy: a National Cancer Database study. *Journal of the American College of Surgeons, 192*(1), 1-8.

Moy, E., Valente Jr, E., Levin, R. J., & Griner, P. F. (1996). Academic medical centers and the care of underserved populations. *Academic Medicine, 71*(12), 1370-1377.

Nance-Nash, S. (2011). Breast Cancer's Financial Toll: The High Cost of Fighting for Your Life. Retrieved from https://www.aol.com/2011/10/05/breast-cancers-financial-toll-the-high-cost-of-fighting-for-yo/

National Cancer Institute. (2016). NCI-Designated Cancer Centers. Retrieved from http://www.cancer.gov/research/nci-role/cancer-centers

National Comprehensive Cancer Network. (2007). *NCCN clinical practice guidelines in oncology: breast cancer*: National Comprehensive Cancer Network.

National Institutes of Health Consensus Development Panel. (1992). Consensus statement: treatment of early-stage breast cancer. *J Natl Cancer Inst Monogr, 11*(1).

Needleman, J. (2003). Assessing the financial health of hospitals: Rockville, Md: Agency for Healthcare Research and Quality.

Nelson, J. A., Nelson, P., Tchou, J., Serletti, J. M., & Wu, L. C. (2012). The ethnic divide in breast reconstruction: a review of the current literature and directions for future research. *Cancer treatment reviews, 38*(5), 362-367.

Nerenz, D. R., McFadden, B., & Ulmer, C. (2009). *Race, ethnicity, and language data: standardization for health care quality improvement*: National Academies Press.

Newhouse, J. P. (1970). Toward a theory of nonprofit institutions: An economic model of a hospital. *The American Economic Review, 60*(1), 64-74.

Nicholson, R. M., Leinster, S., & Sassoon, E. M. (2007). A comparison of the cosmetic and psychological outcome of breast reconstruction, breast conserving surgery and mastectomy without reconstruction. *The Breast, 16*(4), 396-410.

O'Donnell, O., Van Doorslaer, E., & Wagstaff, A. (2006). Decomposition of inequalities in health and health care. In A. Jones (Ed.), *The Elgar Companion to Health Economics* (Vol. Second, pp. 179). Massachusetts: Edward Elgar Publishing.

Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *International economic review*, 693-709.

Oaxaca, R. L., & Ransom, M. R. (1994). On discrimination and the decomposition of wage differentials. *Journal of Econometrics, 61*(1), 5-21.

Office of Statewide Health Planning and Development. (2015). Patient Discharge Data. Retrieved from http://www.oshpd.ca.gov/HID/Products/PatDischargeData/PublicDataSet/

Offodile, A. C., Tsai, T. C., Wenger, J. B., & Guo, L. (2015). Racial disparities in the type of postmastectomy reconstruction chosen. *Journal of Surgical Research, 195*(1), 368-376.

Oliver, C. (1991). Strategic responses to institutional processes. *Academy of management Review, 16*(1), 145-179.

Onega, T., Weiss, J., Kerlikowske, K., Wernli, K., Buist, D. S. M., Henderson, L. M., . . . Tosteson, A. N. A. (2014). The influence of race/ethnicity and place of service on breast reconstruction for Medicare beneficiaries with mastectomy. *SpringerPlus, 3*(1), 1-9.

Paradise, J., & Garfield, R. (2013). What is Medicaid's impact on access to care, health outcomes, and quality of care? Setting the record straight on the evidence. *Kaiser Family Foundation, August*.

Parker, T. (2011). USDA Economic Research Service-Urban Influence Codes.

Pfeffer, J., & Salancik, G. (1978). The external control of organizations: A resource dependence approach. *NY: Harper and Row Publishers*.

Pink, G. H., Holmes, G. M., D'Alpe, C., Strunk, L. A., McGee, P., & Slifkin, R. T. (2006). Financial indicators for critical access hospitals. *The Journal of Rural Health, 22*(3), 229-236.

Piot-Ziegler, C., Sassi, M. L., Raffoul, W., & Delaloye, J. F. (2010). Mastectomy, body deconstruction, and impact on identity: a qualitative study. *British Journal of Health Psychology, 15*(3), 479-510.

Polednak, A. P. (1999). Postmastectomy breast reconstruction in Connecticut: trends and predictors. *Plastic and Reconstructive Surgery, 104*(3), 669-673.

Polednak, A. P. (2001). How frequent is postmastectomy breast reconstructive surgery? A study linking two statewide databases. *Plastic and Reconstructive Surgery, 108*(1), 73-77.

