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Factors for Selecting a Consumer Directed Health Care Plan

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Factors for Selecting a Consumer Directed Health Care Plan

A dissertation submitted in partial fulfillment of the requirements for the degree of
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by

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List of Abbreviations

CDHC = **C**onsumer **D**irected **H**ealth **C**are

CDHP = **C**onsumer **D**irected **H**ealth **P**lan

ESI = **E**mployer **S**ponsored **I**nsurance (group health plan(s) offered to employees by their employer)

HDHP = **H**igh **D**eductible **H**ealth **P**lan (plan associated with CDHPs)

HRA = **H**ealth **R**eimbursement **A**ccount (type of CDHP with employer funded Personal Care Account)

HSA = **H**ealth **S**avings **A**ccount (type of Personal Care Account associated with CDHPs)

FSA = **F**lexible **S**pending **A**ccount (pre-tax savings account for out of pocket medical costs)

PCA = **P**ersonal **C**are **A**ccount (pre-tax savings account for medical costs used with CDHPs)

Abstract

FACTORS FOR SELECTING A CONSUMER DIRECTED HEALTH CARE PLAN

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

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Health Reimbursement Arrangements (HRAs) and Health Savings Account (HSA) eligible High Deductible Health Plans (HDHPs) emerged as a new health care insurance models referred to as Consumer Directed Health Plans (CDHPs) in the early 2000s. The purpose of this study is to examine the association between enrollees' prior financial experiences as they relate to health care access and use with plan choice when a Managed Care Preferred Provider Organization (PPO), HRA, and HSA eligible HDHP are offered concurrently in an ESI program.

It is important to examine new health insurance structures, such as CDHPs, to better understand their impact on enrollees' choice of health plan. Factors that determine enrollees' plan choice can influence the distribution of socio-economic, health risk, and behavioral characteristics across plans. These factors in turn can affect the financial costs, risk pools, and long-term solvency of such plans.

The theoretical framework used in this study is adapted from Andersen's behavioral model and suggests economic enabling resources, self-perceived need for health care, predisposing characteristics, and plan cost character ristics are significant factors in Managed Care verses CDHP choice. First, descriptive statistics are used to describe the enrollee population relative to available plans. Then, multivariate analyses are used to examine hypotheses developed to examine employee earnings, prior Flexible Spending Account (FSA) participation, prior total cost sharing and Relative Risk Scores (RRS).

Findings suggest first that CDHPs benefit from favorable selection, however the type of CDHP is a critical factor in the dynamics of plan choice. It is important not to categorize different forms of HRAs and HSA eligible HDHPs generically as CDHPs, but treat them as unique based upon their cost and administrative characteristics. Second, enrollees appear to select a plan that minimizes their future financial exposure based on past ESI experiences. Finally, CDHP choice and enrollee earnings may not have a simple linear relationship as suggested by prior research. Plan choice may depend largely on the dynamics between factors of economic resources, perceived need, and plan cost characteristics.

Chapter 1 – Introduction

Introduction and Problem Statement

Rising health care expenditures and the related cost of Employer Sponsored Insurance (ESI) have contributed to the formation of Consumer Directed Health Plans (CDHPs). The development of CDHPs represents one of the first large scale efforts to design health insurance plans around enrollee demand cost controls, and is intended to reduce or slow the rate of growth for ESI costs through consumers' engagement in health care decision-making. CDHP design emphasizes cost sharing, but cost and quality information are also made available to encourage enrollees to make effective and efficient health care purchase decisions.

An important part of any change in health insurance structure is the impact on why enrollees choose one health plan over another. If available health plans' cost sharing or utilization parameters change, it is essential to understand potential changes in the factors that influence plan choice. Factors that determine enrollees' plan choice can influence the distribution of socio-economic, health risk, and behavioral characteristics across plans. These factors in turn can affect the financial costs, risk pools, and long-term solvency of such plans. Furthermore, many enrollees have little or no choice

in the decision to switch plans. In 2012, nearly 67 percent of all enrollees who changed plans, did so due to employer-initiated changes to the plans offered in their Employer Sponsored Insurance (ESI) program (Cunningham, 2013). Therefore it is important it is important to

understand factors that affect consumers' decision-making processes when faced with selecting a health plan as well as for employers to consider that characteristics of new or different plans may have a significant impact on their employees and the ESI program. These issues are discussed in more detail in Chapters 2 and 3.

Purpose of the Study

The purpose of this study is to examine CDHP enrollment and the factors that contribute to plan choice as they relate to health care access and use when a Managed Care PPO, HRA, and HSA eligible HDHP are offered concurrently in an employer health insurance program. Enrollee demographics and plan cost characteristics will be accounted for as controls.

Background

Employer Sponsored Insurance (ESI) makes up the largest market for Consumer Directed Health Plans. Approximately 56 percent of the US population is insured through ESI (Kaiser Family Foundation and Health Research And Educational Trust, 2012)). Of that 56 percent, CDHP enrollment has grown from 4 percent in 2006 to 19 percent in 2012, with 31 percent of employers offering at least one CDHP plan (Kaiser Family Foundation and Health Research And Educational Trust, 2012)). Furthermore, insurance premiums for health care are the largest single ESI cost to employers. Insurance premiums are directly linked to claims experience and expected payout of benefits. As health care costs increase, premiums increase to cover expected payouts. Average ESI health insurance premiums increased 34 percent more than salaries and wages between 1996 and 2005, and the average insurance premiums paid by employees and employers reached $5,615 for single and $15,745 for family coverage in 2012 (Eibner & Marquis, 2008; Claxton, et al., 2012; US Department of Labor, 2006,).

There have been a number of efforts to slow the rate of inflation in health care cost due to its impact on ESI costs. To remain competitive, third party payers have played a primary role by experimenting with ways to reduce ESI cost inflation. Cost containment programs have become a focus for third party payers in the1960s. Many factors such as an aging population and technology advancement contribute to health care cost inflation, but they are not affected by third party payer intervention. Therefore, cost containment efforts have largely focused on the structure of insurance policies that establish consumer cost sharing parameters, provider incentives, and procedures that control how services are utilized and financed. Consumer Directed Health Plans have emerged as part of this effort.

There is a dearth of accessible data, and subsequently research that examines plan choice when enrollees choose between Managed Care and CDHPs. Of ten studies that examine CDHP choice, three study the same employer for the same period (Fowles, Kind, Braun, & Bertko, 2004; Lo Sasso, Rice, Gabel, & Whitmore, 2004; Tollen, Ross, & Poor, 2004), six pre-date CDHPs as a more defined and distinct insurance model (Fowles et al., 2004; Lo Sasso et al., 2004; Parente, Feldman, & Christianson, 2004a, 2004b, 2008; Tollen et al., 2004), and six do not discuss a theoretical structure (Barry, Cullen, Galusha, Slade, & Busch, 2008; U.S. Department of Health & Human Services, 2009; U.S. General Accountability Office, 2006; Lo Sasso et al., 2004; Parente et al., 2004b; Tollen et al., 2004). Preliminary research that examines Managed Care verses CDHP choice has a focus on income, socio-demographic characteristics, and the health of enrollees (Barry et al., 2008; U.S. Department of Health & Human Services, 2009; Fowles et al., 2004; GAO, 2006; Greene, Hibbard, Dixon, & Tusler, 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004). These studies suggest favorable selection and a positive association with income for CDHPs. A health insurance plan experiences

favorable selection when healthier enrollees are more likely to chose it, and less healthy enrollees are more likely to chose a different plan. However, a broader scope of financial experiences related to prior health care access and use that may contribute to enrollees' plan choice, are not thoroughly assessed. Additionally, although research examines the relationship between income and CDHP choice, it assumes a simple linear association, which may not be the case. Furthermore, financial factors of enrollees' good or poor health are only examined indirectly as part of prior utilization measures. Therefore, this study examines enrollees' prior financial experience of health care use, health care access, and health risk, as independent factors of CDHP choice. Enrollee health risk represents their likelihood to need and/or incur the use of medical. The analyses include an assessment of whether a linear association exists between CDHP and income and whether prior health utilization and health risk influence plan choice.

Conceptual Framework

A conceptual framework is developed to structure this study. Adaptations are needed because at the time the model was developed there was little choice in health insurance plan type. Today there are multiple Managed Care and CDHP types that can affect the access and use of health care by enrollees. The framework is adapted from Andersen's behavioral model and suggests economic enabling resources, self-perceived need for health care, predisposing characteristics, and plan cost characteristics are significant factors in Managed Care verses CDHP choice. Andersen's model emphasizes the importance of possessing the necessary resources to access and use health care services, individuals' characteristics that affect the means and manner health care is accessed and used, and the prominent role of third party insurance coverage such as ESI (Ronald Andersen, 1995; Ronald Andersen & Newman, 2005).

At the time the behavioral model was developed, the ESI market was relatively monolithic; it was dominated by fee for service insurance plans prior to Managed Care and CDHPs. An adaptation of the behavioral model is used because CDHPs represent significant changes to: the way enrollee resources are required to access and use health care, the consequences of enrollee characteristics interaction with different plan features, and the cost characteristics of the plans. Andersen's model was developed to examine the access and use of health care services. This study suggests plan choice is an outcome that defines the access and use of health care services, and factors associated with the prior access and use of health care are predictors of subsequent years' plan choice.

Research Questions

This study strives to answer two research questions. The first research question: *What are the utilization and distribution characteristics of various types of health insurance plans across the employee population?* is examined via descriptive statistics, and is discussed in Chapter 4. The second research question: *What economic factors are associated with the choice of health plan type?* is examined via hypotheses developed in Chapter 3 to test the association between this study's independent variables and plan choice. Hypotheses developed in Chapter 3 examine the relationship between plan choice and employee gross earnings, prior total cost sharing, prior participation in a Flexible Savings Account (FSA), and relative health risk of all household enrollees.

Scope and Approach

This study employs a cross sectional non-experimental ex post facto design that examines data from a single large employer in multiple regions of the United States. The unit of analysis is the enrollee household. First, descriptive statistics are used to describe the enrollee population

relative to available plans. Then, multivariate analysis is used to examine each hypothesis developed in Chapter 3 to answer the second research question.

This study examines census data from a single large employer's enrollee population. Enrollee and plan data are collected from the employer's human resources information system (HRIS), and a data management vendor contracted by the employer's broker for managing their ESI claims data.[1] The data incorporates health plan enrollment, claims, socio-demographic, and plan data related to the ESI program for 2005 and 2006. The data include employees and household members eligible for benefits who were continuously enrolled from January 1, 2005 to December 31, 2009, and under 60 years of age. By including only those continuously enrolled through 2009 and more than five years before Medicare eligibility, the study focuses on employee households that demonstrate the expectation to maintain a relationship with this employer's ESI program. This is important because CDHPs allow unused funds for medical expenditure to accrue in Personal Care Accounts (PCA), and enrollees who don't expect to have a long-term employment relationship may view health care PCAs with prejudice. This also limits enrollees of short duration who may behave differently if they are more transient in their employer employee relationship.

The employer granting data access for this research is a regulated publicly traded holding company and employs about 20,000 persons. The company has employees in East North Central, South Atlantic, East South Central, and West South Central United States. The participating employer's workforce is comprised of hourly and salaried positions including administrative, technical, skilled trades and non-skilled laborers (union and non-union), various levels of management, and generalists.

The company changed the mix of plans offered for the 2006 calendar year. Plans chosen were effective January 1, 2006, and included new Managed Care and CDHP choices. Thus, 2006 enrollment presented all eligible enrollees with a new choice set of health plans. To examine factors related to plan choice, claims and employer personnel data are captured for the full year prior to the plan choice study period, and include all eligible enrollees that fit study inclusion parameters described in Chapter 4 - Analytical Methods. Plan choice is viewed as an insurance contract level (household) outcome. All enrollees covered by a contract influence plan choice decisions as either direct decision-making participants, or through the influence of a collective prior experience and personal characteristics on the choice of a single decision-maker.

Significance of Study

This study will contribute to the body of research in seven ways. First this study offers additional evidence where there is little available data. Findings of favorable selection for CDHPs are based on a few studies with limited data, and examine divergent groups or types of plans. Second, enrollees that were added or dropped from enrollee plans mid year are accounted for in contract level measures. Research to date does not address this issue. Third, sensitivity analyses are performed to assess data limitations. Data limitations addressed by sensitivity analyses in this study, but unaccounted for by other research, include: sources of health insurance other than the study employer, and individual verses household level of measurement for variables (such as income, job type, ethnicity, and marital status). Next, this research will examine the broader influence of enrollees' prior financial experience and household health risk related to health care access and use, and control for enrollee and plan characteristics. Fifth, this study will examine if the relationship between income and CDHP enrollment is linear. Research suggests that income has a positive association with CDHP enrollment. However, a non-linear

relationship may exist and remains untested. Sixth, hypotheses are formulated for this study based on a theoretical structure specifically developed to examine influences on the access and use of health care services. The adaptation of a social science behavioral framework provides for broad considerations of enrollee characteristics and health risk, prior health related cost experiences, and plan cost characteristics. Finally, this research analyzes more recent data than most studies. The employer in this study initially offered a CDHP in 2006. Thus, the 2006 enrollment study period will be more representative of modern CDHPs. Furthermore, this study examines an ESI program that includes the most evenly distributed enrollment mix to date. The study group includes approximately 40 percent of enrollees in a CDHP.

The research suffers from three primary limitations. First, as with other research, the difficulty in identifying and gaining access to data results in the study of a single employer and limits genralizability. There are no national data sets available for CDHPs. CDHP data must be solicited directly from sources, such as insurers or employers that offer such plans. Second, the use of secondary data limits available measures. Sensitivity analyses are needed to assess error associated with data limitations. The difficulty of accessing data makes continued research important to examine influences on plan selection for different populations and ESI structures. Third, because the study data are limited and make non-experimental methods necessary, it is not possible to prove direct causal relationships.

Summary of Remaining Chapters

This chapter provides an overview of the remaining chapters. Chapter 2 reviews literature in detail to provide a background on how Consumer Directed Health Care (CDHC) developed and the research that has examined individual, household, environmental and plan attributes' association with enrollee plan choice when CDHPs are offered concurrently with

Managed Care plans. Chapter 3 describes Andersen's Behavioral Theory and adaptations to form a conceptual framework that guides the formulation of hypotheses tested by this study. Chapter 4 details the study design, methods, and analytical procedures used to describe the enrollee population and test those hypotheses. Data sources, collection, and measures used are also discussed in Chapter 4. Chapter 5 illustrates the findings from the analyses, and Chapter 6 details the results and pertinent conclusions that can, and cannot, be drawn from those findings.

Chapter 2 – Literature Review

This chapter is divided into two broad sections, Background of Consumer Directed Health Plans (CDHP) and Overview of Empirical Research that examines CDHP choice. The background section summarizes how health care cost inflation has encouraged private third party payers to experiment with plan design to control costs, such as with Health Maintenance Organizations (HMOs), Preferred Provider Organizations (PPOs), and CDHPs to make health insurance premiums more affordable for employers and enrollees in the employer sponsored insurance (ESI) market. The section then describes the underlying economic rationale and government actions taken to sanction CDHC. CDHC market expansion and key features of these plans are then outlined.

The empirical research section examines research on consumer choice of CDHPs. However, because CDHPs are relatively new and empirical research is limited, empirical research regarding consumer choice of HMO and PPO models will be reviewed as well. The chapter ends with a summary of findings and a conclusion that identifies gaps in the literature and contributions this study will bring to the existing body of evidence.

Background

Since the mid 1960s, healthcare expenditures in the United States have consistently grown faster than the overall economy's rate of inflation, and consumed increasingly more of the gross domestic product (GDP). Health care expenditures grew from 5.4 percent of GDP in 1961

to 17.9 percent by 2011 (Centers for Medicare & Medicaide Services, 2013). Health care expenditures continue to consume a greater share of GDP with an inflation rate that exceeds that of the overall economy. The Centers for Medicare and Medicaid Services (CMS) project the annual rate of inflation in health care expenditures will remain near 6.7 percent through 2017 exceeding the overall economy's rate of 4.9 percent. Health care expenditures are expected to reach 19.6 percent of GDP and cost 4.5 trillion dollars per year by 2019 (Centers for Medicare & Medicaide Services, 2013).

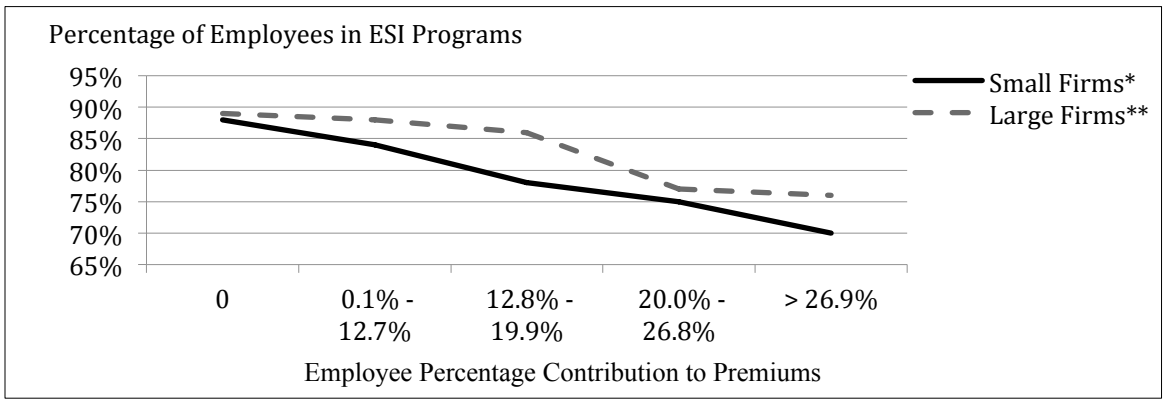
Increased health care costs have encouraged private third party payers to take steps to control benefits costs. In 2012 employers, on average, paid approximately 72 percent and employees 28 percent of employer-sponsored insurance (ESI) premiums for family coverage (Kaiser Family Foundation and Health Research And Educational Trust, 2012). Approximately 56 percent of the US population is insured through ESI (Claxton, et al., 2012). Increasing health care costs have led to higher insurance premiums in the ESI market.

Insurance premiums for health care are the largest single ESI cost to employers (Garrett & Buettgens, 2011). Insurance premiums are directly linked to claims experience and expected payout of benefits. As health care costs increase, premiums increase to cover expected payouts. Mirroring national health care cost inflation, average ESI health insurance premiums increased 34 percent more than salaries and wages between 1996 and 2005, and the average insurance premiums paid by employees and employers reached $5,615 for single and $15,745 for family coverage in 2012 (Eibner & Marquis, 2008; Claxton, et al., 2012; US Department of Labor, 2006). In 1961, employers spent 1.3 percent and individuals paid 0.07 percent of wages and salaries for group health insurance. By 2012, group health insurance costs increased to approximately 12 percent of wages and salaries for employers ((*Employer Costs for Employee*

Compensation, 2012). In the last decade ESI premiums increased 131 percent between 1999 and 2009, and employee contributions increased by 128 percent (Claxton, DiJulio, Finder & Lundy, 2010). According to data from the Bureau of Economic Analysis, employers spent $623.5 billion on group health benefits in 2006, while employees spent an additional $279.6 billion on health insurance premiums and $38.8 billion on health savings accounts.

Increased ESI costs have been partly absorbed by employers and partly passed on to employees in the form of contributions toward their benefits (U.S. Bureau of Economic Analysis, 2008). Although larger employers are more often able to absorb increased costs, ESI enrollment rates have dropped in recent years. Increased costs are believed to be one reason fewer employers offering benefits, and fewer employees accepting ESI group health insurance.[2] Employers who offer health benefits dropped from 69 percent in 2000 to 61 percent in 2012 (Claxton, et al., 2012). Figure 1 illustrates how ESI enrollment has declined as employee premium contributions increased. It also illustrates that increased employee premium contributions affects all employers, but small employers have been affected more (Eibner & Marquis, 2008; U.S. Department of Labor, 2006). Employers experience reduced ESI enrollment as cost increases are passed on to enrollees, but benefits offered by companies with fewer than 1,000 employees are particularly affected (North Carolina & the Institute of Medicine Task Force on Covering the Uninsured, 2006). The cost to such employers is important because they comprise 94.5 percent of all businesses that offer group health benefits and employ more than 116,000 million workers (North Carolina & the Institute of Medicine Task Force on Covering the Uninsured, 2006; U.S. Department of Commerce, 2008).