Popescu, I., Cram, P., & Vaughan-Sarrazin, M. S. (2011). Differences in admitting hospital characteristics for black and white Medicare beneficiaries with acute myocardial infarction. *Circulation, 123*(23), 2710-2716. doi:10.1161/CIRCULATIONAHA.110.973628 [doi]

Preminger, B. A., Trencheva, K., Chang, C. S., Chiang, A., El-Tamer, M., Ascherman, J., & Rohde, C. (2012). Improving access to care: breast surgeons, the gatekeepers to breast reconstruction. *Journal of the American College of Surgeons, 214*(3), 270-276.

Press, R., Carrasquillo, O., Sciacca, R. R., & Giardina, E.-G. V. (2008). Racial/ethnic disparities in time to follow-up after an abnormal mammogram. *Journal of Women's Health, 17*(6), 923-930.

Reuben, B. C., Manwaring, J., & Neumayer, L. A. (2009). Recent trends and predictors in immediate breast reconstruction after mastectomy in the United States. *The American Journal of Surgery, 198*(2), 237-243.

Rhoades, S. A. (1993). The Herfindahl-Hirschman Index *Fed.Res.Bull., 79*, 188.

Ritter, J. A., & Taylor, L. J. (2011). Racial disparity in unemployment. *The Review of Economics and Statistics, 93*(1), 30-42.

Rizki, H., Nkonde, C., Ching, R., Kumiponjera, D., & Malata, C. (2013). Plastic surgical management of the contralateral breast in post-mastectomy breast reconstruction. *International Journal of Surgery, 11*(9), 767-772.

Robb, G. (2007). Immediate versus delayed breast reconstruction. *Breast Cancer Research, 9*(1), 1.

Rosenberg, S. M., Tamimi, R. M., Gelber, S., Ruddy, K. J., Kereakoglow, S., Borges, V. F., . . . Partridge, A. H. (2013). Body image in recently diagnosed young women with early breast cancer. *Psycho‐Oncology, 22*(8), 1849-1855.

Rosson, G. D., Singh, N. K., Ahuja, N., Jacobs, L. K., & Chang, D. C. (2008). Multilevel analysis of the impact of community vs patient factors on access to immediate breast reconstruction following mastectomy in Maryland. *Archives of Surgery, 143*(11), 1076-1081.

Rubin, L. R., Chavez, J., Alderman, A., & Pusic, A. L. (2013). 'Use what God has given me': Difference and disparity in breast reconstruction. *Psychology & Health, 28*(10), 1099-1120.

Rubino, C., Figus, A., Lorettu, L., & Sechi, G. (2007). Post-mastectomy reconstruction: a comparative analysis on psychosocial and psychopathological outcomes. *Journal of plastic, reconstructive & aesthetic surgery, 60*(5), 509-518.

Ryan, C. L., & Bauman, K. (2016). Educational Attainment in the United States: 2015: Current Population Reports, P20-xxx. Washington, DC: US Census Bureau.

Saha, S., Davila, A. A., Ver Halen, J. P., Jain, U. K., Hansen, N., Bethke, K., . . . Kim, J. Y. S. (2013). Post-mastectomy reconstruction: A risk-stratified comparative analysis of outcomes. *The Breast, 22*(6), 1072-1080.

Sallis, J. F., & Glanz, K. (2009). Physical activity and food environments: solutions to the obesity epidemic. *Milbank Quarterly, 87*(1), 123-154.

Saloner, B., & Lê Cook, B. (2013). Blacks and Hispanics are less likely than whites to complete addiction treatment, largely due to socioeconomic factors. *Health affairs*, *32*(1), 135-145.

Schain, W. S., Wellisch, D. K., Pasnau, R. O., & Landsverk, J. (1985). The sooner the better: a study of psychological factors in women undergoing immediate versus delayed breast reconstruction. *The American Journal of Psychiatry*.

Schatzkin, A. (1984). The relationship of inpatient racial composition and hospital closure in New York City. *Medical care*, *22*(5), 379-387.

Scott, W. R., & Davis, G. F. (2007). Organizations and organizing. *Rational, natural, and open system perspectives.Upper Sadle River: Pearson*.

Shavers, V. L., & Brown, M. L. (2002). Racial and ethnic disparities in the receipt of cancer treatment. *Journal of the National Cancer Institute*, *94*(5), 334-357.

Shippee, T. P., Kozhimannil, K. B., Rowan, K., & Virnig, B. A. (2014). Health insurance coverage and racial disparities in breast reconstruction after mastectomy. *Women's Health Issues*, *24*(3), e261-e269.