Figure 1. 2005 & 2006 Premium Contribution Effects on ESI Take-up Rates



Notes. Source: Kaiser/HRET Annual Employer Health Benefits Surveys (Kaiser Family Foundation, 2007a)

* Small Firms 3-199 employees
** Large Firms 200 or more employees

Overview of Health Insurance Cost Control Efforts

Cost containment programs became a focus for third party payers since the 1960s. Many factors such as an aging population and technology advancement are the largest contributors to health care cost inflation (Shi & Singh, 2003). For third party payers, cost containment efforts have largely focused on health insurance plan design (Thorpe, 2005). Plan design refers to the structure of an insurance policy that establishes consumer cost sharing parameters, provider incentives, and procedures that control how services are utilized and financed.

Cost control efforts in health plan design can be categorized as supply or demand side initiatives. Supply side controls reduce the supply (or availability) of health care services through limiting the number of providers eligible for indemnity and a centralized coordination of care to limit utilization of services. These cost controls limit approved services, manage/coordinate care, limit the use of technology and name-brand pharmaceuticals, establish some physician practice guidelines, and determine payment amounts and methods (Garrison, 1991).

Alternatively, demand side controls generally increase the financial risk assumed by the enrollee to decrease utilization of some or all services. Demand side controls are intended to limit discretionary care, offer incentives for the efficient use of services, and propagate cost and quality conscious behavior. They include enrollee cost sharing, educating enrollees on the effective and efficient use of health services, and making cost and quality information about providers available. However, cost sharing, which is the primary demand side control, generally describes any portion of health insurance or health care services cost borne by the enrollee. Since the 1980s, cost sharing has increased in the proportion of premiums paid by the employee, and the burden of co-pays, deductibles, and coinsurance (Ginsburg, Strunk, Banker, & Cookson, 2006; Newhouse, 2004; Short, 1988).

Managed Care cost containment efforts. Many modern cost containment strategies through health insurance plan design were developed for managed care plans. The dominant modern form of managed care design in the late 1970s and early 1980s was Health Maintenance Organizations (Shi & Singh, 2003). Health Maintenance Organizations (HMOs) were later used as a basis for additional designs such as Preferred Provider Organizations (PPOs) and Point of Service (POS) Plans.

Health Maintenance Organizations. Although HMOs originated in the late 19th century, growth in the number of these plans did not occur until the late 1970s after the Health Maintenance Organization Act of 1973 was passed, which provided incentives through grants and loans for private insurance companies to establish HMO plans (Shi & Singh, 2003; Tufts Managed Care Institute, 1998). HMOs were intended to control health care cost inflation through supply side controls and competition created by increasing the number of plans that consumers could choose (Shi & Singh, 2003).

There are six common HMO cost control features. First, many use closed provider panels with contractual agreements between providers and insurers to purchase prepaid medical care in return for greater or assured patient volume and revenues. Second, some HMO models use open provider panels and assure patient volume in exchange for capped rates.. Third, a primary care physician is used as a gatekeeper to guide patients to less intensive services and suppress the use of discretionary care. Fourth, medical case managers are commonly used to review, approve, and audit the use of care. Fifth, many HMOs include a provision to prohibit treatment with non-contracting providers who have not accepted the insurance terms. The sixth feature common to many HMOs is an expressed emphasis on preventive and conservative care.

Private insurance HMO enrollment remained low through the 1980s, but grew to become the dominant model by the 1990s. Enrollment grew from six million enrollees in 1976 to a peak of 80.9 million in 2000 (Shi & Singh, 2003). This growth was largely attributable to employers who chose lower premium HMOs in effort to reduce escalation in health care benefit costs (Shi & Singh, 2003). However, as HMOs became the most common form of ESI, a public backlash ensued due to restrictive managed care features. Medical professional and consumer complaints prompted legislators to regulate restrictive HMO care restrictions, and ensure greater physician autonomy (Bovbjerg & Miller, 1999; Shi & Singh, 2003). Insurers responded to public sentiment by developing additional models of managed care that were less restrictive. The two predominant forms were called PPO and POS plans.

PPO and POS. PPO and POS models of managed care were developed as additional options to ease supply side controls while maintaining some contractual control over provider costs. Thus, PPO plans include a network of health care providers who agree to discounted services. However, there are four primary differences between PPOs and HMOs. First, although

HMOs can employ some or all network providers, all PPO network providers remain independent business entities. Second PPO network providers are not prepaid or restricted to capped fees, but agree to contracted discounts off a fee for service structure. Third, PPOs have limited utilization review and no gatekeeper. And, fourth, many non-exclusive PPOs allow enrollees to seek treatment outside the preferred discount network with greater cost sharing (Bureau of Labor and Statistics, 2002).[3]

POS plans emerged as a mixed HMO/PPO model. POS plans include PPO style provider networks, but incorporate some HMO features. POS plans include a primary care physician gatekeeper and lower cost sharing for all in-network care. However, as with most PPOs, consumers can seek care outside the provider network with no gatekeeper, but pay higher out-of-pocket costs (Bureau of Labor and Statistics, 2002). POS plans are considered to be a blended option that offers cost controls of an HMO, but extend enrollee liberty to seek insured care with non-network providers.

PPOs and POSs are not as restrictive as HMO plans and have fewer cost controls. As consumer discontent grew with HMOs, these less restrictive designs gained ESI market share (Claxton, et al., 2010). Premium inflation remained high through the 2000s as these plans offered enrollees options with more relaxed supply side controls.

Beginning in the early 2000s, some private insurers began to experiment with plan designs that had a greater focus on demand side controls. The term Consumer Directed Health Care was coined to describe those plans.

Consumer Directed Health Care cost containment efforts. CDHC is the term used to describe one of the first large scale efforts to design plans primarily around demand side controls (Robinson, 2005). CDHC design emphasizes cost sharing, but includes additional demand side

controls to encourage consumer value conscious decision-making. Such controls include providing cost and quality information to assist enrollees in making effective and efficient health care purchase decisions.

CDHP designs, based on CDHC concepts, are shaped by economic principles, findings produced by the seminal Rand Health Insurance Experiment (Rand HIE), as well as by legislation and regulation that sanction the design. Each is discussed in turn. This section will conclude with a brief synopsis of CDHP characteristics and CDHC enrollment expansion.

Economic rationale for Consumer Directed Health Care. CDHC plan designs are based on a neoclassical economic model that posits individuals will make purchase decisions in a way that maximizes their value gain, or personal utility (Folland, Goodman, & Stano, 2003; J. Goodman, 2007; Mankiw, 2004; Weintraub, 1993). When individuals have the liberty to make individual choices based on price, quality, available resources, and personal wants and needs, their satisfaction is enhanced. Increased personal utility leads to increased value. This suggests that by maximizing utility at the individual level, macroeconomic social value or welfare can be maximized.

A focus on personal utility relies on demand side health care consumerism. Robinson (2005) describes consumerism as a concept that takes health service planning and purchasing decisions away from third parties (insurance administrators), and places greater confidence in consumers' ability to make intelligent decisions. Individual utility-based decisions, not greatly altered by full indemnity or third party supply side intervention, are expected to minimize discretionary consumption and create more informed, thus more efficient consumers of health care. Efforts to minimize discretionary spending are intended to reduce moral hazard. Moral

hazard refers to the concept that people will consume more when they are insulated from its cost (Arrow, 2004).

CDHC plan designs are intended to compel health care consumers to "…steer clear of moral hazard, purchasing only the health care they need or, more precisely, only the health care that enhances their welfare more than alternative goods such as food, transportation, or movie tickets." (Kravitz, 2007, p. 1337) Cost sharing is the primary control incorporated in plan designs to reduce moral hazard. Cost sharing requires individuals to share the expense of consumption in the form of healthcare insurance premium contributions, deductibles, co-pays, co-insurance, and other out-of-pocket costs.

The Rand Health Insurance Experiment. The Rand Health Insurance Experiment (Rand HIE) provided empirical evidence to support cost sharing as a demand side control to limit the effects of moral hazard on healthcare purchases with minimal adverse health outcomes (Brook, Ware, Rogers, Keeler, Davies, Sherbourne, Goldberg, Lohr, Camp & Newhouse, 1984).[4] Conducted between 1974 and 1981, the study included more than 5,800 participants from six cities (Peterson, 2006). Brook, et al. (1984) tracked multiple groups enrolled in catastrophic coverage plans, full indemnity coverage, and various combinations between these two types of plans. The results showed the high cost-sharing group (95 percent co-insurance/cost sharing) used 25–30 percent fewer services than the full indemnity (zero cost sharing) group. Additionally, those in the high cost-sharing plan were 23 percent less likely to be hospitalized in a year. The Rand HIE stimulated debate as to how inflation could be contained without significant adverse health effects.

Regulatory & legislative history of CDHC. CDHC plan designs rely on a tax incentive savings account paired with a high deductible health plan (HDHP). These tax-advantaged

accounts have been called Personal Care Accounts (PCAs). PCAs are individual spending accounts funded by tax-free dollars that are used for out-of-pocket medical costs. Legislative and regulatory policy that sanctioned PCAs began with Flexible Spending Accounts (FSAs). Eventually FSAs led to the creation of Medical Savings Accounts (MSAs), Health Reimbursement Arrangements (HRAs), and Health Savings Accounts (HSAs). FSAs, HRAs, and HSAs are the forms of PCAs in use today. The evolution of tax advantaged PCAs will be discussed next.

Flexible Spending Accounts. Flexible Spending Accounts (FSAs), sanctioned by a 1978 regulatory adjustment in Section 125 of the Internal Revenue Code, were the first of several tax advantaged PCAs the United States government would designate as exempt from FICA, federal, state, and local income taxes (Bureau of Labor and Statistics, 2002; Hamilton & Marton, 2007). FSAs were created to allow employees to set aside pre-tax earnings to pay for out-of-pocket medical expenses in an account created and controlled by their employer. These accounts provide an opportunity for enrollees to save money for predictable out-of-pocket medical expenses. However, the IRS imposes yearly FSA contribution caps and use-it-or-lose-it provisions. These provisions limit the use of FSAs due to the risk of losing unused funds at the end of the year, and encourage unnecessary care seeking if unused funds remain near year-end.

Flexible Spending Accounts were created as an ancillary account used to defray consumer costs, not as a new benefit design. These accounts were optional, supplemental to, and independent of an enrollee's health plan. FSAs provide insurers with a demand side tool that encourages enrollees to plan for and financially manage some health care needs. According to the U.S. Department of Health and Human Services National Health Survey (2007), 14.8 percent of non-elderly persons with private insurance funded an FSA (U.S. Department of Health &

Human Services, 2009). The next legislative or regulatory effort, the MSA which included a PCA, would not occur for nearly eighteen years.

Medical Savings Accounts. MSAs were established as a pilot within the Health Insurance Portability and Accountability Act (HIPAA) passed by Congress in 1996. Medical Savings Accounts allowed participants who were enrolled in a high deductible health plan and had no additional comprehensive coverage to establish a PCA. The employer or employee, but not both, could make contributions to the PCA. As with FSAs, if the employee funded the account, those funds were pre-tax. If the employer funded the account, it could deduct contributions from wages and earnings before taxes.

The MSA pilot restricted enrollment and plan design. MSA restrictions included maximum yearly account contributions, minimum health plan deductibles, eligibility only for the self-employed or employers with fifty or fewer employees, a sunset provision where no new MSAs could be established after the legislative trial period, and a maximum of 750,000 enrollees in the U.S. (Bureau of Labor and Statistics, 2002; Minicozzi, 2006).

Although the adoption of MSAs was limited due to restrictive guidelines, unlike FSAs, they allowed unused funds to be rolled over to the next year and interest to accrue in an investment account. MSAs became the basic model for CDHPs that include a PCA and high deductible health plan. The MSA pilot program was the first formal CDHC effort that incorporated a PCA as part of an insurance plan design versus an ancillary independent and optional benefit. The MSA pilot program ended in 2003, but it established the basic model for Health Reimbursement Arrangements (HRAs), discussed next.

Health Reimbursement Arrangements. The term HRA became common to describe the structure and guidelines for PCAs paired with High Deductible Health Plans (HDHPs) that were

no longer part of the HIPAA MSA pilot program. Although the MSA pilot expired and no sanctioned medical savings PCA was formally recognized by the IRS, some insurers continued to offer a MSA styled plan that became known as HRA. These arrangements were eventually sanctioned by an IRS ruling on June 26, 2002 that stated employers were permitted to fund HRAs on a tax-free basis, employees could use account funds for out-of-pocket health care costs, unused funds could be carried over from year to year (also tax-free), and employers may permit employees to use remaining HRA funds if they change employers or retire (Neurath, 2002).[5]

Although HRAs provide significant advantages over their PCA predecessors, restrictions remain for account contributions, use, and ownership. First, as with MSAs, Health Reimbursement Arrangements are not available in individual insurance markets. Second, although there are no restrictions against allowing continued access to HRA funds when an employee leaves a company to work for a new employer, employers are not required to (and most do not) permit continued access.[6] Third, only employers are permitted to fund HRAs, and manage them as nominal accounts. A nominal account is funded on an as needed basis when enrollees require a distribution. Nominal accounts act as a clearinghouse for managing the transfer of funds. They are funded immediately prior to the distribution of money and do not maintain a rolling balance. HRA funding allowances are pre-determined each year. Fourth, employers determine HRA funding levels and have some control over benefit payments, and for what services employees may use the funds. Finally, although HRAs are most commonly accompanied by a HDHP, there is no requirement that any health plan accompany the account. HRAs continue to be used today, but Health Savings Accounts are the latest version of PCA that are a competing option to the HRA design, and are discussed next.

Health Savings Accounts. Although HRAs represent several components of health care reform that President G.W. Bush's administration sought related to less restrictive PCAs, HSAs championed by that administration were established as part of Medicare legislation passed in 2003. With the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, HSAs became the most recent type of PCA (*Medicare Prescription Drug, Improvement, and Modernization Act of 2003*, 2003). HSAs introduced employee ownership of PCAs via account portability, investment characteristics, and greater control of account use. As with other PCAs, restrictions remain for HSAs. HSAs have annual contribution limits, must be complemented by a HDHP with a minimum deductible, and have a maximum out-of- pocket expense. Table 1 compares and contrasts the features of HSAs and HRAs. HRAs are similar to HSAs but are not owned by employees and do not required coupling with a high-deductible plan (Buntin, Damberg, Haviland, Kapur, Lurie, McDevitt & Marquis, 2006). The ownership and portability feature of HSAs make them an attractive investment tool with incentives to accumulate funds for future use; they are the first true enrollee-owned PCA.

An historical perspective is helpful in understanding the forces that contributed to the development of CDHPs. However, modern CDHP characteristics are not homogeneous. Generally accepted features of what constitute a CDHP are discussed next.

Consumer Directed Health Plan characteristics. CDHP is a generic title that is applied inconsistently. It is a label used to describe several forms of health insurance found in ESI and individual policy markets. Buntin, et al. (2006) reviewed CDHC research and summarized consumer directed health care as

> "…a term that means different things to different people. CDHC, which involves enrollment in consumer-directed health plans, refers to insurance that provides financial incentives for consumers to become involved in purchasing decisions regarding their health care" (p. 517).

Table 1

Key Features of Health Savings Account & Health Reimbursement Accounts

Feature	HSA	HRA
Who can fund:	Employee and/or employer	Employer
Portability:	Account follows employee	Employer decides, usually absorbed by employer
Account ownership:	Employee, and can bequeath account upon employee death	Employer
Required plan:	HDHP – as of 2009: Individual Minimum Deductible of $1,150, Individual Maximum Out-of-Pocket of $5,800, Family Minimum Deductible of $2,300, Family Maximum Out-of-Pocket of $11,600	None
Yearly contributions:	Individual Maximum Contribution of $3,000, Family Maximum Contribution of $5,950, and Catch-up Contribution (55+ years old) of $1,000	Employer discretion no Federal limits
Tax advantages:	Employee can deduct contributions. Employer contributions are deducted from compay gross income	Employer contributions are deducted from gross income
Rollover of unused Funds:	Yes	Yes, but employer can absorb upon retirement or end of Employment
Non-medical use:	Allowed, but taxed as income plus 10% penalty	Not permitted

Sources: (Buntin, et al., 2006; HSAFinder, 2008)

Buntin et al. (2006) consider CDHPs to include "… any high deductible insurance plan; typically, "high deductible" refers to a plan with a deductible of $1,000 or more" (p. 517).

CDHPs emerged with MSAs in the late 1990s, but became a recognized health insurance model in the early 2000's with the proliferation of Internet access and information tools (Fronstin & Collins, 2003). Literature from this period assessed the concept of design versus specific plan components. CDHPs were described as those that offered incentives for effective and economical health care based on cost sharing, availability of tiered networks, or the ability to

customize plan options, were accompanied by information support for health care decisions, and those that placed the consumer in an active role to maintain and control their own health through informed choice (Christianson, Parente, & Taylor, 2002; Rosenthal & Milstein, 2004; Shaller, Sofaer, Findlay, Hibbard, Lansky & Delbanco, 2003).[7&8]

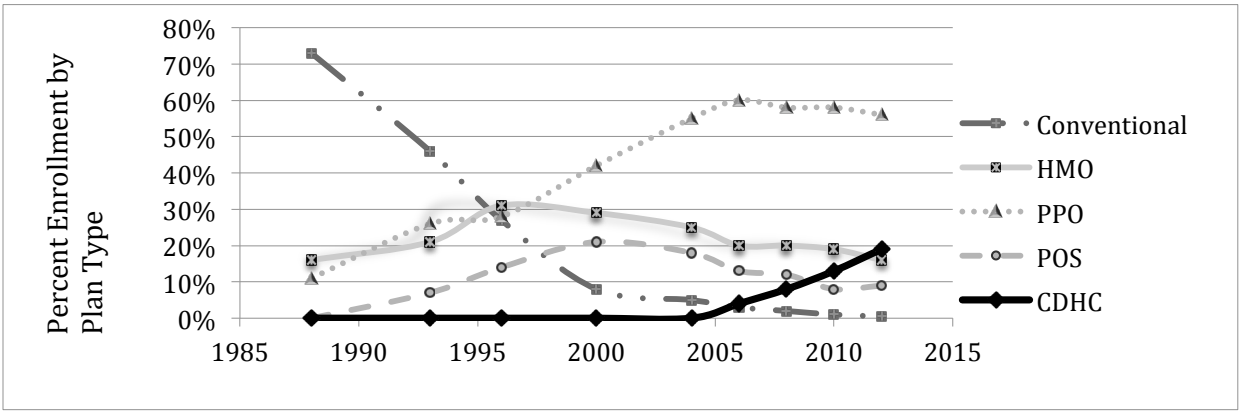
In the early 2000s, CDHPs began to be associated with PCA eligible health plans (Balcker, Dow, & Wolfson, 2007; Davis, 2004; Feldman, Parente, & Christianson, 2007; Goodman, 2006; Hall & Havighurst, 2005; Robinson, 2002). This defining association emerged with the growth of HRAs and HSAs.

CDHPs are offered in multiple formats designed to provide the consumer with more responsibility and financial control over their health care. Although increased ESI market share and plan features such as high deductibles and PCAs have continued to clarify what constitutes a CDHP, early research has not established a clear definition. Thus, each study must establish clear parameters for what health insurance plans will be included as CDHC.

Although CDHPs, which include HDHPs, HRAs and HSAs, represent only a minimal market share, they have grown in recent years. CDHC market expansion is discussed next.

Consumer Directed Health Care market expansion. Illustrated in Figure 2, the Kaiser HRET Survey of Employer Sponsored Health Benefits (2012) found the percentage of CDHP enrollment rose from 4 percent in 2006 to 19 percent in 2012. The Kaiser HRET survey found CDHP enrollment also was linked to employer size. CDHP enrollment between 2005 and 2012 grew from 4-31 percent for employers with 3-199 employees, from 4-34 percent for employers with 200-999 employees, and from 10-41 percent for employers with 1,000-4,999 employees (Claxton, et al., 2012). Greater enrollment in Consumer Directed Health Plans (CDHPs) is

Figure 2. ESI Health Plan Enrollment Percentages by Plan Type

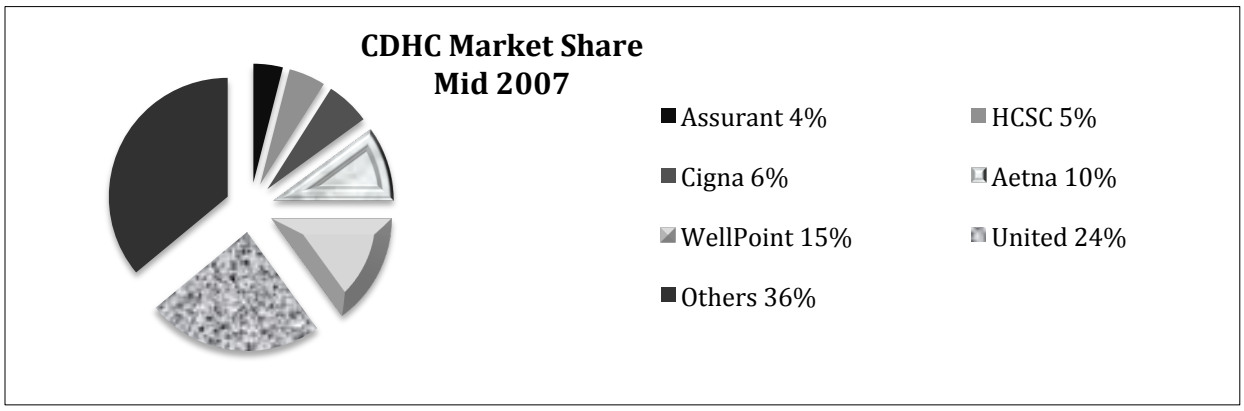


Source: (Henry J. Kaiser Family Foundation/Health Research and Educational Trust Survey of Employer-sponsored Health Benefits, 1999–2012; KPMG Survey of Employer-sponsored Health Benefits, 1993 & 1996; and The Health Insurance Association of America (HIAA), 1988).

largely attributed to the relationship between employer size and what plans are offered (Claxton, et al., 2012).

Newly created insurance companies that developed CDHC health plans and the purchase of some CDHP insurance upstarts by major health insurers since the early 2000s also contributed to increased CDHP enrollment. Increased insurer offerings of CDHPs could represent market share protection, a hedge against adverse selection (discussed later), or an indication of increased enrollment expectations (Figure 3). Protection of market share and speculation in opportunities to expand revenues in emerging markets seems to have driven larger national insurers to offer CDHC options in more traditional HMO and PPO markets (Robinson, 2004). If CDHPs are to continue as a limited market or become more common, the effects of increased enrollment and the attributes of who selects a CDHP are important to understand.

Figure 3. Major Insurance Carrier Shares of All CDHC Enrollees



Source: (MCOL, 2007a)

Empirical Research on Consumer Directed Health Plan Choice

The remainder of this chapter will discuss empirical research related to CDHP choice. However, because there is a dearth of research specific to CDHC, a review of earlier work that analyzed HMO and PPO plan choice (when such plans were new to a fee for service ESI market) will be discussed.

This section is presented in four parts beginning with the importance of studying plan choice. Second, parameters for selecting the type of CDHC research included in the review are explained. Third, empirical studies are discussed. Finally, this section will close with a summary of findings for variables examined in the reviewed research.

The importance of studying health plan choice. The relationship between health plan enrollment decisions and the distribution of risks across health plans is the primary reason for studying enrollees' choice of health plan. Selection bias and risk pool segmentation are terms used to describe the effects of these issues. In the context of health plan choice, selection bias refers to an individual's self-selection into plans based on their characteristics and needs, so that persons with certain characteristics are concentrated in some plans. People with certain socio-

demographic characteristics or health status choose among health plans based on plan characteristics and generosity of benefits (Marquis & Buntin, 2006). Selection bias can be adverse or favorable. Adverse selection occurs when people with high health risk prefer generous benefit plans. A generous benefit plan is one that pays for broader health care use with lower enrollee cost sharing than less generous plans. Favorable selection occurs when people with low health risk prefer plans with less generous benefits and lower premium costs. For such plans, cost sharing is low when health care services are not used, but is high with health care utilization. Selection bias occurs because people with high health risk are more likely to choose a plan with greater breadth of coverage, and those with low health risk are more concerned with a lower up-front premium cost (Marquis, Buntin, Escarce, Kapur, Louis & Yegian, 2006).

The function of an insurance risk pool is to spread individual health risk exposures over a large enrollee population. Selection bias inhibits effective distribution of enrollee risks between plans, which can lead to risk pool segmentation (Marquis & Buntin, 2006). Risk segmentation between plans with different levels of benefit generosity and premium cost threaten the economic solvency and affordability of more generous health care plans. If adverse selection occurs for generous health care plans, the expected increased utilization for higher risk enrollees would increase premiums. That cycle of increased utilization and increased premiums would eventually lead to fewer enrollees because of their inability to afford coverage as premium inflation occurs. This would continue until only high-risk enrollees remained. Escalating premiums would cause the plan to become financially non-viable. Researchers have referred to this scenario as a risk pool death spiral (Davis, 2004; Shearer, 2004; Tollen et al., 2004).

Rationale for studies included in this review of the literature. In recent years, researchers have narrowed the plans considered as CDHC. Beginning in the mid 2000's, studies

began to limit what was considered to be a CDHC plan to those with an HRA or those eligible to be accompanied by a PCA such as an HSA (U.S. Department of Health & Human Services, 2009; Dixon, Greene, & Hibbard, 2008; Feldman, et al., 2007; Claxton, et al., 2007; Miller, 2007; Sharon, 2007; Yoo, 2008). This narrowed definition of CDHP has occurred for three reasons. First, HRAs and HSA eligible plans comprise the largest share of the CDHC market. Second, MSAs have been phased out as the Health Insurance Portability and Accountability Act (HIPAA) pilot expired. Finally, tiered network plans are a variation of POS plans that offer more than one price strata dependent on provider cost or quality groupings and lack many previously discussed CDHC characteristics.

Employer CDHPs are generally introduced to an ESI program in two ways; as a full replacement of existing plans, or as a slice offering. A slice offering adds one or more CDHP options along side other traditional forms of health plans such as HMO, PPO, POS or Fee For Service (FFS). CDHC empirical research related to plan choice falls in the slice offering category. A slice offering makes it possible to evaluate who selects a CDHP, why they select it, and the possible effects that result from those enrollment choices.

Empirical research discussed in this chapter will include descriptive and multivariate analyses of enrollees who have chosen CDHPs. This discussion will focus on key variables drawn from the empirical research in this area including the research methodologies employed. Studies that evaluated tiered POS plans or MSA arrangements are not included because they are not comparable with modern HRA and HSA designs.

Reviewed literature: methodologies & findings. Methods employed in the studies discussed in this chapter include descriptive statistics, individual case studies coupled with descriptive statistics, and multivariate analyses. Of ten studies, two employ utility maximization

as a theoretical framework, two discuss a quasi-theoretical structure, and six describe no theoretical structure. Seven studies examined single employer populations, of which three analyzed the same employer for the same timeframe (Fowles et al., 2004; Lo Sasso et al., 2004; Tollen et al., 2004). Data were captured via employer interview, telephone survey, mailed survey, email survey, human resources employment data, and claims data. Variables measured include income, health status, prior use, plan characteristics and, socio-demographics (Barry et al., 2008; U.S. Department of Health & Human Services, 2009; Fowles et al., 2004; U.S. General Accountability Office, 2006; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004).

CDHP choice research. Of the ten studies related to CDHP choice discussed in this inquiry, two describe a theoretical framework and two discuss quasi-theoretical frameworks. Each is described next.

Studies by Parente et al. (2004a & 2008) apply utility maximization models to evaluate the effects of socio-demographics, health status, and personal preference of plan characteristics on plan choice. In the first study Parente et al. (2004a) conduct telephone surveys and collect human resources employment data from University of Minnesota employees in 2002. Response rates were 63 and 73 percent respectively for CDHC (n=430) and non-CDHC (n=501) plans (Parente et al., 2004a). The authors combine plan enrollees in two CDHC options and over-sample them due to low enrollment. Enrollment in the CDHP option was less than one percent. They also combine single and family contracts because it could not be determined if other insurance was available in the household. The results of their conditional logit analyses show that CDHC enrollees are more likely to have higher earnings, placed a higher value on provider choice, and value greater liberty in making health care decisions than non-CDHC enrollees. Low

premiums are found to be significant for enrollees' choice across plans, while self reported chronic conditions are not significantly associated.

In another effort, Parente et al. (2008) study plan selection related to socio-demographics, health status and premium costs for a different single national employer. The researchers use conditional logit regression to examine selection between low deductible HRA, high deductible HRA, high deductible HSA, traditional PPO, and HMO plan enrollees. The data consists of claims utilization and human resources employment variables collected for 48,201 employees from 2006 in 22 states. The findings suggest favorable selection for HSA plans, adverse selection for low deductible HRAs, higher out of pocket premium elasticity, and higher primary subscriber earnings for CDHPs. Adverse selection for the low-deductible HRA, referred to as the generous option, suggests end cost to the enrollee is more pertinent than plan features that require enrollee engagement for some financial and planning tasks. Parente et al.'s, (2004a; 2008) findings that premiums are key factors in plan choice also support this concept. Furthermore, it suggests enrollees who are less healthy are more likely to choose a plan with a lower deductible as to not incur higher out-of-pocket costs.

Fowles et al. (2004) collect data via a cross-sectional mail survey of 4,680 employees with a 66.2 percent response rate. CDHP enrollment for the study employer is seven percent. Fowles et al. (2004) use binomial logistic regression analyses and discuss theoretical constructs that suggest plan choice is a product of four dimensions: socio-demographic characteristics, health status, utilization, and plan characteristics. The authors state that these dimensions, and variables chosen to measure them, are based on a literature review of plan choice by Scanlon, Chernew, and Lave (1997). Fowles et al.'s (2004) binomial logistic regression finds CDHP enrollees are more likely to have single coverage, not to have had a "recent" medical visit, and

believe premium contributions are the most important plan characteristic. They are less likely to have a chronic condition(s), be African-American or have no coverage via plans outside the employer's ESI program. Fowles et al. (2004) is the only study that measures other available insurance plans in addition to that offered by the study employer. Results indicate that those with other sources of insurance are more likely to choose a CDHP (Fowles et al., 2004). However, respondents in this study are more likely to be older, be exempt status employees, have a family coverage contract, and less likely to be enrolled in an HMO than non-respondents, which calls the representativeness of their sample into question.[9] As found by Parente et al. (2004a; 2008), this study suggests enrollee premium cost is a key factor in plan choice.

Similar to Fowles et al. (2004), a study by Green, Hibbard, Dixon, & Tusler (2006) use theoretical constructs to develop a plan choice model for which plan choice is a product of socio-demographic characteristics, health status, utilization, and plan characteristics. Green, et al., (2006) use multinomial logistic regression to predict CDHP choice. Data for this study are collected by telephone, mail, and email surveys from a single manufacturing employer population. Enrollment in CDHP plans is highest in Green, et al.'s (2006) study versus other reviewed research, with 13 percent in a high deductible HRA and 23 percent in a 'generous' low deductible HRA. The researchers create exempt and non-exempt strata (exempt status generally referring to salaried versus hourly earners) to isolate social structure and social status of enrollees. The sample strata are comprised of 1,119 non-exempt and 985 exempt respondents. Salaried and CDHC enrollees are over-sampled to assure that an adequate range of wages/ earnings levels and those with a chronic condition(s) are represented in the different employee groups in their sample. The survey response rate was 62 percent (n=2,104). Greene et al. (2006) collected 2003 claims utilization and human resources employment data from the employer, and

self-reported health status via an employee survey during the 2004 plan choice year. Green, et al. (2006) find those who enroll in CDHPs are more likely to be healthier and have more formal education than PPO enrollees. The less generous HRA experienced greater favorable selection than the generous option. This study suggests adverse selection for generous plans regardless of CDHC or Managed Care plan characteristics. Green et al. (2006) and Parente et al., (2008) define generosity as lower initial enrollee cost sharing related to health care use.

Tollen et al. (2004) studied the same Humana employee population as Fowles et al. (2004). Their study population includes all Humana Insurance employees and their dependents (approximately 10,000 enrollees) in 2001. Tollen et al., (2004) evaluate socio-demographic, utilization, and health risk variables for enrollees across different health plans. Health risk measures are based on software that algorithmically examines enrollee pharmaceutical use and socio-demographic factors. They use claims, enrollment, and human resources employment data for all enrollees, and therefore do not test for statistical significance (sampling error cannot occur when the entire population is used). One limitation of note is that out-of-network utilization data is not available, which according to the authors can represent approximately ten percent of enrollees' health care use. Additionally, no utilization data is available for PPO plans prior to the deductible being satisfied, thus under reporting claims when compared with the HMO plan. Tollen et al. (2004) find CDHC enrollees use fewer health care services in the prior year and have lower health risk than the HMO or PPO plans.

A third study by Parente et al. (2004b) focuses on health care utilization and health status before and after plan choice for a single self-insured employer, however it is included in this review as the researchers offer findings on factors related to plan choice. They sample nearly 60 percent of the 2001 employer population (n=3,636 contracts). CDHPs were introduced to the

study employer for 2002 open enrollment. Parente et al. (2004b) examines claims data from health plan and employer socio-demographic records in a log-linear regression model. This study finds, based on lower health risk and less health care use, CDHPs experience initial favorable selection compared to HMO and PPO plans, with mixed results for health care use in the subsequent year.[10] This study is the only to assess prior FSA participation, which they find to be positively associated with CDHP choice.

Barry et al. (2008) studied a single ALCOA, Inc. location with a workforce that is 70 percent male. CDHP enrollment is 14.3 percent for the study employer. Employees are offered four PPOs and one employer funded HRA plan. All plans access the same provider network. Data for the study are collected from insurers' claims history and employer human resources records (Barry et al., 2008). The authors combine enrollees in all PPO plans, and then stratify the sample by family or single contract. While all reviewed research measures coverage tier, which can be used to control for the number of enrollees at the contract level, Barry et al. (2008) is the only study to create separate strata to examine individual and household level socio-demographic measures separately.[11] The authors state the reason for splitting their sample into single subscriber and multiple enrollee contracts is to avoid aggregated health care spending error due to individual level measures of primary subscriber verses household level measures. The analysis is a logistic regression that assesses socio-demographic characteristics of primary subscribers and health status of household members at the contract level. Although Barry et al.'s sample is "... a little over 70 percent male, HRA enrollees were younger and more likely to be white, to be salaried (exempt), to have individual coverage, and to have higher employee income in the year prior to enrollment compared with PPO enrollees" (p. 1,674). Additionally, HRA family contract enrollees are less likely to have a chronic condition(s) and spend less on health care in the prior

year than PPO enrollees. Barry et al. (2008) additionally note that higher premium costs for the PPO plan is found to be negatively associated with enrollment in that plan. Thus, similar to other studies, Barry et al. (2008) find possible favorable selection and the importance of enrollee premium cost on CDHP choice (Fowles et al., 2004; Parente et al., 2004b, 2008; Tollen et al., 2004).

The U.S. Department of Health & Human Services, (2009) conducted a descriptive analysis of CDHP enrollees based on the 2007 National Health Insurance Survey (NHIS) with a sample of N=67,325. No theoretical framework is discussed. They examine estimates of CDHP enrollment, source of coverage, and socio-demographics of CDHP enrollees. The U.S. Department of Health & Human Services (2009) define CDHPs as a HDHP coupled with a PCA. CDHP enrollment in 2007 is estimated at 4.5 percent of persons under age 65, and those enrolled in a HDHP at 17.3 percent. They find an association between those who choose a CDHP and enrollees who purchase insurance in the private non-ESI market, are more educated, more likely to be Caucasian, and have higher household wages/salaries.

LoSasso, et al. (2004) conduct interviews with human resource managers of three companies and couple responses with limited descriptive statistics to provide early evidence on CDHP choice. They find CDHP enrollees are more likely to view provider network inclusiveness and employee premium costs as very important plan characteristics (Tollen et al., 2004). They also find CDHPs experience some favorable selection when introduced as a slice offering. One employer studied by LoSasso, et al. (2004) is Humana Insurance, which is also the study population for Tollen et al. (2004) and Fowles et al. (2004), and produces similar findings.

The last study examined is by The United States Government Accountability Office (GAO), (2006). The GAO (2006) report uses descriptive statistics for a convenience sample of

government employees enrolled in CDHPs in 2005. CDHC is loosely defined and includes many different HDHP structures from multiple government employee benefit programs across the nation. The study finds CDHP enrollees are younger and have higher primary subscriber earnings. Findings provide early insights to variables that affect CDHC enrollment, but they are not tested for significance.

Discussion of findings. Early evidence of CDHP selection includes few studies and not all use rigorous analytical methods. Generalizability of CDHC research is limited by single employer study populations, heterogeneous CDHC and traditional plans across studies, a lack of data to control for exogenous effects, and insufficient data to identify effects for vulnerable populations. A literature review of CDHP choice research by Buntin, et al. (2006) presents similar conclusions.

Key factors examined across the research include: enrollee or household earnings, health status/health risk, prior health care utilization, cost of enrollee premium contributions, gender, age, ethnicity, education, job type, and plan coverage tier.[12] Additionally, two studies examined enrollee liberty (freedom of medical provider choice and control over health care decisions) and the strength of plan provider network, while one study assessed enrollees' prior participation in an FSA. These factors address three core concepts. First, health status and prior health care utilization factors reviewed in the research are key to assess possible selection bias in plan choice that may lead to risk segmentation. Second, plan premium, liberty, network strength, and prior FSA participation assess enrollee utility or health plan characteristics preferences. Third, socio-demographic variables are examined due to the influence social and individual characteristics can have on plan choice (Kronick, Dreyfus, Lee, & Zhou, 1996; Lee & Rogal, 1997; Tollen et al., 2004; Wison, et al., 1998). Some socio-demographic variables such as earnings, job type,

education level, and ethnicity are measured at the individual primary subscriber level. [13] These factors are summarized in Table 2 and Table 3 and are discussed next. Factors in Tables 2 and 3 are listed horizontally and studies are listed vertically.

Health status and health risk. Health status and health risk are evaluated to determine if favorable selection exists for CDHPs. They are used to identify enrollees' level of health risk or their potential to be high users of health care. Studies discussed in this chapter use one or a combination of five proxies to measure health status or health risk. Measures include self-report health status (Fowles et al., 2004; Greene et al., 2006; Lo Sasso et al., 2004), prior spending on health care services (Barry et al., 2008; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004b; Tollen et al., 2004), the number or recentness of medical care visits (Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004b; Tollen et al., 2004), pharmaceutical use (Greene et al., 2006; Lo Sasso et al., 2004;Parente et al., 2004b; Tollen et al., 2004), or the use of validated software program(s) to calculate health risk scores (Barry et al., 2008; U.S. Department of Health & Human Services, 2009; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004). [14]
Of eight studies that examine the presence of chronic conditions, self-reported health status, or calculated health risk scores, seven find healthier enrollees are more likely to choose a CDHP, one produces contradictory results, and one finds no significant association (Barry et al., 2008; Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004). Health status surveys and calculated health risk scores are discussed first, followed by chronic conditions, and then prior health care spending.