Silvestre, J., Serletti, J. M., & Chang, B. (2016). Disparities in Cosmetic Procedures Performed by Plastic Surgery Residents. *Plastic and Reconstructive Surgery–Global Open*, *4*(9S), 104-105.

Silvestre, J., Serletti, J. M., & Chang, B. (2017). Racial and Ethnic Diversity of US Plastic Surgery Trainees. *Journal of surgical education*, *74*(1), 117-123.

Sisco, M., Du, H., Warner, J. P., Howard, M. A., Winchester, D. P., & Yao, K. (2012). Have we expanded the equitable delivery of postmastectomy breast reconstruction in the new millennium? Evidence from the national cancer data base. *Journal of the American College of Surgeons*, *215*(5), 658-666.

Slavin, S. A., & Halperin, T. (2004). *Reconstruction of the breast conservation deformity.* Paper presented at the Seminars in plastic surgery.

Spear, S. L., Mardini, S., & Ganz, J. C. (2003). Resource cost comparison of implant-based breast reconstruction versus TRAM flap breast reconstruction. *Plastic and Reconstructive Surgery, 112*(1), 101-105.

Stevens, L. A., McGrath, M. H., Druss, R. G., Kister, S. J., Gump, F. E., & Forde, K. A. (1984). The psychological impact of immediate breast reconstruction for women with early breast cancer. *Plastic and Reconstructive Surgery, 73*(4), 619-626.

Tammemagi, C. M., Nerenz, D., Neslund-Dudas, C., Feldkamp, C., & Nathanson, D. (2005). Comorbidity and survival disparities among black and white patients with breast cancer. *JAMA, 294*(14), 1765-1772.

The Breast Reconstruction Awareness Campaign. (2016). Braest Cancer Patient Education Act. Retrieved from http://www.breastreconusa.org/breast-cancer-patient-education-act/

The Henry J. Kaiser Family Foundation. (2013). *Health Coverage by Race and Ethnicity: The Potential Impact of the Affordable Care Act*. Retrieved from https://kaiserfamilyfoundation.files.wordpress.com/2014/07/8423-health-coverage-by-race-and-ethnicity.pdf.

The Henry J. Kaiser Family Foundation. (2015). Population Distribution by Race/Ethnicity. Retrieved from http://kff.org/other/state-indicator/distribution-by-raceethnicity/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

Timmins, C. L. (2002). The impact of language barriers on the health care of Latinos in the United States: a review of the literature and guidelines for practice. *Journal of Midwifery & Women's Health, 47*(2), 80-96.

Tønseth, K., Hokland, B., Tindholdt, T., Åbyholm, F., & Stavem, K. (2008). Quality of life, patient satisfaction and cosmetic outcome after breast reconstruction using DIEP flap or expandable breast implant. *Journal of plastic, reconstructive & aesthetic surgery, 61*(10), 1188-1194.

Torio, C., & Andrews, R. (2006). Geographic variation in potentially preventable hospitalizations for acute and chronic conditions, 2005–2011: Statistical Brief# 178: Agency for Health Care Policy and Research (US), Rockville (MD).

Trust for America's Health and Robert Wood Johnson Foundation. (2014). Racial and ethnic Disparity in Obesity. Retrieved from http://stateofobesity.org/disparities/

Tseng, J. F., Kronowitz, S. J., Sun, C. C., Perry, A. C., Hunt, K. K., Babiera, G. V., . . . Ames, F. C. (2004). The effect of ethnicity on immediate reconstruction rates after mastectomy for breast cancer. *Cancer, 101*(7), 1514-1523.

Tseng, W. H., Stevenson, T. R., Canter, R. J., Chen, S. L., Khatri, V. P., Bold, R. J., & Martinez, S. R. (2010). Sacramento area breast cancer epidemiology study: use of postmastectomy breast reconstruction along the rural-to-urban continuum. *Plast Reconstr Surg, 126*(6), 1815-1824. doi:10.1097/PRS.0b013e3181f444bc

Tuttle, T. M., Habermann, E. B., Grund, E. H., Morris, T. J., & Virnig, B. A. (2007). Increasing use of contralateral prophylactic mastectomy for breast cancer patients: a trend toward more aggressive surgical treatment. *Journal of Clinical Oncology, 25*(33), 5203-5209.

U. S. Department of Health and Human Services (2016). [Area Health Resource Files (AHRF)]. Web Page.

United States Census Bureau. (2010). 2010 FIPS Codes for Counties and County Equivalent Entities. Retrieved from https://www.census.gov/geo/reference/codes/cou.html

Waljee, J. F., Hu, E. S., Ubel, P. A., Smith, D. M., Newman, L. A., & Alderman, A. K. (2008). Effect of esthetic outcome after breast-conserving surgery on psychosocial functioning and quality of life. *Journal of Clinical Oncology, 26*(20), 3331-3337.