Of four studies that examine health status questionnaire responses or calculate health risk scores, three find healthier enrollees are more likely to choose a CDHP (Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004b; Tollen et al., 2004). Tollen et al. (2004) and Parente et

Table 2

Past Health Care Utilization of Plan Characteristics and CDHP Selection

Author(s) & Study Population		Chronic Conditions[c]	*Good* Health Status	Total Spending	Hospital Use	Pharma. Use	Provider Use	Recent Visits	FSA Participant	Liberty	Network	Importance of Low Premium
		Health Status / Past Utilization							Plan Characteristics			
Tollen et al., 2001[a]												
1 employer: HMO, PPO POS, or HDHP with PCA		nt	(+)[b]	(-)[c]	(-)	(-)	(-)	nt	nt	nt	nt	nt
Fowles et al., 2004												
Same as Tollen et al.		(-)[d]	(+)[d]	nt	ns	nt	nt	(-)	nt	ns	(-)[e]	(+)
Parente et al, 2004a												
1 employer: HMO, PPO, POS, or HDHP with PCA		ns[d]	nt	nt	nt	nt	nt	nt	nt	(+)	(+)	(+)
Parente et al, 2004b												
1 employer: HMO, PPO, HRA		nt	(+)[b]	(-)	(-)	(-)	nt	(-)	(+)	nt	nt	nt
Green et al., 2006												
1 mfg employer:												
PPO & Less Gen. HRA[g]	Exempt	ns[d]	ns[d]	(-)	nt	(-)	nt	nt	nt	nt	nt	nt
PPO & Less Gen. HRA[g]	Nonexempt	(-)[d]	ns[d]	(-)	nt	(-)	nt	nt	nt	nt	nt	nt
Generous HRA[g]	Exempt	ns[d]	ns[d]	ns	nt	ns	nt	nt	nt	nt	nt	nt
Generous HRA[d]	Nonexempt	(-)[d]	ns[d]	(-)	nt	ns	nt	nt	nt	nt	nt	nt
LoSasso et al., 2004												
case study	Employer 3	nt	nt	(-)	nt	nt	nt	nt	nt	nt	nt	nt
Same Emp. as Tollen et al. & Fowles et al.												
Parente et al, 2008		(PPO experienced most favorable (HMO also exp. fav. sel.)										
1 employer: HMO, PPO, POS,		selection regarding chronic condition)										
Generous HRA[g]		(+)[f]	nt	nt	nt	nt	nt	nt	nt	nt	nt	(+)
Less generous HRA[g]		ns[f]	nt	nt	nt	nt	nt	nt	nt	nt	nt	(+)
Low generosity HSA[g]		(-)[f]	nt	nt	nt	nt	nt	nt	nt	nt	nt	(+)
Barry et al. 2008		(All plans accessed the same network)										
1 employer location		(-)[f]	nt	(-)	nt	nt	nt	nt	nt	nt	na	(+)
4 PPOs and 1 HRA CDHC												

Notes. (+) or (-) indicates significant finding of positive or negative correlation, **ns** = not significant, and **nt** = not tested to selecting a CDHP,

[a]Census data was used for claims – no test for significance.

[b]Tollen et al. (2004) used Ingennix, and Parente et al. (2004b) used Johns Hopkins ASC illness burden software

[c]Out of network spending was not available, nor was PPO spending prior to deductible being satisfied

[d]Self report health status and chronic condition

[e]Have a plan with personal physician was statistically significant and important

[f]Barry et al. (2008) used ICD-9 algorythms, and Parente et al. (2008) used RXRisk software to estimate conditions

[g]The term "generous" used to describe plans refers to the a low deductible plan, where "less generous" or "low generosity" refer to high deductible plans – terms were used by authors of studies identified as such.

Table 3

Demographic Findings for CDHP Selection

Author(s), Study & Plan Type Population		Wages/ (+) Earnings [b]	Gender: **M**ale	Age (+)	Coverage Tier: Single/ **Fam**ily	Job Type: **NE** = Non-exempt	Education	Caucasian = **W**hite	% In CDHC
Tollen et al., 2001[a]		Sample: single employer, Humana Insurance Company							
HMO, PPO POS, or HDHP with PCA		(+)	+M	(+)	+S	nt	nt	nt	6.3%
Fowles et al., 2004[a]									
HMO, PPO		Sample: same employer as Tollen et al., 2004 – survey							
POS, or HDHP with PCA		nt	ns	nt	+S	-NE	ns	+W	7% [c]
Parente et al, 2004a[a]									
HMO, PPO, POS,		Sample: One employer, University of Minnesota - survey							
or HDHP with PCA		(+)	ns	ns	ns	nt	nt	nt	< 1%
Parente et al, 2004b[a]									
HMO, PPO, POS,		Sample: single employer							
or HDHP with PCA		(+)	nt	nt	nt	nt	nt	nt	< 1%
U.S. General Accountability		Sample: Federal Employees Health Benefits - survey							
Office (GAO), 2006 (multiple CDHPs)		(+)	+M	(-)	+S	nt	nt	nt	NA
Green et al., 2006		Sample: one mfg employer – survey							
PPO &Less Gen. HRA[d]	Exempt	ns	ns	ns	nt	+E	(+)	ns	13%
PPO &Less Gen. HRA[d]	Nonexempt	ns	ns	(-)	nt	-E	(+)	ns	
Generous HRA[d]	Exempt	ns	ns	ns	nt	ns	ns	ns	23%
Generous HRA[d]	Nonexempt	ns	-M	(+)	nt	ns	ns	ns	
LoSasso et al., 2004[a]		Sample: Countrywide Financial, Woodward Governor, & Humana							
case studies	Employer 1	(+)	+M	nt	+Fam	nt	nt	nt	4%
HMO, PPO, HRA	Employer 2	nt	nt	nt	nt	nt	nt	nt	12%
	Employer 3[c]	(+)	nt	nt	nt	nt	nt	nt	6.3%
Parente et al, 2008		Sample: One national employer: HMO, PPO, POS,							
Generous HRA[d]		(+)	ns	(+)	+F	nt	nt	nt	7%
Less generous HRA[d]		(+)	+M	(-)	ns	nt	nt	nt	2%
Low generosity HSA[d]		(+)	+M	(-)	+S	nt	nt	nt	2%
Barry et al. 2008		Sample: Alcoa, Corp. - one employer location (70% male pop.)							
4 PPOs and 1 HRA CDHC		(+)[e]	ns[e]	(-)[e]	+S	+E[e]	nt[e]	+W[e]	14.3%
U.S. Department of Health &		Sample: Civilian US population survey - N=67,325							
Human Services, (2007)		U.S. Department of Health and Human Services National Health							
HDHPs only		Interview Study							
CDHP (PCA or PCA eligible)		(+)	ns	nt	nt	nt	(+)	+W	4.5%

Notes. (+) or (-) indicates significant finding of positive or negative correlation to selecting a CDHP, **ns** = not significant, and **nt** = not tested

[a]Pre HRA regulations prior to rules by IRS, including that un-used balances could be rolled over each year

[b]All studies except Green, et al. (2006) measured primary subscriber wages/salary – Greene et al. (2006) measured household wages/salaries

[c]Same population as Tollen et al. assuming author rounded CDHC participation from 6.3% to 7%

[d]Labels used by Parente et al. (2008) & Green, et al. (2006): low deductible plans deemed generous & vice versa

[e]Individual level measures were examined for single subscribers only

al. (2004b) use claims utilization software to calculate health risk scores, and Fowles et al. (2004) rely on enrollee responses to a health status survey question.[15&16] These three studies find evidence of favorable selection for CDHPs based on their respective health status measures. However, Green, et al. (2006) finds no significance for self-reported health status and CDHP choice.

Four of five studies examine the presence of chronic conditions for household enrollees and find a significant negative relationship to CDHP enrollment (Barry et al., 2008; Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004a, 2004b, 2008). Findings are inconsistent for the presence of chronic conditions and CDHP choice. First, Fowles, et al (2004) find a negative association between the self-reported presence of chronic conditions and CDHP enrollment at the primary subscriber level, yet Barry et al. (2008) find similar results only at the household (contract) level. Barry et al. (2008) use ICD-9 health risk software scores based on diagnosis codes to estimate the presence of chronic conditions.[17] Second, Greene et al. (2006) examines a sample stratified by exempt status in a study that includes low and high deductible CDHPs. The authors examine enrollees' self-reported presence of chronic conditions and self-reported health status. They find non-exempt employees having one or more chronic conditions are less likely to enroll in both high and low deductible HRA plans than a PPO. However, the authors find no association between chronic conditions and plan enrollment for exempt employees. Greene et al. (2006) suggests this could have occurred because exempt employee households as a group had significantly fewer chronic conditions than non-exempt employees. Finally, Parente et al. (2004a) find no statistically significant relationship between CDHP enrollment and self-reported diagnosed chronic health conditions (Parente et al., 2004a). However in a different study that employs pharmaceutical utilization risk assessment software to measure the aggregated presence

of chronic conditions per household, they find favorable selection for a high deductible HSA plan, but the low deductible HRA experienced unfavorable selection (Parente et al., 2008).[18] The researchers suggest inconsistent findings between the low deductible HRA and high deductible HSA could be due to their dissimilar cost structures largely based on deductibles. High deductible HRA enrollees' characteristics are more similar to HSA enrollees'. Parente et al. (2008) also found favorable selection for the HMO; and found the PPO plan experienced the greatest favorable selection which is not consistent with the expectation that less healthy enrollees would seek HMO or PPO plans with lower initial cost sharing and more generous benefits. One possible explanation is the low deductible HRA may be viewed as similar to more generous Managed Care plans with the added benefit of an employer funded PCA.

Total health care spending is a proxy for health care utilization, and subsequently is sometimes used as a proxy for health status or health risk. Total health care spending includes enrollee out-of-pocket costs and the amount paid by the insurer to health care providers. Five studies find lower prior year spending is associated with CDHP choice (Barry et al., 2008; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004b; Tollen et al., 2004). Green, et al. (2006) studies a sample stratified by employee exempt status for high and low deductible CDHPs, and produce similar findings with one exception. Exempt employees in the high deductible plan and non-exempt employees in both plans have a negative association between CDHC enrollment and total health care spending (Greene et al., 2006). However, there is no significant association between exempt employees and enrollment in the low deductible HRA plan. Green, et al. (2006) suggests the low deductible HRA plan may represent a choice similar to the PPO for exempt employees. Although an alternative design, the low deductible HRA plan offers similar cost sharing as the PPO and produces no significant relationship for that group.

Another possibility is that non-exempt employees with prior lower total health care spending may view the low deductible HRA as an alternative that cost about the same as the PPO, but allows PCA funds to accrue for future benefit.

Four studies examine enrollees' prior health care utilization for one or more types of use (Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004b; Tollen et al., 2004). Types of use include the number of hospital stays, pharmaceutical spending, and the number of prior year physician office visits.[19] In some instances, such as hospital use, different types of utilization represent the seriousness of the health issue requiring care, and are more costly than others.

Analyses by Tollen et al. (2004) and Parente et al. (2004b) find CDHP enrollment to have a negative association with hospital, physician, and pharmaceutical use. Fowles et al.'s (2004) logistic regression analysis does not support a relationship for hospital use and CDHC enrollment, but reveals a negative association for those who experience some type of recent medical care visit. Green et al.'s (2006) study shows a negative association between prior pharmaceutical use and enrollment in the high deductible HRA plan for both exempt and non-exempt enrollees. In contrast, there is no difference for previous pharmaceutical use and the likelihood of enrollment in the low deductible plan for exempt and non-exempt employees (Greene et al., 2006). Furthermore, pharmaceutical use prior to CDHP enrollment by those in the low deductible HRA and PPO plans is nearly identical, which lends further support to the notion that the low deductible HRA may represent a similar alternative to the PPO plan.

Findings related to health status or health risk across all research examined suggest CDHPs enjoy favorable selection. The CDHP exceptions are only for HRA plans with low deductibles and represent similar cost and benefit generosity levels as Managed Care plans.

Plan characteristics. Plan characteristics examined in the research include FSA participation, liberty of health care decision-making, health care provider network strength, and employee premium contribution. Each is described with subsequent findings.

CDHP designs incorporate consumer engagement by encouraging financial planning for health care needs and greater consumer health care decision-making liberty. Plan characteristics of planning and liberty are used to reduce moral hazard and encourage consumer engagement in health care utilization decisions. These CDHP features are represented by FSA participation, health care provider network, and liberty of health care use decisions. FSA participation prior to CDHP enrollment suggests individuals may demonstrate some basic planning characteristics for the financing and coordination of future medical care similar to that required by CDHP plan design mechanisms, such as PCAs. Past FSA participation may be used as a proxy for consumer planning and engagement. Health care provider network and liberty represent importance enrollees placed on freedom of choice as exhibited by the number of in-network providers, and how restrictive plan parameters are for approval to use services or use of PCA funds.

Two studies by Parente et al. (2004a, 2004b) suggest a greater desire by CDHC enrollees to be personally engaged in health care decisions. The authors find those who fund an FSA in the prior year were more likely to enroll in a CDHP. Another study by the same researchers find a significant positive relationship between CDHC enrollees' and those who report that selecting a plan with the liberty of not requiring pre-certifications for care is very important (Parente et al., 2004a).

Two studies examine provider networks across plans (Fowles et al., 2004; Parente et al., 2004a). Plan networks include a list of health care providers who are covered/approved for reimbursement under the policy, provide care at lower cost-sharing levels, or offer a discount for

care to enrollees that self-pay for non-reimbursed or uncovered costs. The greater number of providers in a network represents a less restrictive "strong" network because more providers are available at lower cost to enrollees. If a person lives in a region with a network that has fewer providers, a "weaker" network, their choice of provider may be restricted, and vice versa. Fowles et al. (2004) state the CDHP has the weakest network, but do not define their measure for network strength. They find enrollees who believe network strength is different across plans are less likely to select the CDHP paired with the weaker network. However, a second survey question to measure the importance of enrollee liberty asks if freedom to choose any specialist is "very important" to enrollees; it is not found to be significant. Parente et al. (2004a) measure network strength using two survey questions that ask if the enrollee's doctor is included in their plan's network, and if their plan has a national network of providers. They find a significant positive relationship between CDHP enrollment and network strength, but the CDHP in that study has the stronger provider network. This suggests that network strength has a greater influence on plan choice than the type of plan.

Liberty and network strength share a common characteristic relative to plan choice. Strong networks offer greater liberty to choose health care providers without a negative financial consequence. Findings suggest that enrollees who value liberty of provider choice are not more likely to prefer a CDHP type unless it has a strong provider network. However, these studies are not generalizable to other employers.

Four of eight studies find a positive relationship between CDHC enrollment and the importance of lower enrollee premium contributions (Barry et al., 2008; Fowles et al., 2004; Parente et al., 2004a, 2008). Interestingly, these studies also find evidence of a positive relationship between primary subscriber wages/salary and CDHP enrollment. Why those with

higher income are also more likely than lower income enrollees to place a high value on premium contributions remains unclear.

Socio-demographic variables. Research examines socio-demographic variables due to the influence social and individual characteristics can have on plan choice (Kronick, et al., 1996; Lee & Rogal, 1997; Tollen et al., 2004; Wison, et al., 1998). Socio-demographic variables in CDHP choice research include income, gender, age, coverage tier (individual or family), job type (exempt/non-exempt), education level, and ethnicity.[20] Gender, job type, education level, and ethnicity are all individual level characteristics and, with the exception of Barry et al. (2008), are treated as secondary analyses in the research. Studies generally assess independent variables at the household or contract level, which precludes the use of individual level measures in their primary analyses. Of socio-demographic factors included in the research, income is discussed first because findings suggest it is a key factor in CDHP choice.

Studies consistently find earnings to be positively correlated with CDHC enrollment. It may signify favorable selection or indicate different levels of financial risk tolerance across socio-economic groups. Favorable selection is sometimes suggested by higher earnings because individuals in higher socio-economic groups are generally healthier and require fewer health care services than those in lower socio-economic groups (Bloche, 2007; Hughes-Cromwick, Root, & Reohrig, 2007; Marquis & Kapur, 2005; Zaslavsky & Epstein, 2005). Alternatively, households with higher earnings may have a higher risk tolerance or premium cost elasticity. This means they are less financially vulnerable if they require medical care and incur greater out-of-pocket cost sharing, and place greater value on premium cost (Callan & Johnson, 2002; Parente et al., 2008). Households with higher earnings may choose the lowest costs up front (in the form of premium contributions) with less regard to breadth of coverage or utilization related out-of-

pocket costs, because they are willing to risk that they will not need medical care (Tollen et al., 2004). If they require medical care in the future, they would not be financially devastated by out-of-pocket costs associated with health care utilization (Christianson, Parente, & Feldman, 2004). An additional issue related to risk tolerance is that those in higher socio-economic groups have greater disposable income to fund a PCA account (Cardon & Showalter, 2007).

The research appears to have an unresolved inconsistency across findings between income and CDHP enrollment. CDHPs are positively associated with income. CDHPs are also positively associated with enrollees who demonstrate greater premium elasticity. However, research generally finds premium elasticity of demand is insignificant for very high-income consumers (Liu & Chollet, 2006). Thus, findings do not address the possibility that the relationship between income and CDHP enrollment is non-linear, for which a positive association between income and CDHP choice does not hold for very low or very high income enrollees.

Five of the nine studies that evaluate gender report a relationship between gender and CDHP enrollment (U.S. Government Accountability Office, 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2008; Tollen et al., 2004). Four find no statistically significant relationship for gender and CDHP selection (Barry et al., 2008; U.S. Department of Health & Human Services, 2009; Fowles et al., 2004; Parente et al., 2004a).

Two of the five studies that find an association between gender and CDHP enrollment examine sample populations enrolled in different types of CDHPs (Greene et al., 2006; Parente et al., 2008). Enrollees are able to choose a "generous" low deductible CDHP with an employer funded HRA, or "less generous" high deductible CDHP with an HRA or HSA.[21] Parente et al. (2008) finds a significant association between males and enrollment in the less generous option.

They also find more women choose the "generous" CDHP, but those findings are not statistically significant. Green, et al. (2006) identifies similar differences between the gender of primary subscribers and CDHC enrollment. They find a significant negative relationship between males and enrollment in a low deductible CDHP, but gender is not significant for the high deductible plan (Greene et al., 2006).

The Parente et al. (2008) and Green, et al. (2006) studies offer some preliminary evidence to suggest that a "generous," or low deductible CDHP with similar cost sharing to an HMO or PPO may be more attractive to women than a high deductible CDHP. Otherwise, evidence suggests that high deductible health plans eligible for a PCA have a positive association with male primary subscriber enrollment. The greater likelihood of males choosing CDHPs may be explained by the greater cost sharing such plans are perceived to require. For those in good health, women on average consume more health care services than men (Bertakis, Azari, Helms, Callahan, & Robbins, 1999; Muller, 1992). Therefore, women may be less likely to select a high deductible CDHP that may be more costly for health care needs. Alternatively, the influence of employee gender on plan choice may suggest an interaction between gender and earning disparities. However, no studies discuss this possibility. Evidence for low deductible CDHPs by Greene et al. (2006) and Parente et al. (2008) offer natural experiments to examine the effect deductibles have when coupled with a PCA. These studies also suggest the association found for gender and enrollment may be largely attributed to initial cost sharing or earnings.

Barry et al. (2008) examine single subscriber and multiple enrollee contracts separately to control the influence that an individual level measurement may have on a household level dependent variable of plan choice. Barry et al. (2008) state that "...spending among those choosing individual coverage (n = 3,619) and family coverage (n = 13,560) is not directly

comparable...” and accordingly stratify their analysis by coverage type (Barry et al., 2008, p. 1673). However, the authors suggest their failure to find an association between gender and plan choice may be explained by the inordinately high number of male employees (70 percent) in the sample (Barry et al., 2008). The different level of measurement for gender and plan choice may however provide an explanation for the inconsistency across other studies for this variable.

Six studies assess age across plans. Five find mixed results and one study produces no significant results related to age (Barry et al., 2008; U.S. Government Accountability Office, 2006; Greene et al., 2006; Parente et al., 2004a, 2008; Tollen et al., 2004). Age is sometimes used as a generic proxy for health status when other more direct measures of health status are unavailable or impractical. Health generally declines with age and health care utilization behaviors change (Ross, Shapiro, & Roos, 1984; Russell, 1981; Wan & Odell, 1981). A second possible influence controlled for by age is the influence of age related behaviors. Physical activity levels often decrease, and risk taking behaviors commonly lessen with age. Although health generally declines with age, it is also influenced by these age related behaviors.

Parente et al. (2008) and Green, et al. (2006) suggests that characteristics of CDHPs determine the effect of age on enrollment decisions. These two studies find younger enrollees are more likely to select a “less-generous” high deductible CDHP. However, they find older enrollees are more likely to select a “generous” low deductible CDHP (Greene et al., 2006; Parente et al., 2008). Green, et al. (2006) find no significant relationship between exempt employees’ age and CDHC enrollment for low or high deductible CDHPs, but do not explore why. Findings for these two studies are similar to those for gender. More generous low deductible CDHPs attract enrollees similar to those who chose an HMO or PPO (Greene et al., 2006; Parente et al., 2008). These findings may be explained by the characteristics of a

"generous" low deductible CDHP. Low deductible plans regardless of the existence of a PCA, may not fit the generally accepted profile of CDHC. Thus, contradictory findings between high deductible and low deductible CDHP enrollment for younger males may still be consistent with typical CDHPs comprised of a HDHP and PCA.

Barry et al. (2008) and the GAO (2006) find younger employees are more likely to choose a CDHP. The GAO report is consistent with Parente et al. (2008) and Green, et al. (2006) relative to high deductible CDHPs. Barry et al.'s (2008) results reveal a statistically significant negative association between age and CDHC enrollment. However, two characteristics of Barry et al.'s (2008) study should be noted. First, their sample population was 70 percent male. Differences in health needs between men and women may be important as they grow older, but the authors did not discuss how that could have influenced findings. Second, as with earnings and gender, Barry et al. (2008) is the only study that examines individual level measures in a subset analysis examining single contracts.

In contrast, Tollen et al. (2004) finds older Humana enrollees are more likely to choose a CDHP. Similarly, Fowles et al. (2004) do not report the effect of age in their logistic analysis, but do find a similar association in a bi-variate analysis between age and CDHC enrollment. The early form of CDHC offered by Humana Insurance may influence findings for these two studies. It is coupled with a PCA that restricts the use of funds to a weak provider network.

Mixed findings make it difficult to draw firm conclusions. The different results may occur because the CDHPs and the populations studied vary across different employers, and CDHP structures evolved between the different study periods of 2002 and 2004. Second, the use of an individual level measure, such as primary subscriber age by all studies except Barry et al. (2008), weakens the validity of related findings.

Seven studies examine the association between coverage tiers and plan choice. Health plan coverage tier has been categorized in CDHC research as single coverage (primary subscriber only) or family coverage.[22] This variable is used by the reviewed research for two purposes. First, the number of dependents covered by a health care policy can influence plan choice. If an insurance contract is intended to cover children or other household members, the choice of health plan may be based on the generosity of benefits or low out-of-pocket costs for their anticipated health care needs. If the primary subscribers seek coverage for only themselves and are in good health, low up-front premium costs or an opportunity to establish a health savings investment vehicle may be the most important factor in plan choice. Second, it is employed to control for the potential error associated with using individual level measures, such as earnings, age, gender, job type, education, and ethnicity in household level analyses.

Four studies find a positive relationship between single enrollee coverage and CDHP choice, one study identifies the opposite association, another suggests results depended on the "generosity" of CDHP, and a seventh study finds no significant relationship (Barry et al., 2008; Fowles et al., 2004; U.S. Government Accountability Office, 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2008; Tollen et al., 2004). Similar to gender and age, the structure of CDHP appears to influence research findings for coverage tier. Parente et al. (2008) finds a significant positive relationship between single coverage and "less generous" high deductible CDHPs, but find the opposite for "generous" low deductible HRA plans (Parente et al., 2008).

Research suggests there is a positive relationship between enrollment in a high deductible CDHP with Personal Care Account, and single coverage tier. Such a relationship may rsuggest that individual enrollees have a greater risk tolerance. Alternatively, it may indicate the likelihood of at least one household member that expects to benefit from a health plan that

provides less uncertainty and greater benefit generosity will be less likely to choose a high deductible CDHP. An example of this could be a spouse's expectation to incur an expensive medical event, such as the birth of a child, and is covered by the plan with no other sources of ESI. Although evidence supports the greater likelihood that those who choose a single coverage will enroll in a CDHP, the varied samples, methods, and divergent CDHP structures do not allow solid conclusions. Additionally, the family coverage tier does not account for the number of dependents or those who may be insured for partial years.

The final three factors discussed are exempt status, education, and ethnicity. Three studies assess exempt status of CDHP enrollees, three examine education level, and four evaluate ethnicity (Barry et al., 2008; U.S. Department of Health & Human Services, 2009; Fowles et al., 2004; Greene et al., 2006). Exempt employees are those who receive no overtime pay, earn a minimum salary of $23,600 per year, and are employed as executives, professionals, or administrative personnel, (Chanberlain, 2003). Green et al. (2006) create exempt and non-exempt strata within their sample population. They find a positive association for exempt employees and a negative association for non-exempt employees with high deductible CDHP enrollment. "Generous" low deductible HRA arrangements do not produce significant results for exempt or non-exempt employee enrollment. Exempt and non-exempt enrollees who have more years of formal education have a positive association with enrollment in the high deductible CDHPs. As with exempt status, years of education and enrollment in the low deductible CDHP do not produce significant results. Similarly, Fowles et al. (2004) report a significant positive relationship between exempt status and high deductible CDHP enrollment. Fowles et al.'s (2004) multivariate analyses do not find education to be statistically significant, while the U.S. Department of Health & Human Services (2009) identify a relationship between higher formal

education and CDHP enrollment. It is worth noting that Fowles et al.'s bi-variate analysis of education and CDHP enrollment does find the relationship significant (Fowles et al., 2004). Two important characteristics could explain different findings for education and CDHP enrollment across these studies. First, Greene et al.'s study population is from a manufacturing employer, and has two CDHP options of varied generosity. Fowles et al.'s employee population is from an insurance company, and the U.S. Department of Health & Human Services' (2009) sample is from the privately insured non-elderly U.S. population. Second, Fowles et al. (2004) study data pre-date 2003 IRS rule stipulations on HRAs, and Humana Insurance's CDHPs stipulate that PCA funds could only be used for providers in a provider network that represents lower penetration than other plan networks. Network strength and PCA limitations may have influenced results.

Because many exempt positions require at least a college degree, exempt employees usually have more years of formal education. Thus, education and exempt status are closely related. However there are exceptions, such as those employed in highly skilled trades. Exempt status and more years of formal education are also associated with higher wages/salaries. These relationships may explain why the effect of education and exempt status mirror those between wages/salaries and CDHP selection.

Four studies evaluate ethnicity among CDHC enrollees (Barry et al., 2008; U.S. Department of Health & Human Services, 2009; Fowles et al., 2004; Greene et al., 2006). Fowles et al. (2004), Barry et al. (2008), and U.S. Department of Health & Human Services (2009) find a negative association between non-white employees and CDHP enrollment. This could be seen as consistent with socio-economic divisions in the United States population. Non-whites in the United States have been found more likely to have fewer years of formal education

and lower wages/salaries (Schneider, Zaslavsky, & Epstein, 2002). This suggests that the significant negative association between non-whites and CDHC enrollment may be related to similar negative relationships for earnings and education with CDHP enrollment. Greene et al. (2006) finds no significant relationship between ethnicity and CDHP enrollment.

Empirical Research on Managed Care Plan Choice

This section will present an overview of plan choice research on two forms of managed care, HMO and PPO. That research has largely focused on the effect of selection bias due to the introduction of managed care plans in a Fee For Service (FFS) dominant ESI market. It is informative for the current CDHC research given the limited number of CDHC studies, and because it assesses similar factors of plan choice. Furthermore, this body of research evaluates plan choice when a new type of plan is introduced, with similar selection bias and risk segmentation concerns as with the introduction of CDHPs. For these reasons, research on CDHC has mirrored the earlier work on managed care plans.

When HMOs and PPOs began to capture ESI market share, FFS plans dominated the market (Hellinger & Wong, 2000). As managed care plans gained market share in the 1980s and 1990s, favorable selection concerns emerged in the health insurance research literature. FFS plans offer broader coverage with few restrictive policies for non-preventive care than HMOs and PPOs, thus more freedom for people to seek and receive care for existing conditions (Hellinger & Wong, 2000). Some managed care plans also offer disease management programs, further structuring treatment and approval regimens that limit consumer choice (Hellinger & Wong, 2000). This presents the possibility that healthier people with little expectation for needing to access care in the near future will choose a plan with the lowest premiums regardless of plan generosity or restrictiveness. Managed care plans offer lower premiums than FFS plans,

thus making them the preferred choice for such persons. Plan restrictions are not as important for those who do not expect to use health care services. Thus, less healthy people are expected to choose a FFS plan that does not restrict provider choice or treatment protocols, because people expect to need care and prefer more freedom in their decision-making (Hellinger & Wong, 2000). Additionally for HMOs, healthier individuals prefer the emphasis on preventive and wellness care (Hellinger, 1995). Thus, researchers hypothesize that HMOs and PPOs experience favorable selection and cause risk pool segmentation.

HMO plan choice. Two comprehensive literature reviews of HMO plan choice research provide key insights, but produce different conclusions. A study by Fred Hellinger (1995) and a second by Hellinger & Wong (2000) review HMO research literature for the methods used, populations studied, and evidence of selection bias in the ESI market. The reviews include studies of managed care enrollment in the Medicare and Medicaid markets. However because CDHC enrollment for non-elderly adults in an ESI market is the focus here, the Medicare and Medicaid research is not discussed.

Methods and study populations are similar across managed care studies, and to CDHP choice research that followed. Managed care research evaluates single employer or provider group study populations, uses similar multivariable analyses, and examines the same variables of health care spending, health status, and socio-demographic controls as the CDHP choice research that emerged in the early 2000s.

The 1995 literature review cites evidence that supports the hypothesis that HMOs experience favorable selection when offered along side FFS plans (Hellinger, 1995). Study samples are drawn from medical provider practices and employer sources, and include those enrolled in different types of HMO plans. Much like CDHP choice studies, researchers evaluate

health status that use measures such as the presence of chronic conditions, dollars spent on health care services in years prior to HMO plan enrollment, and types of utilization prior to HMO enrollment. Hellinger cites research by Welch (1985) to conclude that although favorable selection exists in HMOs, it is overestimated. There is less favorable selection than first believed. Hellinger (1995) suggests prior utilization measures for a health status proxy are flawed, in that they "…tend to move toward their mean over time, and those persons who are relatively high users of health care resources today are likely to experience levels of utilization closer to the mean in future periods (Hellinger, 1995, p. 141)." Hellinger (1995) suggests some favorable selection remains for HMOs even after adjusting for overestimation. However, he also suggests the inclusiveness of HMO provider networks can influence levels of HMO selection bias. If low-risk individuals place a higher value on keeping their current physician, who may be unavailable in a more restrictive HMO network, HMO plans will experience less, or no, favorable selection because enrollees will place too much value on existing provider relationships (Hellinger, 1995). Thus, Hellinger believes network strength and its affect on available health care providers to be important factors in selection bias.

The Hellinger & Wong review examines research published between 1993 and 2000. The authors find limitations similar to Hellinger's 1995 study. As with CDHC research, all studies are limited by self-reports of health status and health care utilization, single employer samples, self-selecting employer respondents, and inconsistent types of HMO plan structures.

In contrast to Hellinger's 1995 review, later research shows favorable selection no longer exists for HMOs in the ESI market (Hellinger & Wong, 2000). They hypothesize this may be due to increased HMO penetration in the ESI market (Hellinger & Wong, 2000). Traditional

indemnity FFS plan enrollment fell from approximately 71 percent of the ESI market in 1988 to 13 percent in 1998 (Hellinger & Wong, 2000).

PPO plan choice. Preferred Provider Organizations were introduced as an ESI plan structure after HMOs in an effort to ease managed care backlash due to restrictive HMO policies (Shi & Singh, 2003). As PPO managed care plans were introduced, selection bias was researched as it had been for HMOs. The rationale for possible PPO favorable selection was similar to that for HMOs. PPOs restrict health care use, although to a lesser degree than HMOs. PPO plans rely on an established network of health care providers, and offer lower out-of-pocket costs for enrollees that use network versus non-network providers. Although many PPOs allow enrollees to use non-network providers for higher out-of-pocket costs, some "exclusive" PPOs pay nothing for non-network provider services. PPOs also employ deductibles, co-pays, and co-insurance to curb use. Although PPOs have higher cost sharing than HMOs, they generally have lower up front premium costs than FFS plans (Montgomery, 2005). Hellinger's 1995 literature review examines PPOs and finds mixed evidence of selection bias. The studies examine socio-demographic characteristics, prior health care utilization, and health status of enrollees. Sources of data include enrollee surveys, employers' human resources files, and enrollees' prior year claims file data (Hellinger, 1995).

However, the studies examine varied plan types such as Exclusive Provider Organizations (EPO) and Preferred Provider Organizations (PPO), examine different employer populations, and are offered as one or more options alongside multiple managed care and non-managed care plan types. The research generally shows that PPO enrollees have lower utilization in the year prior to selecting the plan compared to enrollees who select an HMO plan. For example, Wouters and Hester (1988) study one employer that offered PPO and HMO plans, and

find favorable selection with low users selecting the PPO plan. The study population includes 25 percent HMO and 75 percent PPO enrollment (Wouters & Hester, 1988). In contrast, a study with a sample from four employers by Hosek and Marquis (1990) examines a similar enrollment mix of 20 percent HMO and 80 percent PPO, and find no significant relationship of prior use or health status and PPO enrollment.

Two of the studies Hellinger (1995) reviews are Strumwasser, Paranjpe, Ronis, McGinnis, Kee & Hall (1989) and Zwanziger and Auerbach (1991). Each study evaluates single manufacturing employer populations that offered EPO and traditional FFS plans. EPOs do not pay for care outside the network. Both studies find the EPOs experience favorable selection. Enrollees, who have between 27 and 30 percent lower health care use in the year prior to joining a plan, are more likely to choose the EPO (Hellinger, 1995).

Billi, Wise, Sher, Duran-Arenas, and Shapiro (1993) examine the University of Michigan Medical Center's initial offering of a PPO, and conclude it experienced favorable selection. The medical center study uses demographic data from human resource files and prior year utilization records from claims data. PPO enrollees are younger, more likely to have a family contract, and have 18.7 percent lower health care spending the year prior to joining the plan (Billi, Wise, Sher, Duran-Arenas, & Shapiri, 1993).

Thus, evidence regarding selection for PPO plan enrollment is similar to that for HMOs. When PPOs were introduced for the first time by ESI programs, research suggests that favorable selection occurs based on health status, prior health care use, and socio-demographics.

Research suggests more restrictive HMO plans with lower premiums are expected to experience favorable selection, not PPOs. However, no generally accepted explanations exist as to why PPOs experience favorable selection when offered as an option with HMO plans.

Wouters & Hester (1988) suggest when PPOs are introduced to ESI programs with an established HMO, an early adopter effect wherein younger healthier employees more likely to change health plans choose PPO plans. Concurrently, less healthy enrollees in HMO plans are less likely to switch to a PPO plan and interrupt current provider care relationships. Additionally, some HMOs establish disease management programs that establish provider relationships and treatment regimen familiarity, which can influence the reluctance of less healthy enrollees to switch to a PPO. This hypothesis is supported by findings that there is reluctance by HMO enrollees to interrupt patient provider relationships when actively using health care (Wouters & Hester, 1988).

The literature suggests that when managed care plans were introduced to a FFS dominant market, they experienced favorable selection. However, as managed care became the dominant form of ESI, selection bias dissipated.

Chapter 2 Summary

CDHC plan choice findings are based on few studies that study homogeneous enrollee groups with low CDHP enrollment, most of which pre-date 2003 IRS rule clarifications on the guidelines for PCA use. Furthermore, three of ten studies examine the same employer over the same period of time.

Early research suggests that when CDHPs are introduced to an ESI program comprised of Managed Care plans they experience initial favorable selection. Prior to enrollment, those who choose a CDHP have lower expenditures on health care services, fewer prior health care visits and are in better health. Findings suggest CDHP enrollees may expect to use fewer future health care services, thus avoiding high CDHP deductible costs, and prefer the plan's lower premiums. However, enrollees who anticipate greater future health costs may perceive CDHPs to represent

a greater risk of high out of pocket costs, and choose a Managed care option. Another possible explanation may be that Managed Care enrollees are simply averse to coordinating the initial financing for the first several thousand dollars of care required by CDHPs. Although demand side cost sharing is a key feature of CDHPs, existing research does not examine the influence of enrollee cost sharing on plan choice.

Research suggests CDHP enrollees are more likely to have single subscriber coverage than Managed Care enrollees, which may be associated with enrollee expectations of future healthcare costs. Single subscribers may perceive CDHPs to represent lower risks for future out of pocket costs than multiple enrollee households where the scale of future health care needs can be less predictable.

CDHP enrollees are more likely than Managed Care enrollees to have higher income. Two causes are suggested to explain the positive association between income and CDHP choice. First, higher income enrollees may have greater emergency or discretionary funds. Thus, they have lower relative financial risk for selecting a CDHP with higher cost-sharing (Hanna & Chen, 1995). Second, this finding may suggest that high income enrollees are more likely to possess greater formal education and relative work experience, which increases their ability and willingness to engage in complex health care use decisions represented by CDHPs. Employee earnings is used as a proxy for household income by most studies because data were not available for sources of income other than the study employer.

Findings for exempt status and CDHP choice are consistent with higher income and better health status. Exempt status is a measure often used to represent higher income, education and better health. Findings of a positive association between exempt employees and CDHP enrollment are consistent those between CDHPs, higher income, and better health.

A relationship with FSAs is also identified with CDHPs. Enrollees who previously funded an FSA are more likely to choose a CDHP (Parente et al., 2004a, 2004b). Similar to findings for income and exempt status, this may represent more educated employees with experience in coordinating the complexity of planning for and coordinating some basic future healthcare costs.

Research finds lower plan premiums are associated with plan choice (Barry et al., 2008; Fowles et al., 2004; Parente et al., 2004a, 2004b, 2008). The same studies also find a positive association between CDHPs and income. Thus evidence supports a relationship between lower premiums, higher income, and CDHPs. These findings can be seen as inconsistent. One would expect lower income enrollees to be most sensitive to premium costs, and CDHPs generally have lower premiums than Managed Care plans. One possible explanation is that the risk of high initial cost sharing featured in most CDHPs may be more critical to lower income enrollees than premiums that are sunk costs after plan selection. A second possible explanation may be that the relationship between income and CDHP enrollment may not be linear. Income may have a positive association with CDHP enrollment for the larger ESI population, but very low-income enrollees may have high premium elasticity and seek the lowest premium plans and very high-income enrollees may seek higher premium Managed Care plans with more generous benefits because they have low premium elasticity. Research does not examine if income has a linear relationship with CDHP choice.

Contributions of this study. This study will attempt to address gaps in the research and add evidence to uncertain associations with CDHP enrollment. It examines more recent employer data than prior research and adds to a dearth of findings from a small sample of

employers studied thus far. For the study period used in this study, CDHPs such as HRAs and HSA eligible HDHPs have become a more standardized insurance model in the ESI market.

First, research does not examine very high or very low-income employee categories for plan choice. The relationship between plan choice and income may be non-linear. This study models a nonlinear relationship between income and plan choice. Early evidence suggests income has a positive association with CDHPs, however the association between highest and lowest income enrollees and plan choice may have a different association with CDHP choice than the larger ESI population.

Second, in contrast to previous research that examines enrollees' health as the primary predictor of plan choice, this study focuses on plan choice based on economic enabling resources and perceived need of household enrollees. Economic enabling resources are factors that influence the ability to seek and procure health care services. Perceived need suggests factors of cost related to prior and future health care use will be associated with plan choice because of future cost. The theoretical model developed in Chapter 3 postulates that economic enabling resources and perceived need are key factors that account for expected health care needs, the influence of prior healthcare cost on future expenditures, and the ability to access and use health care services, all of which influence CDHP choice.

Third, no study discussed in this chapter examines enrollees' prior cost sharing's association with plan choice. This study examines prior enrollee household cost sharing. Cost sharing includes two components, fixed enrollee premium contributions and variable cost sharing that is determined by enrollee out-of-pocket costs with health care utilization. Premiums are a factor in plan choice, but they are only one component to an enrollee's cost to access and use

health care. Cost sharing includes the fixed premium cost as well as the variable costs associated with the use of healthcare in conjunction with plan financial characteristics.

Fourth, this study adds to the literature by assessing the relationship between prior FSA funding and the choice between Managed Care and CDHPs for an ESI program with different plans and employee population. Parente et al. (2004b) find a positive relationship between prior FSA participation and CDHP enrollment. FSAs use some characteristics similar to PCAs used in CDHPs. Thus, this study will add to the literature as only one study examines the FSA relationship with CDHPs.