Walton, L., Ommen, K., & Audisio, R. A. (2011). Breast reconstruction in elderly women breast cancer: a review. *Cancer treatment reviews, 37*(5), 353-357.

Ward, E., Jemal, A., Cokkinides, V., Singh, G. K., Cardinez, C., Ghafoor, A., & Thun, M. (2004). Cancer disparities by race/ethnicity and socioeconomic status. *CA: a cancer journal for clinicians, 54*(2), 78-93.

Weech-Maldonado, R., Elliott, M. N., Pradhan, R., Schiller, C., Dreachslin, J., & Hays, R. D. (2012). Moving towards culturally competent health systems: Organizational and market factors. *Social science & medicine, 75*(5), 815-822.

Weigelt, B., Peterse, J. L., & Van't Veer, L. J. (2005). Breast cancer metastasis: markers and models. *Nature reviews cancer, 5*(8), 591-602.

Weisgrau, S. (1995). Issues in rural health: Access, hospitals, and reform. *Health care financing review, 17*(1), 1.

Wellisch, D. K., Schain, W. S., Noone, R. B., & Little Iii, J. W. (1985). Psychosocial correlates of immediate versus delayed reconstruction of the breast. *Plastic and Reconstructive Surgery, 76*(5), 713-718.

Williams, D. R., & Jackson, P. B. (2005). Social sources of racial disparities in health. *Health affairs, 24*(2), 325-334.

Wong, S. M., Freedman, R. A., Sagara, Y., Aydogan, F., Barry, W. T., & Golshan, M. (2016). Growing Use of Contralateral Prophylactic Mastectomy Despite no Improvement in Long-term Survival for Invasive Breast Cancer. *Annals of Surgery*.

Yang, R. L., Newman, A. S., Lin, I. C., Reinke, C. E., Karakousis, G. C., Czerniecki, B. J., . . . Kelz, R. R. (2013). Trends in immediate breast reconstruction across insurance groups after enactment of breast cancer legislation. *Cancer, 119*(13), 2462-2468.

Yang, R. L., Newman, A. S., Reinke, C. E., Lin, I. C., Karakousis, G. C., Czerniecki, B. J., . . . Kelz, R. R. (2013). Racial disparities in immediate breast reconstruction after mastectomy: impact of state and federal health policy changes. *Annals of surgical oncology, 20*(2), 399-406.

Youdelman, M. (2007). Medicaid and SCHIP reimbursement models for language services. *Washington, DC: National Health Law Program*.

Yueh, J. H., Slavin, S. A., Adesiyun, T., Nyame, T. T., Gautam, S., Morris, D. J., . . . Lee, B. T. (2010). Patient satisfaction in postmastectomy breast reconstruction: a comparative evaluation of DIEP, TRAM, latissimus flap, and implant techniques. *Plastic and Reconstructive Surgery, 125*(6), 1585-1595.

Yun, M. S. (2005). A simple solution to the identification problem in detailed wage decompositions. *Economic inquiry, 43*(4), 766-772.

Zabicki, K., Colbert, J. A., Dominguez, F. J., Gadd, M. A., Hughes, K. S., Jones, J. L., . . . Smith, B. L. (2006). Breast cancer diagnosis in women≤ 40 versus 50 to 60 years: increasing size and stage disparity compared with older women over time. *Annals of surgical oncology*, *13*(8), 1072-1077.

Zinn, J., & Flood, A. B. (2009). Commentary: Slack Resources in Health Care Organizations—Fat to Be Trimmed or Muscle to Be Exercised? *Health services research*, *44*(3), 812-820.

Zinn, J. S., Weech, R. J., & Brannon, D. (1998). Resource dependence and institutional elements in nursing home TQM adoption. *Health services research*, *33*(2 Pt 1), 261-273.

Vita

Jaya Khushalani was born on 13th December, 1985 in Mumbai, India. In 2009, she graduated from Grant Medical College and Sir J.J. Group of Hospitals, Maharashtra University of Health Sciences at Mumbai, India with a Bachelor in Medicine and Bachelor in Surgery (MBBS) degree. She received a Master of Hospital Administration degree in 2011 from Tata Institute of Social Sciences at Mumbai, India. She joined Sir HN Reliance Foundation Hospital in 2011 and worked there as a Patient Services Manager until 2013. In the Fall of 2013, she enrolled in the Department of Health Administration's doctoral program at Virginia Commonwealth University. She completed the requirements for the Ph.D. degree in August, 2017.