Fifth, much of the research examines employee level variables relative to plan choice with no formal theoretical model. This study presents a theoretical model to examine plan choice at the household level of analysis. All enrollees covered by a subscriber contract influence the plan choice decision directly or indirectly.

Finally, prior studies used coverage tier to control for the number of household enrollees. Coverage tier includes single subscriber, employee + spouse, employee + child, or family. Coverage tier fails to capture how many dependents are enrolled, does not account for those added or dropped from coverage during the policy period, and thus does not adjust cost sharing or health risk measures for the specific number of enrollees per household. This study includes coverage tier, but also controls for enrollments months to account for the exact number of enrollees per household that comprise aggregate household measures of health risk and prior cost sharing. Enrollment months account for enrollees who are added or removed from a household plan during the policy year and make it possible to identify the number of household enrollees.

Chapter 3 - Theoretical Framework

This chapter consists of two sections. The first section discusses theoretical models used to explain individual health care behaviors and explains the model used to guide this study. The second section presents an adapted theoretical framework and is the basis for the study hypotheses.

Individual Behavioral Theories

Health behavior theories use personal attributes, individual characteristics, and overt behavior patterns to explain individual health care behavior (Gochman, 1997). Many individual behavioral theories include "…factors (such as) …intentions to behave, environmental constraints impeding the behavior, skills, outcome expectancies, norms for the behavior, self-standards, affect, and self-confidence with respect to behavior" (Elder, Ayala, & Harris, 1999, p. 276). For example, the Health Belief Model was developed to help explain why and when individuals will engage in preventive healthcare and has since evolved to address illness and sick role behaviors (Gochman, 1997). The model purports that individuals decide if they will seek medical care depending on their own perceived health vulnerability and efficacy of such care (Elder, et al., 1999). Model constructs include perceived illness susceptibility, perceived illness severity, perceived benefits related to individual actions, and the barriers related to those actions (Gochman, 1997). The Health Belief Model is a framework used primarily to understand health behavior and non-compliance with health care recommendations (Becker & Rosenstock, 1984).

The transtheoretical model, sometimes referred to as Prochaska and DiClemente's stages of change, suggests there are six stages of personal change through which a person may progress. The stages are pre-contemplation, contemplation, preparation, action, confirmation or maintenance, and relapse. The model, widely used in behavioral modification research, purports experiential and behavioral change activities are factors for an individual to cyclically progress forward or backward between the stages of change (Whitelaw, Baldwin, Bunton, & Flynn, 2000).

Andersen's behavioral model was developed to evaluate factors that influence health care seeking behaviors, particularly access to health care using the family as the unit of analysis (Andersen, 1995). The model was later expanded to include utilization behaviors of health related services. The behavioral model has four recursive dimensions: environment, population characteristics, health behavior, and outcomes. Each dimension consists of factors that impede or facilitate the access and use of health care services. Andersen's model has been widely used to study equitable access for vulnerable populations and has been broadly applied in health care utilization research.

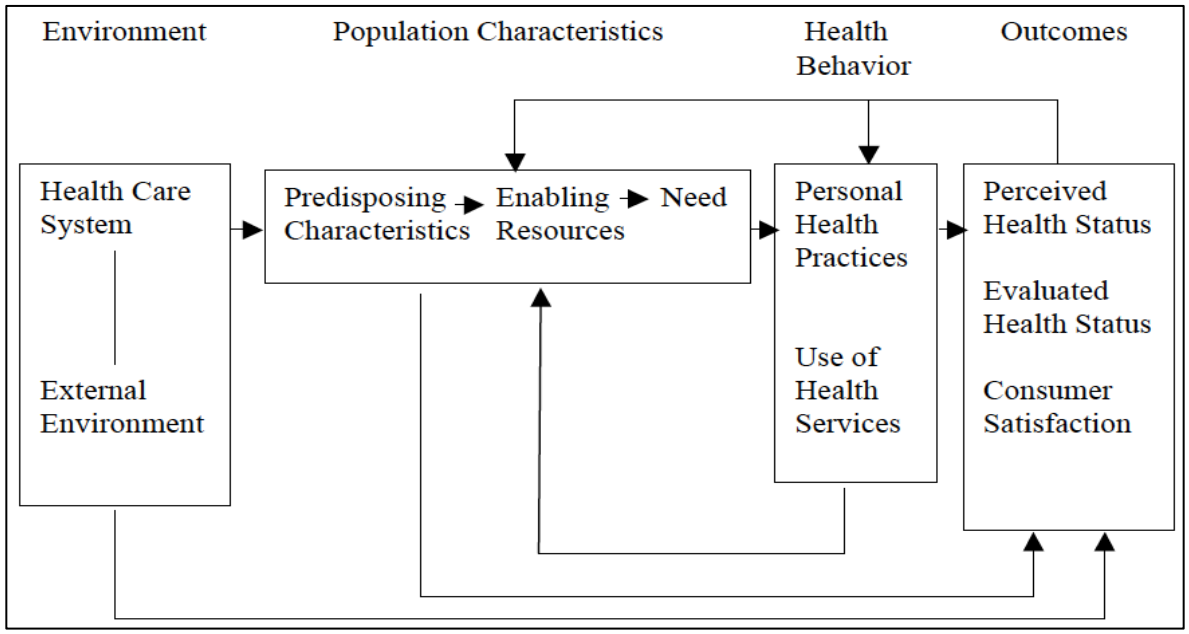
The conceptual framework for this research is based on the behavioral model. Andersen's model is focused on what factors influence the access to and use of health care. Given the crucial role of health insurance in accessing health care, employee choice of a health plan is a decision that governs their health behavior. Such a choice also influences their use of health related services since health care insurance coverage, in large part, determines how services are accessed and used.

Behavioral Model

Andersen's model has evolved since it was first developed in the late 1960s. The behavioral model's first iteration originally consisted of four dimensions: predisposing characteristics of the individual, enabling resources available to the individual, their need for health care, and use of health services (Andersen, 1995). The second iteration developed by Andersen and others in the 1970s revised the behavioral model dimensions to population characteristics, health care system, use of health services, and consumer satisfaction (Andersen, 1995). These changes were intended to stress the influence of the health care system on health behaviors and health care policy, as well as account for satisfaction as an outcome. In a third iteration of the model developed over the 1980s-1990s health status outcomes were added to address population health maintenance as part of effective and efficient access and account for possible health care system reform (Andersen, 1995). Figure 4 depicts the behavioral model's fourth iteration. This model's primary change was to illustrate the dynamic and recursive nature of health care services' access and use (Andersen, 1995). The behavioral model developed in the 2000s in Figure 4 modifies the dimensions by segregating contextual and individual characteristics for predisposing, enabling, and need constructs. This emphasizes community, healthcare policy, and the physical environment within a separate contextual characteristics dimension, while the former version encapsulates these factors under the environment dimension (Andersen, Rice, & Kominski, 2007). This study's theoretical structure is based on the latest version of the behavioral model illustrated in Figure 4 to focus on the Employer Sponsored Insurance (ESI) environment, discussed later.

In their simplest form, efforts to access and use health care are individual behaviors (Andersen & Newman, 1973). Andersen purports that factors related to seeking health care

Figure 4. Andersen's Behavioral Model



Source: "Revisiting the Behavioral Model and Access to Medical Care: Does it Matter," by R.M. Anderson, 1995, Journal of Health and Social Behavior, 36, p. 8.

include characteristics that facilitate access to care, overt efforts taken to access care, and behaviors related to the actual use of health care services. Access may exist without the use of health care, but some form(s) of enabler(s) to access such health care must precede use (Andersen, 1995). Andersen and Newman contend that access to health care increases with third party insurance reimbursement, and "…the greatest effect on health service utilization (*has*) todo with how medical care is financed" (Andersen & Newman, 2005, p. 10). Andersen & Newman (2005) additionally purports that enabling resources at the household level, such as income and insurance coverage, play a key role in the access and use of health care by individuals.

Research guided by the behavioral model relies on basic constructs developed over time within each dimension and include: the health care system and external environment, predisposing characteristics, enabling resources, need, personal health practices, use of health services, perceived and evaluated health status, and consumer satisfaction (Figure 4). These

constructs, the respective dimensions, and their interaction are described first. Then an adapted conceptual model is developed for the current study.

Model dimensions.

Environment. Andersen's environment dimension includes the health care system and external environment (Figure 4). Health care system characteristics include the number and types of health service providers or facilities, the level of technology, and financial make-up (profit verses non-profit). The external environment includes physical (variations in diet, climate, and environmental conditions), political (financing and health education), regulatory (certificate of need programs, credentialing, or certification and licensing rules) and economic (unemployment, inflation rates, or strain on the availability of health care systems' resources) conditions.

Population characteristics. Population characteristics include predisposing characteristics, enabling resources, and need. Each factor is described next within the context of population characteristics.

Predisposing characteristics. Predisposing characteristics are individual level factors that "…enable or impede use, and … need for care" (Andersen, 1995, p. 1). They include demographics, social structure, and health beliefs. Demographics refer to immutable and exogenous variables such as age, gender, and geographic residence. They are related to the likelihood of certain health issues among population segments (E.g. hypertension among African Americans). Social structure is an individual's interpersonal and social status within the community. Social structure characteristics include education, ethnicity, occupation, and family status. Such characteristics "… suggest what the lifestyle of the individual may be, and they point to the physical patterns which may be related to the use of health services" (Andersen & Newman, p. 15). Health beliefs "… are attitudes, values, and knowledge that people have about

health and health services that might influence their subsequent perceptions of need and use of health services" (Andersen, 1995, p. 2).

Enabling resources. Enabling resources are factors that influence the ability to seek and procure health care services, and represent what Andersen calls "potential access." Enabling resources at the individual level can be social or economic. Social resources include the support available from relationships. Family, friends, or acquaintances are sources of knowledge, experience, and support. Social resources improve or enable the ability to access or navigate the complexity of the health care system. Economic enabling resources are factors that affect the ability to pay for health care services. Community level enabling resources include community based health education and outreach or financial assistance to purchase health services (e.g. free health clinics, vaccination programs, information campaigns, and community based programs).

Andersen identifies health insurance as one of the most important factors for potential access and use of health care related services. Health care use is costly across all forms of care such as routine care, serious illness, disease, or injury. First, aggregate costs for routine preventive care and minor medical needs can accrue to significant financial costs over short periods of time and become a burden for many. Second, serious illness, disease, or injury may require treatment with costs that exceed the net worth of most persons. Insurance makes a portion of medical costs more predictable via monthly insurance premiums, helps defray routine medical expenditures, and largely insulates individuals from the risk of catastrophic financial loss. Thus, health insurance provides a vehicle to make potential access more possible to more people than most other economic enablers.

Need. Andersen describes two types of need, perceived need and evaluated need. Perceived need is one's subjective assessment of the necessity to seek health care services. It

includes how well (or unwell) one feels, how important one views seeking care for an illness or injury, and the social or cultural influences on a perceived physical or psychological condition. Alternatively, evaluated need may be the result of a physiological exam, or an outsider's subjective assessment and treatment recommendation. It is strongly correlated with seeking health care services for biological self-preservation (Andersen, 1995; Hulka & Wheat, 1985). Evaluated need only exists after an outside stimulus.

Perceived need, whether it originates from evaluated or perceived need, is essential to activate individuals for the access and use health care services. Need acts as the catalyst to change mere potential for the access and use of care into actual access and use.

Health *b*ehavior. The health behavior dimension attempts to capture behavioral factors of personal health practices and use of health services. Personal health practices include health behaviors that influence a person's health status, and as a result, the likelihood of seeking health care services (Shi & Singh, 2003). Unhealthy practices increase the potential to seek formal health care, either voluntarily or involuntarily. Additionally, health care experience may lead a person to change his or her personal health practices. Past health care use can result in a negative or positive opinion of formal health care services. Past experience may influence individuals to either adopt healthy behaviors in an effort to reduce the need to seek formal care, or become averse to such care seeking regardless of need.

Outcomes. The outcomes dimension includes perceived health status, evaluated health status, and consumer satisfaction. Perceived health status refers to the subjective self-assessment of one's own physiological and psychological condition. Activities and social interaction can alter such perceptions of physiological and psychological health. For example, changes in the ability to perform daily activities relative to one's peers can raise or lower perceived health

status. Evaluated health status is determined via a physical or psychological exam by a health care professional. This can influence behavior and lead to future use of health care services. The ability to understand, or willingness to believe, an evaluated outcome is necessary. First, a person must understand their evaluated illness or condition and the consequences of action or inaction. Second, they must be willing accept the professional's evaluation.

All dimensions of the behavioral model influence consumer satisfaction. Consumer satisfaction is the psychological product of health care access and use that has been perceived as either a positive or negative experience. The environment can affect ease of access and use; predisposing characteristics can enhance, decrease, simplify, or complicate access and use; health behaviors can create positive or negative experiences; and health status influences a person's current comfort level or unfulfilled need. Satisfaction is a product of positive or negative influences from such obstacles or facilitators, predispositions, perceptions, and experiences related to the access and use of health care services.

Use of the Behavioral Model. The behavioral model has been used extensively in health services research to guide the study of health care related behaviors. The behavioral model has served as a theoretical framework to examine multiple forms of health care access and use including family health care use, mental health services, dental care (Andersen & Davidson, 1997; Andersen, Kravits, & Anderson, 1976; Davidson, Cunningham, Nakazono, & Andersen, 1999; Fasoli, Glickman, & Eisen, 2010, Gilbert, Branch, & Longmate, 1993). The model has also been used to evaluate patterns of utilization, behaviors of those with chronic conditions, discretionary use of health care by older adults, societal and individual determinants that affect equity in health care use, and health care use for vulnerable populations (Hulka & Wheat, 1985;

Goff, 2007; Mitchell & Krout, 1997; Andersen & Newman, 1973; Andersen & Davidson, 1997; Stein, Andersen, & Gelberg, 2007).

These studies focus on one or more of the dimensions or constructs from the full model. One widely applied dimension is that of population characteristics to evaluate predisposing characteristics, financial enablers, and health care need characteristics (Andersen, 1974; Andersen & Davidson, 1997; Andersen & Newman, 1973; Fasoli et al., 2010; Gilbert et al., 1993; Hulka & Wheat, 1985; Liu & Chollet, 2006; Mitchell & Krout, 1997; Stein et al., 2007). Enabling resources, such as third party health insurance, is a key factor in obtaining access to health care (Andersen, 1995; Andersen & Newman, 2005).

Although Andersen & Newman (2005) emphasize the relevance of how health care services are financed, to date no research has used the behavioral model to examine employee household choice across differing types of health plans. At the time of the initial development of the Andersen model, health insurance was limited to Fee For Service (FFS) models. The health insurance environment now offers a variety of health plan types from which an employee can choose, e.g. HMOs, PPOs, POS, mini med plans HRAs, and HSA eligible plans.

As discussed in Chapter 2, the evolution of different health insurance plans focuses largely on supply or demand controls, which are modifications to plan financial structures that affect the access and use of health care. Although the evolution of plan financial structure can in part determine the impact of enabling resource factors on health care use and access, research to date has narrowly focused on employee or household income. There may be additional enabling and need factors that lend clarity to how these changes in plan financial structure may affect plan choice. This study uses an adaptation of the behavioral model to focus on the enabling resources

and need constructs to assess plan choice in an Employer Sponsored Insurance program that includes managed care and Consumer Directed Health Plan options.

Conceptual Model

A conceptual model adapted from Andersen's behavioral model guides this study to examine ESI choice, which determines how health care is accessed and used. Andersen's model emphasizes the importance of individuals' characteristics that affect the means and manner health care is accessed and used, their need for health care, their possessing the necessary resources to access and use health care services, and the prominent role of third party insurance coverage such as ESI. Where Andersen's full theoretical model was designed to predict overall health care access and use, this study creates an adaptation that concentrates on perceived need and enabling resources as an outcome that determines *how* health care is accessed and used.

A few studies have explored CDHC plan choice with quasi-theoretical models. Fowles et al. (2004) and Green, et al., (2006) suggest plan choice is a product of four domains similar to the behavioral model (socio-demographic characteristics, health status, utilization, and plan characteristics) but do not develop a conceptual model. Parente et al. (2004a, 2008) use a model of utility maximization and emphasize economic tradeoffs between enrollee resources and plan characteristics. These studies and others discussed in Chapter 2 suggest predisposing characteristics, health care need and prior use, and economic enabling resources, as described by Andersen, play a significant role in plan choice (Ronald Andersen, 1995; Barry et al., 2008; Fowles et al., 2004; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Government Accountability Office, 2006; U.S. Department of Health & Human Services, 2009). Based on findings from these studies factors of predisposing characteristics, economic enabling resources, health care need, and plan cost characteristics are

key constructs from the behavioral model used to guide this study's analyses of CDHP choice. Four independent variables under these constructs are examined.

This study will examine income as a key economic enabling resource, but expands the analysis to contrast enrollees with the highest and lowest levels of income with the larger mean income population. Research in Chapter 2 treats income as having a linear relationship with CDHP plan choice (Barry et al., 2008; Fowles et al., 2004; ; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009; U.S. Government Accountability Office, 2006). This study will assess if the relationship between income and plan choice is non-linear.

The second and third independent variables examined by this study are prior cost sharing and FSA use. Research has examined prior health care utilization and health status as predictors of future use to assess the likelihood of adverse selection between plans. In this study, the association between plan choice and prior health care utilization variables is examined to measure self-perceived need from prior financial outcomes of health care use. Factors of self-perceived need may account for behaviors related to plan choice, which determines how health care is accessed and used.

Prior cost sharing and FSA use are products of an enrollee's prior health care need and utilization. Greater need suggests greater cost sharing and FSA use. Cost sharing and the use of a spending account vary across health plans and can impede or ease health care access and use. Therefore, the plan chosen influences the financial outcomes of future health care use. A person who experienced high prior cost sharing and FSA use is expected to have a greater self-perceived need for future health care and to be more likely to choose a plan with lower cost sharing characteristics or demands to coordinate funding (as with an FSA). This suggests, greater or

lesser prior cost sharing and FSA use will contribute to self-perceived need and are related to plan choice.

The fourth independent variable, relative health risk, is also part of the self-perceived need construct. Findings by Fowles et al., (2004), and Parente et al. (2004a; 2008) suggest that healthy enrollees with a low relative health risk are more likely to choose a CDHP. Enrollees with a low relative health risk can expect to use less health care. Those who expect to incur fewer out-of-pocket costs will be more likely to choose a lower premium and less generous CDHC versus a Managed Care Plan. Alternatively, enrollees with greater relative health risk are more likely to perceive greater health care needs and seek to minimize cost sharing with a Managed Care plan versus CDHP.

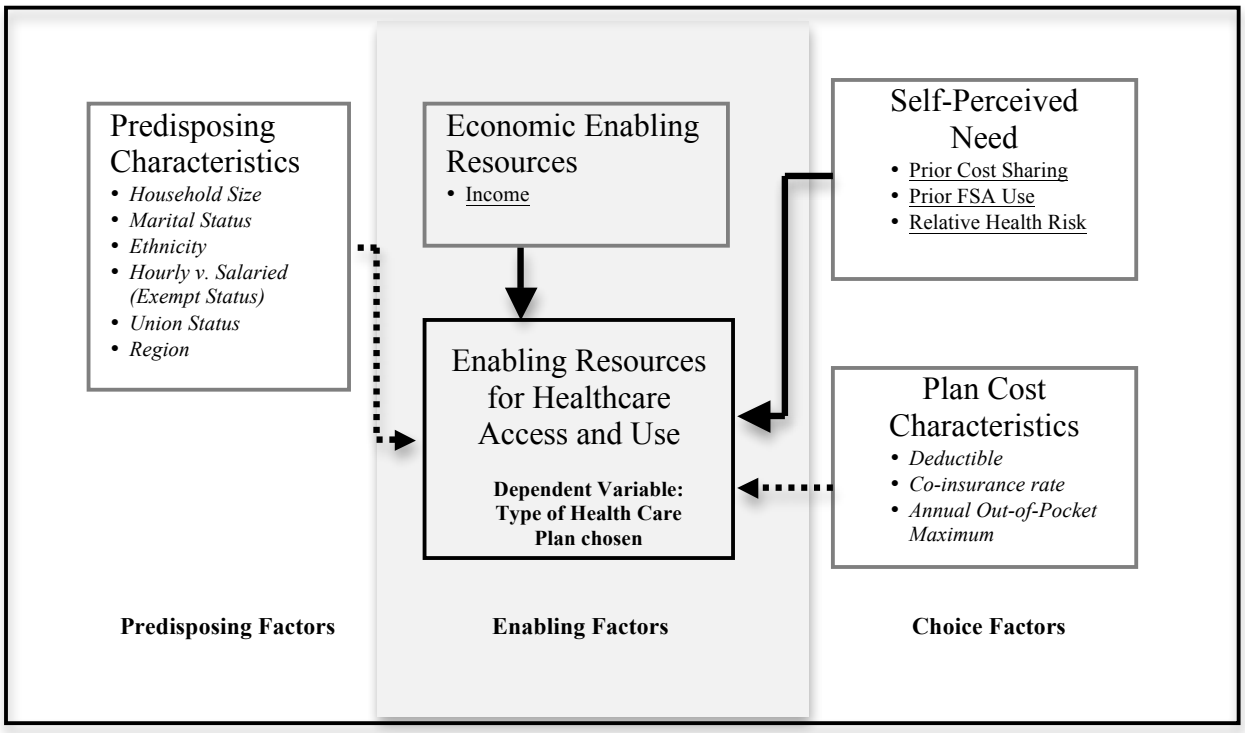
Finally, variables that measure plan cost and predisposing characteristics are included in the model as controls. These variables can affect how each plan is used based on their influence on end user cost, as well as the immutable characteristics of enrollees that frame their approach to healthcare related decisions, including the choice of a plan used to access care.

The focus of this study is enrollees' prior experience relative to economic enabling resources and self-perceived need, but plan choice cannot be examined without controlling for cost characteristics of the plans that comprise the group of plans from which one is chosen. Enrollees are assumed to assess the cost characteristics of available plans in the choice set. Indeed, research supports an association between enrollee premium contributions and plan generosity with plan choice (Barry et al., 2008; Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004). Parente et al. (2008) measure generosity with the plan deductible, co-insurance rate, and annual out-of-pocket maximum. The remaining control variables of household size, marital status, ethnicity, employee exempt status, union status, and

region are under the predisposing characteristics construct. Control variables are discussed later in more detail.

Figure 5 illustrates three dimensions that include constructs and variables in the conceptual framework based on an adaptation of Andersen's behavioral model. First, as in the behavioral model predisposing characteristics are factors that can influence immutable enabling resources and need. Second, choice factors are plan cost characteristics that ease or impede access to care and self-perceived need represents the personal and financial implications of future care on plan choice. Third, economic enabling resources are factors that affect the ability to access and use health care services (Andersen, 1995).

Figure 5. Conceptual Model for Plan Choice



Notes.
[1] Underlined factors and solid arrow lines represent predictor variables in the model
[2] Italicized factors and dashed arrow lines represent control variables in the model,
[3] Conceptual Model is adapted from Ronald Andersen's Behavioral Model, Figure 4

The conceptual model consists of predisposing, enabling, and choice factors. Predisposing characteristics from the original behavioral model comprise predisposing factors in this study's adapted model. These are considered by Andersen (1995) as largely immutable and are measured by household size, marital status, ethnicity, years of formal education, employee exempt status, and region. Figure 5 illustrates an indirect relationship between predisposing characteristics and self-perceived need and economic enabling resources. According to Andersen, predisposing characteristics shape social structures and beliefs that are indirectly associated with income and self-perceived needs (Andersen, 1995). Consequently, predisposing characteristics influence the outcome of plan choice. The model also includes choice factors of plan cost characteristics and self-perceived need. Plan cost characteristics are immutable costs associated with each plan, with or without health care use, that influence the outcome of plan choice. Self-perception of need is also largely immutable and directly associated with the outcome of plan choice. Self-perceived need includes variables that measure prior health care access and use experience. The connection to plan choice is based on the premise that prior health care experience suggests future need, and the plan chosen will determine how health care will be accessed and used in the future. Finally, enabling resources include economic enabling resources and enabling resources for healthcare access and use. The economic enabling resource of income, also considered to be largely immutable by Andersen (1995), is key for enrollees to finance enrollment in a plan and any out-of-pocket costs associated with the use of healthcare under the chosen plan. The outcome variable of plan choice is the enabling factor that determines how healthcare is accessed and used.

Model assumptions. This study relies on two sets of assumptions, one relative to the study sample's environment and a second regarding enrollee decision-making. The environment

in this study consists of the health plan provider networks available with the insurance, ESI enrollment parameters, and plan geographic coverage. These factors reflect the Behavior Model's health care system and external environment (Figure 4), but no data are available to directly measure these constructs. The employer in this study established three parameters for the ESI program across the enrollee population. These parameters represent some basic controls in lieu of direct environment measures. First, the ESI setting provides that all full time employees are offered benefits under the same cost and conditions of their contractual enrollment. Next, all plans in the ESI program meet a minimum PPO network penetration. PPO network penetration refers to the percentage of "in-network" medical providers that are within an enrollee population's geographic region for each plan. Third, the percent of employee households within a minimum travel distance to "in-network" health care providers and hospitals meets a minimum level for each plan in every geographic region. All reviewed literature in Chapter 2 treated the environment in a similar manner, as no environment measures were discussed as included in the research.

The second set of assumptions includes three issues regarding enrollee economic decision-making required to explore the relationship between economic enabling resources' and plan choice. First, due to a scarcity of resources, there is a trade-off between choices. Individuals must give up something of value to obtain another resource of value, such as lower premium contributions versus benefit generosity of the plan. Second, persons making a choice between different plans are rational decision makers. This assumes that individuals will make the best choice to further their interests within their budget constraints. Third, for individuals to make a rational choice they must be capable of thinking at the margin. This means they are able to distinguish between the cost and value of purchasing one more unit of value, or between health

plans that offer varied benefits and costs (Folland et al., 2003). Based on these assumptions, individuals faced with a choice set of health plans with differing benefit generosity and costs, will choose a plan that represents the best value to meet their needs relative to their budget constraints, access to care, and health care use demands, all derived from current and past experiences that help shape financial expectations.

Research questions. This study includes two research questions. The first research question: What are the utilization and distribution characteristics of various types of health insurance plans across the employee population? will be examined via descriptive statistics, and is discussed in Chapter 4. The second research question: What economic factors are associated with the choice of health plan type? is examined via hypotheses developed next to test this study's independent variables' association with plan choice.

Economic enabling resources: Income. Income is an important factor for enrollees' ability to pay costs associated with the access and use of health care such as cost enrollee premium contributions (Andersen, 1995). Plans with lower premium costs to enrollees are more likely to be chosen than higher premium plans (Barry et al., 2008; Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004a). Because employee household income must be sufficient to cover living expenses and insurance premiums, including out of pocket costs when health care is utilized, low-income enrollees are expected to be more sensitive to enrollee premium cost. In fact research suggests that enrollees in the 200-300% poverty range are found to be highly sensitive to premium costs (Atherly, Dowd, & Feldman, 2004; Chan & Gruber, 2010). Thus, because of budget constraints, low-income individuals appear to be more likely to choose plans with lower premiums.

Income is also a factor when assessing the risk of cost sharing across plans relative to one's own likelihood to use health care services. Research suggests enrollees' risk of high cost sharing with health care use due to poor health plays a role in plan choice (Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004b, 2008; Tollen et al., 2004). If a person expects to use health care and therefore risks incurring out-of-pocket costs (cost sharing), they are more likely to choose a plan that represents lower cost sharing when health care is used. A low-income enrollee is expected to be more sensitive to the risk of cost sharing for the same reasons they are more sensitive than high-income enrollees to premium costs. Research supports a relationship in which plans with high initial cost sharing and less generous benefits, such as CDHPs, are less likely to be chosen by a low-income enrollee when plans with lower initial cost sharing and more generous benefits, such as Managed Care plans, are also available (Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004b, 2008; Tollen et al., 2004). It follows that a low-income enrollee is less likely than a high-income enrollee to choose a plan with greater cost sharing risk. This is supported by Barry et al. (2008), Greene et al. (2006), Lo Sasso et al. (2004), Parente et al. (2004a; 2004b; 2008), Tollen et al. (2004), U.S. Department of Health & Human Services, (2009), and U.S. Government Accountability Office, (2006), who find a positive association between income and enrollment in CDHPs.

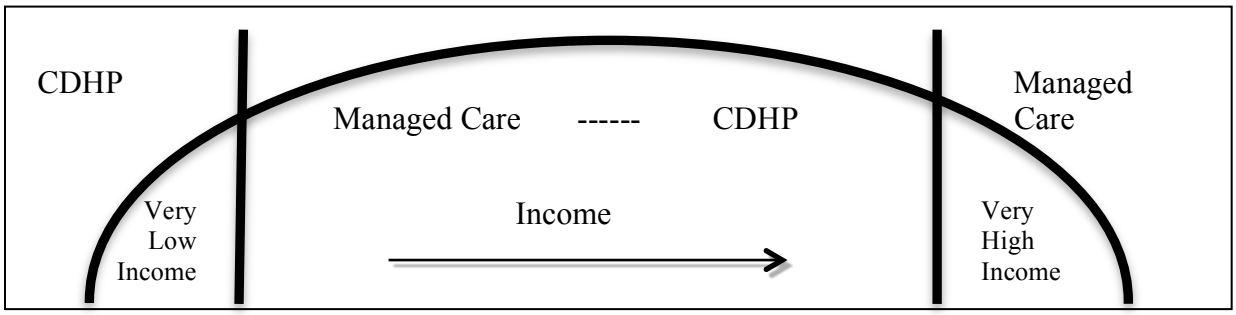
An inconsistency in CDHP choice research emerges between income, enrollee premium costs, and the risk of cost sharing with health care use. CDHPs generally have lower premium costs but greater cost sharing than Managed Care Plans. However, findings suggest low-income enrollees are more likely to choose plans with lower premium contributions and be less likely to choose plans with high cost sharing risk, but CDHPs generally have lower premiums and higher cost sharing. One possible explanation for the inconsistency of findings between income and

premium with plan choice may be the effect of plan generosity. Parente (2008) describes greater plan generosity as lower initial out-of-pocket costs (cost sharing) associated with a plan. Managed Care plans are associated with greater generosity than CDHPs because they have much lower initial cost sharing. It is possible that low-income persons seek to minimize financial risk by choosing a plan with greater generosity. Large deductibles associated with less generous CDHPs could be financially catastrophic for low-income enrollees. Thus, they are risk averse to potential health care costs perceived to be far outside their budget constraints and are more likely to choose a Managed Care plan verses a CDHP. It follows that high-income individuals are able to stand greater financial risk due to less restrictive budget constraints. Thus, they are more willing to choose a less generous plan with lower fixed premium costs as a better value at the margin.

However, Atherly et al. (2004) find premium elasticity of demand is insignificant for higher income consumers, which suggests high-income persons would be more likely to choose a more generous plan regardless of higher premium costs. Thus, the association between income and plan choice may not be linear relative to premium cost.

Looking at cost, risk of cost sharing, and plan generosity, this study will examine the possibility that income and CDHP choice have a non-linear relationship for which very low and very high-income employees have different choice behaviors than the larger middle income range of the employee population as illustrated in Figure 6. Employees with very low-income may be limited by budgetary constraints and seek the lowest premium cost health plan (CDHP), while very high-income enrollees may seek more generous coverage due to less restrictive budget constraints and that their premium elasticity of demand is insignificant. Low-income enrollees may view the lowest up-front premium plan with low generosity as catastrophic

Figure 6. Possible Non-linear Association Between Income and CDHP Choice



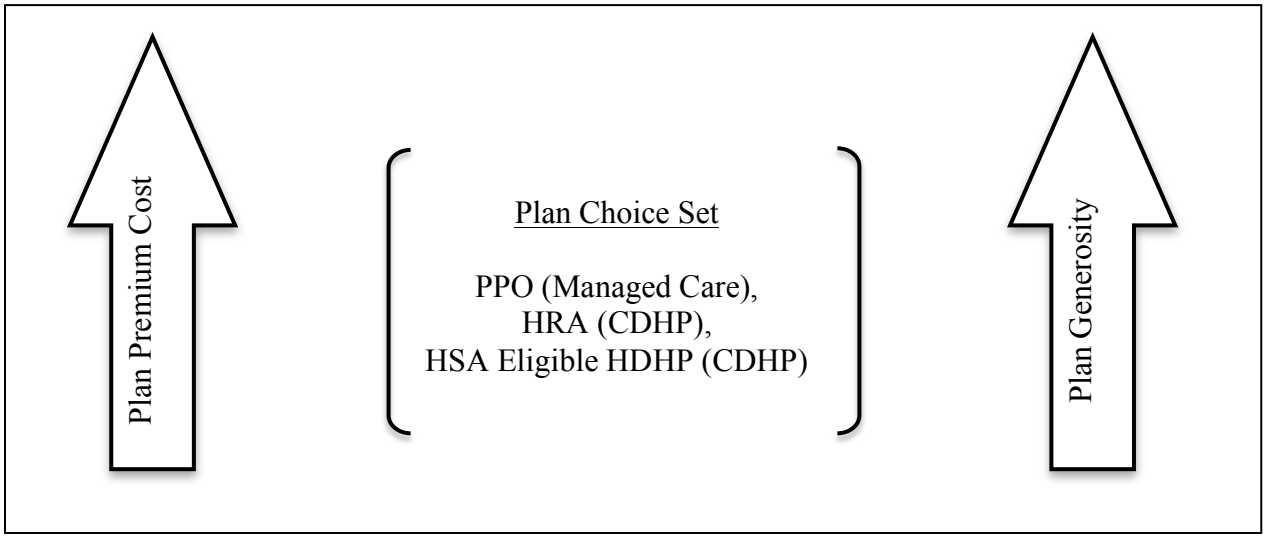
coverage that is better than nothing, and very high-income enrollees may view the premiums for the most generous coverage as insignificant. Enrollees in the middle may have a linear relationship between income and CDHP choice as findings suggest (Barry et al., 2008; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009; U.S. Government Accountability Office, 2006). Higher incomes allow enrollees to accept an increased risk of incurring unanticipated out-of-pocket costs in exchange for the opportunity to save on premiums if they expect to use minimal care or wish to invest in or manage a PCA. Higher income is associated with more formal education that suggests better health and greater involvement in planning and managing more complex health care finances (Andersen et al., 2007; Greene et al., 2006; U.S. Department of Health & Human Services, 2009).

Thus, this study examines if enrollees' plan choice behaviors at the lowest and highest income levels differ from the linear relationship suggested by the research. Research discussed in Chapter 2 examines enrollee income categories' associated with plan choice, but findings for enrollee categories of very high or very low-income are unclear. Findings were mixed and measures varied between studies (Barry et al., 2008; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human

Services, 2009; U.S. Government Accountability Office, 2006). Studies measured either household income or employee income. Additionally, the lowest and highest income categories discussed were < 25th percentile (lowest: < $25k) and > 75th percentile (highest: > $100k) respectively (Barry et al., 2008; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009; U.S. Government Accountability Office, 2006).

To develop hypotheses for economic enabling resource variables, a discussion of the three plans in this study is warranted regarding employee premium contributions and generosity. Figure 7 illustrates premium cost and generosity across the plan choice set in this study.

Figure 7. Plan Premium Cost and Generosity of Benefits



Employee premium contributions measure premium cost. Deductible size, co-insurance rate, and annual maximum out-of pocket limits comprise each plan's cost sharing characteristics to measure plan generosity. Premium contributions negatively correspond to the size of the plan's deductible and annual out-of pocket maximum. Plans with lower deductible and annual out-of pocket maximum have higher premiums.

In this study, the Managed Care PPO (plan 1) has the highest premium costs and highest level of generosity. It has the highest enrollee premium contributions, but the lowest deductible and annual out-of-pocket maximum. Next, the HRA (plan 2) has lower premiums and generosity than the PPO. The HRA has a higher deductible, larger annual out-of-pocket maximum, and requires enrollees to manage an employer-funded personal care account to finance initial health care costs. Third, the Health Savings Account (HSA) eligible High Deductible Health Plan (plan 3) requires no employee premium contributions, but has less generosity than the HRA and PPO. This plan has a high deductible, and although it includes the option for a PCA that can accrue personal net worth, the employee must fund the account and receives no employer contributions. The High Deductible Health Plan (HDHP) has the highest annual out-of-pocket maximum of the three plans.

It is necessary to comment on the rate of co-insurance when discussing cost characteristics and premium cost for the plans in this study. Co-insurance is a pre-determined percentage of medical costs an enrollee must pay after their deductible is met. The co-insurance rate for the HDHP plan (0%) is less than the Managed Care (PPO) and HRA plans (15%). Per Table 4 although the HDHP has no co-insurance, based on average medical spending levels of $7,000 per capita for 2006 the deductible and annual out-of-pocket maximums result in cost sharing levels for that plan that exceed those for enrollees in the PPO or HRA plans (Claxton, et al., 2009). Thus, the average enrollee(s) would experience cost sharing levels commensurate with the distribution of deductible and annual out-of-pocket maximum levels across plans in the choice set as illustrated in Figure 7. Cost characteristics of each plan in the choice set are discussed in more detail in Chapter 4.

Table 4

Plan Cost Sharing Per Plan Based on 2006 Average Per Capita Medical Spending

Plan	Co-insurance	Deductible	Out-of-Pocket Max	Cost Sharing [1]
PPO	15%	$0	2,000	$1,050
HRA	15	500	3,000	1,550
HDHP	0	2,100	2,100	2,100

Note. [1.] Cost sharing is calculated for a single enrollee based on the average medical spending per capita 2006 and the co-insurance, deductible, and out-of-pocket maximum for each plan (The Kaiser Family Foundation, 2009).

Based on enrollee premium cost and plan generosity, hypotheses to test the association between highest and lowest income and plan choice follow:

H1.1 Enrollees with the highest employee income are less likely to choose a HRA or HDHP versus a PPO.

H1.2 Enrollees with the lowest employee income are more likely to choose an HDHP rather than a PPO.

H1.3 Enrollees with middle employee income (Illustrated in Figure 6) are more likely to choose a HDHP or HRA than a PPO as income increases.

Self-perceived need. ***Prior cost sharing.*** The second independent variable examined is prior cost sharing. Prior cost sharing is the out-of-pocket cost incurred for a specified period prior to a plan choice, and includes fixed employee premium contributions and variable out-of-pocket costs associated with health care utilization (e.g. co-pays, deductibles, coinsurance). The combination of fixed and variable costs represent the financial cost directly associated with health care access and use.

As discussed earlier, research finds the plan chosen and premium cost to be associated (Barry et al., 2008; Fowles et al., 2004; Parente et al., 2004a, 2008; Tollen et al., 2004).

Employees are expected to account for their prior experience of how premium contributions affected their total cost of health care. Furthermore, the Rand Health Insurance Experiment (Rand HIE) discussed in Chapter 2 shows that enrollees are expected to minimize the likelihood of incurring out-of-pocket costs (Manning et al., 1987). This would also suggest that enrollees who previously incurred higher cost sharing can be expected to choose a plan that will limit future cost sharing relative to expected health care needs. Therefore, employees are expected to account for how their prior experiences of plan premiums and out-of-pocket costs affected total cost of health care.

Employees are assumed to choose a plan that will meet their expected needs in the most cost-effective manner. Prior cost sharing is expected to be a factor in enrollees' expected future costs sharing relative to the cost characteristics of plans in the choice set. Higher prior cost sharing suggests enrollees will be more sensitive to expected cost sharing characteristics of plans in the choice set, particularly variable costs that generally represent higher levels of cost sharing for enrollees. For example, employees with high prior cost sharing may seek greater plan benefit generosity, but those plans generally have higher premiums. Alternatively, lower prior cost sharing suggests enrollees will be more likely to select a plan with the lowest fixed cost sharing (E.g. lower plan benefit generosity and lower premium contributions).

Therefore, the lowest total expected plan cost to the employee, based on prior experience, requires an assessment of total cost sharing. Total cost sharing includes fixed premium contributions and variable costs, which are both associated with benefit generosity. Thus, expectations of an enrollee's total cost may be drawn from prior total cost sharing experience and the cost characteristics that comprise plan generosity. As illustrated in Figure 7, employee premium contributions are inversely related to plan benefit generosity.

Green, et al., (2006) evaluated prior total allowed medical costs for available plans that include Managed Care plans and low and high deductible CDHPs. They find the high deductible CDHP plan enrollees are healthier, which suggests lower prior health care spending and therefore lower cost sharing. In this study, compared to the Managed Care PPO, the HDHP represents the lowest cost least generous plan followed by the HRA (Figure 7). Thus, based on enrollee prior cost sharing experience when examining available plans' cost structures:

H2.1 Lowest prior total cost sharing is most likely associated with enrollment in an HDHP versus a PPO.

H2.2 Lower prior total cost sharing is more likely to be associated with enrollment in an HRA versus a PPO

(To explore whether prior variable cost sharing has a different effect on choice than fixed premium cost, each variable will be entered in the model separately.)

Prior Flexible Spending Account (FSA) use. The third independent variable included in this study is prior use of a flexible spending account (FSA). Prior use of an FSA suggests individuals possess some basic knowledge and experience associated with the financial planning and management demanded by different health plans' cost sharing structures (Figure 4). Parente et al. (2004b), the only CDHP plan choice study that examines prior FSA participation, suggest FSA participation represents the willingness and intellectual ability to plan for and manage some future health care needs. They found a positive association between CDHP enrollment and enrollees who participated in an FSA.

CDHPs have high initial health care utilization costs for which enrollees must coordinate funding and payment. They also include a Personal Care Account (PCA) that has characteristics similar to an FSA. PCAs provide the opportunity to set aside funds for future health care costs

and offer longer term planning opportunities with greater funding levels than FSAs. Managed Care plans have low initial health care cost and no PCA. Therefore, they demand less coordination of health care funds and payment by enrollees than CDHPs. Of the two CDHPs, the HDHP that is eligible for enrollees to fund an HSA more closely resembles voluntary participation in an FSA. To fund an HSA the HDHP enrollee has the freedom to choose (or not choose) to establish an HSA and must fund it themselves, whereas the HRA includes a PCA that is not optional, is funded by the employer, yet still requires the coordination of funds for medical costs.

H3.1 Enrollees who previously participated in an FSA are most likely to choose a HDHP than a PPO.

H3.2 Enrollees who previously participated in an FSA are more likely to choose a HRA than a PPO.

***Relative health risk*.** The final independent variable in this study is relative health risk. The original behavioral model includes health status as a factor in the access and use of health care; the adapted model includes relative health risk. Health status and relative health risk are similar, but the latter more directly suggests individuals' risk for future health care needs that affect the cost and access enrollees may experience, depending on premiums and generosity of the different plans in the ESI choice set.

Relative health risk is closely associated with cost sharing. As relative health risk increases, health care utilization and related variable cost sharing are expected to increase. However relative health risk is not equivalent to utilization. Relative health risk suggests the potential for increased utilization, while utilization is that realized potential. As with health status, relative health risk can be evaluated or perceived. Evaluated relative health risk is

examined in this study, but perceived measures are unavailable. Evaluated relative health risk represents an ongoing health condition or status that has been formally identified through the use of health care services. Enrollees with a high-evaluated relative health risk may anticipate accessing and using more health care services than those with lower risk.

Research suggests high relative health risk is positively associated with enrollees' choice of a plan considered to have more generous benefits and higher premiums (Barry et al., 2008; Fowles et al., 2004; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004b, 2008; Tollen et al., 2004). Managed Care plans generally have more generous benefits and lower financial risk for out of pocket costs (utilization costs) than CDHPs (Parente et al., 2008).

Hypotheses to examine the relationship between relative health risk and plan choice are examined assuming enrollee households will choose a plan from their choice set that represent the lowest total expected future health care costs according to their needs. Similar to prior cost sharing, poorer relative health risk suggests greater expected utilization needs and a preference for more generous benefits. Enrollees with lower relative health risk would be expected to use either minimal health care (possibly preventive services) or no care based on the absence of need, and seek a plan with the lowest premium costs (lower benefits generosity).

Figure 7 illustrates the premium cost and generosity of plans. Based on relative health risk, premium cost, and benefit generosity:

H4.1 Lowest relative health risk is most likely associated with enrollment in a HDHP verses a PPO.

H4.2 Lower relative health risk is more likely associated with enrollment in a HRA verses a PPO.

Control Variables. The conceptual model (Figure 5) includes the predisposing characteristics construct from the original behavioral model. Variables in this construct are used as controls in this study. Additional controls are the plan cost characteristics of enrollee premium contributions, plan deductible, co-insurance rate, and annual out-of-pocket maximum for plans in the choice set. Environmental factors were discussed under study assumptions. Predisposing characteristics and cost characteristics of plans in the choice set are described next.

Predisposing characteristics. Predisposing characteristics in the conceptual model consist of demographics and social structure (Figure 5). Data needed to capture health beliefs from the behavioral model are not available. Demographic data are limited to geographic residence of the employee household in this study. Social structure controls include household size, marital status, ethnicity, employee exempt status, union status, and geographic region as similarly used by Barry et al., 2008, Fowles et al., 2004, Green et al., 2006, LoSasso et al., 2004, Parente et al, 2008, Tollen et al., 2001, the U.S. Department of Health & Human Services, (2009), and the Government Accountability Office, 2006. Other predisposing characteristics, such as age and gender found in other research cannot be effectively measured at the household level used in this study.

Plan cost characteristics. Plan deductible, co-insurance rate, and annual out-of-pocket maximum are included as controls in this study's model for two purposes. Enrollee premium contributions are included in total cost sharing as previously discussed. The three additional plan cost characteristics are used to control for effects related to consumers' evaluation between plan purchase cost and the value received, and for premium risk adjustment used by employers to avoid risk segmentation. First, the independent variables in this study examine factors of health insurance choice and the predisposing factor of relative health risk, but cost characteristics for

plans in the choice set are basic cost components of a consumer purchase decision. Consumers evaluate the cost of a purchase against the value they expect to receive from it. Thus, cost characteristics of plans in this study's choice set are similarly related to plan choice and must be controlled. Second, ESI programs often adjust enrollee premium contribution, deductible, co-insurance rate, and annual out-of-pocket maximum levels in an effort to avoid risk segmentation caused by adverse selection for generous plans, or favorable selection for less generous plans. When favorable selection occurs, enrollees with low relative health risk and who expect to need fewer health care services enroll in the low cost less generous plans. Plans experience adverse selection when persons with high relative health risk and greater health care needs enroll in the most generous high cost plans. Employers often increase the cost of less generous plans in effort to offset such selection bias. Thus, enrollee premium cost, deductible, co-insurance rate, and annual out-of-pocket maximum is included to control for any risk adjustment across plans.

Summary

The behavioral model was developed to predict access and use of health care services. Research has emphasized predisposing characteristics, need, and enabling resources in the access and use of health care. Third party insurance has consistently been identified as an important enabling resource. The type of third party insurance that individuals are enrolled in has not been researched extensively, yet it largely influences where, how, and the extent enrollees access and use care.

Based on the hypotheses developed in this chapter, CDHP enrollment is expected to have a non-linear relationship with income, CDHP enrollees will have experienced lower prior cost sharing, greater participation in FSAs, and have lower relative health risk (refer to Table 5).

Table 5

Expected CDHP Enrollment Relationships Based on Hypotheses

	Hypothesis	Relationship to DV Outcome
H 1.1	Highest Income	Most Likely to Choose PPO
H 1.2	Lowest Income	Most Likely to Choose HDHP
H 1.3	Middle Income	More Likely to Choose CDHP (HRA/HDHP)
H 2.1	Lowest Prior Cost Sharing	Most Likely to Choose HDHP
H 2.2	Lower Prior Cost Sharing	More likely to Choose HRA
H 3.1	Prior Participation in FSA	Most Likely to Choose HDHP
H 3.2	Prior Participation in FSA	More likely to Choose HRA
H 4.1	Lowest Relative Health Risk	Most Likely to Choose HDHP
H 4.2	Lower Relative Health Risk	More likely to Choose HRA

The research that follows applies a conceptual model adapted from the behavioral model to predict the enrollee health care behavior of choosing a health insurance plan when Managed Care and CDHPs are available in an ESI setting. Next, Chapter Four will detail the methods used to operationalize this model.

Chapter 4 – Methodology

This study examines enrollee choice between Managed Care and CDHPs in an ESI program. Methodology described in this chapter is organized into three sections. First, the research design is outlined. Second, the data and its sources are described. The chapter concludes by developing the study analyses, which includes the estimation model, variable definitions, and the analytical procedures used to test the hypotheses in Chapter 3, and chapter summary.

Research Design

This study is a cross sectional non-experimental ex post facto design that examines data from a single large employer in four regions of the United States. The outcome of interest, the dependent variable, is plan choice at the contract level. Contract level observations include all enrollees covered under a primary subscriber's (employee's) ESI policy. Research suggests that family members influence health related decisions (Hawley, et al., 2009). All enrollees under each primary subscriber contract influence plan choice as either direct decision-making participants, or through collective past experience and personal characteristics. Thus, conceptual model constructs of enabling resources, predisposing characteristics, and health plan characteristics are operationalized at the contract level.

A cross sectional non-experimental ex post facto design is chosen based on the resources and data available for research in this genre. Access to health insurance and human resources data in the ESI market is very difficult to obtain. As with much of the prior research discussed in

Chapter Two, a secondary data set is used due to the cost and difficulty to gain permission for experimentation or to collect primary data for a large employer population. The advantage of this design is its use for assessing inference or association for a large population as in this study.

Data source

This section discusses the data source and its overarching characteristics. The databases the data originate from are also briefly reviewed. A detailed discussed of the data and how it was acquired is discussed in Chapter 5.

Data used for this research are from a single large self-insured employer's ESI enrollee population. The data source is a regulated publicly traded holding company with assets of approximately $40 billion. It employs about 20,000 persons in East North Central, South Atlantic, East South Central, and West South Central United States. The workforce is comprised of salaried and hourly (exempt and non-exempt) positions including administrative, technical, skilled trades and non-skilled laborers (union and non-union), various levels of management, and professional generalists.

Nearly all employees are enrolled in the ESI program that extends coverage to eligible members under each contract, which increases the total number of covered lives to approximately 31,000.[23] Persons eligible for ESI benefits include employees who work a minimum average of 40 hours per week, and part time employees who are scheduled to work an average of 20 hours per week. Contractors, temporary employees, and leased employees are not eligible to receive benefits. Eligible dependents include an employee's spouse, domestic partner, unmarried children up to age 19, unmarried children between the ages of 19 and 25 if a full time student in a college or university, unmarried disabled children of any age (onset prior to age 19

or 25), and unmarried children of domestic partners with similar parameters as with traditional heterosexual marital relationships.

Plan offerings changed from 2005 to 2006. In 2005 the company offered ten ESI plans including six HMOs, three PPOs, and one HSA eligible high deductible health plan (HDHP). Effective January 1, 2006, four HMOs and a PPO offered in 2005 were eliminated, and an HRA was added. Thus, six plans were offered in 2006: two HMOs, two PPOs, and two CDHC plans.[24] However, the HMOs and one PPO were only offered in limited "carved out" geographic regions to compensate for weak provider networks of the other health plans.[25]

The study data are retrieved from two data sets: 1) a data set extracted from the employer's human resources information system (HRIS), and 2) a data set extracted from a health insurance claims system by a data management firm that is contracted by the employer's insurance broker for managing the ESI data.[26] Data are available for one full year prior to the plan choice. The two data sets that comprise the study data are described next, followed by inclusion criteria.

Data sets. The first data set extracted from the employer's HRIS includes socio-demographic and employment status variables. Table 6 lists these variables for the 2005 enrollment year. Ethnicity and marital status are self-reported, while other characteristics such as date of birth and address are verified by the employer at the time of hire via official documentation (e.g. drivers license and birth certificate), or each time a status change occurs (e.g. marital status, gross earnings, or job change). Some status changes (e.g. birth of a dependent child, marriage, divorce, etc.) are reported by the employee, but are verified through vendors that perform compliance audits or by company personnel.

Table 6

Employer Human Resources Information System (HRIS) Variables

Employee Level 2005	Contract Level 2005
- Gender, Age in Years, Social Security # [a]	- Prior FSA Funded: Y / N & dollars [b]
- Ethnicity – EEOC categories	- Marital Status: Y / N
- Gross Earnings: Dollars	- Region – zip code [c]
- Salaried / Hourly (Exempt / Non-exempt)	
- Part-time / Full-time	
- Union / Non-union	

Notes. All variables are measured as of December 31, 2005

[a] Variables used to merge with data management vendor data – Social Security Number is de-identified prior to acquiring data by researcher(s)

[b] Allocation amount selected during open enrollment when plans are chosen.

[c] Zip code is used by third party data management firm to merge data, and is then cleaned to a three digit zip code prior to access for this study.

The second set of data is extracted from the employee population's health insurance policy and claims data. These data include eligibility, enrollment, and health care utilization data for all persons insured by the ESI program (Table 7). For policy and claims data to be available for analyses under the Health Insurance Portability and Accountability Act of 1996 (HIPAA), the employer uses an independent third party to collect and remove all personal health identifiers.[27] The employer's insurance broker contracts with a data management firm on their behalf to perform this function, and are the supplier of the second data set used in this study.[28]

Contract and individual level identifiers for each enrollee and health plan contract are created to merge the data. After identifiers are added, individual enrollee measures are aggregated under each contract for the 2005 policy year (single subscriber contracts include a single enrollee's data, and contracts with multiple enrollees will include aggregated data for all enrollees under that contract). Finally, the data management firm will remove all HIPAA identifiers listed in Table 8 prior to delivery of the data for this study.

Table 7

Data Management Vendor Variables

Plan Eligibility & Enrollment Data	
- Encrypted Contract Level ID Number	- Primary Subscriber Age in Years
- Plan Type (HMO, PPO, HRA, HSA eligible HDHP)	- Primary Subscriber Residence 3-Digit Zip Code and U.S. Census 9 Zone Geographic Region
- Coverage Tier (single, plus children, plus spouse, family)	- Primary Subscriber Gender
- Plan Chosen	- Plan Co-insurance Rate
- Plan Deductible	- Employee Premium Contributions
- Enrollee Months for Enrollment Period (Aggregate for the number of months of all enrollees under a subscriber contract, E.g. 1 enrollee all year and 2nd enrollee added mid year would measure 18 months for the contract.)	- Plan Annual Out-of-Pocket Maximum
Claims Data: Utilization and Risk Profiles	
- Allowed Provider Payments (Total amount provider is paid by health plan for all contract enrollees)	
- Net Provider Payments ("Allowed Amount", minus amounts owed by enrollee, E.g. co-insurance, deductible, co-pay)	- Relative Risk Score (RRS) (RRS for each enrollee added for contract level score)

Table 8

Personal Health Identifiers Restricted by HIPAA

Variables Restricted by HIPAA		
1. Names	2. Telephone Numbers	3. FAX numbers
4. Email Addresses	5. All Dates	6. Medical Records #
7. Account #	8. Social Security #	9. Health Plan #
10. Vehicle #	11. Device/Serial #	12. Certificate/License Web #
13. Identity (URL)	14. IP Address	15. Biometric Identifiers
16. Photos	17. Geographic Identifiers More Precise Than 3 Digit Zip Code	
18. Any Other Identifying Number, Characteristic or Code		

Sample inclusion criteria. This study attempts to exclude enrollees who are influenced by employment decisions not similar to those who anticipate a full-time on-going employment

relationship with the study employer. This is done because the employer's ESI program includes plans with PCAs. Enrollment choices for plans with PCAs may be affected by short-term verses long-term enrollment expectations when they include placing funds aside for future health care needs. PCAs allow unused funds to accumulate. If an employee expects to leave the employer, he/she would be less likely to fund an HSA. Additionally, short-term enrollees are more likely to use all employer funded HRA money, and not roll unused funds over to the next enrollment period.

Data are available for active full-time employee primary subscribers and associated eligible enrollees for those primary subscribers, continuously employed and enrolled in the study employer's ESI program from January 1, 2005 to December 31, 2009. Employees who were not continuously enrolled in the ESI program during that period are not included in the data. Thus, retired employees and beneficiaries who left the employer and are eligible for benefits under the Consolidated Omnibus Budget Reconciliation Act of 1986 (COBRA) are excluded from the study population.[29] Additionally employees aged 60 years or greater are excluded from this study. Employees greater than 60 years of age will become eligible for Medicare at age 65 and, their decisions on health plan choice would be influenced by the potential of their coming retirement or Medicare coverage.

Finally, employees living in some geographic areas are not included in the study sample. Based on provider network weakness in certain geographic areas of the three primary plans available (one Managed Care and two CDHPs), the employer offered additional plans in limited "carved out" geographic areas. This study only includes enrollees who were offered the three primary plan choices nationally for 2006: PPO, HRA, and HSA eligible HDHP. Data are not available for employees that were not enrolled in the employers ESI program.

Empirical Model

General specification of the plan choice model is:

$Choice_{2006} = a_0 + \beta_1 EER_{2005} + \beta_2 SPN_{2005} + \beta_3 PC_{2005} + \beta_4 PCC_{2005} + e$, where Choice is the health plan chosen by employees for the 2006 benefits year; EER is a construct of Economic Enabling Resources measures; SPN is a construct of enrollees' Self Perceived Need for healthcare; PC is a construct of enrollees' Predisposing Characteristics measures; and PCC is a construct of Plan Cost Characteristics measures; and e is error. The Dependent variable is discussed next followed by a description of independent and control measures that comprise the conceptual model's constructs.

Variables

Dependent variable. The dependent variable in this study is health plan choice examined at the contract level. Plan choice is a discrete (nominal) categorical variable. Study population enrollees may choose between a PPO, an HRA, or HSA eligible HDHP. If the HRA is chosen, enrollees must manage payment of medical costs from an employer funded PCA. After the PCA is exhausted, enrollees have a deductible prior to the health plan paying for medical services. If the HDHP is chosen, enrollees must also decide if they will, or will not, fund an HSA. If enrollees fund an HSA, they determine an amount to be deducted from each pay for the following twelve-month enrollment period. If enrollees do not fund an HSA, they are required to pay for medical services until the high deductible is met prior to the plan paying for medical services. Thus, the dependent variable health plan choice set = (PPO, HRA, CDHP) and dummy variables are created to represent each choice.

Economic enabling resources.

Primary subscriber gross earnings. Economic enabling resources include the independent variable of primary subscriber gross earnings. Economic Enabling Resources are described in Chapter 3 as factors that affect the ability to pay for health care services, and ultimately represent potential access (Andersen, 1995). Income is discussed in the theoretical model as the primary economic enabling resource, however data limitations require the use of primary subscriber gross earnings as a proxy measure described as follows:

1) Primary Subscriber Gross Earnings - used as a proxy measure for income, which is an independent predictor variable in the model. Data available to measure income is unavailable and is limited to employee primary subscriber gross earnings. Gross earnings are pre-tax wages, salaries, bonuses, commissions, and tips before payroll deductions (E.g. those used toward benefits for insurance, retirement, or other are considered sunk costs and the data are not available for this study). Employee primary subscriber gross income is used as a categorical measure in dollars for 2005. Dividing employees' gross earnings into equal quintiles will create five categories. Quintiles are used because it creates the natural ability to assess highest, high, middle, low, and lowest incomes examined in hypotheses H1.1 through H1.3. Quintiles allow this without expanding the earnings range for highest and lowest earners. The lowest and highest income earner quintiles will be used to test hypotheses H 1.1 and H 1.2. The middle three earner quintiles will be used to test hypothesis H 1.3. At the time of analyses the resulting quintiles will be compared to national income distributions to determine if quintiles are the most appropriate categories for analysis of hypotheses H 1.1 through H 1.3. Dummy variables will be created for the three categories. Other sources of income not derived

from the study employer are unavailable and represent a limitation of the study. Other CDHP research shares similar data limitations (Barry et al., 2008; Government Accountability Office, 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009).

Self perceived need. The Self Perceived Need construct includes prior cost-sharing, prior FSA use, and relative health risk. Self Perceived Need is described in Chapter 3 as prior health care access and use experience that informs future need. In turn, that future anticipated need helps determine the plan chosen, which sets parameters for how health care will be accessed and used in the future. The variables used to measure Self Perceived Need are described as follows:

1) Prior cost sharing - measured in dollars paid out-of-pocket by all enrollees under each primary subscriber contract that result from the access and use of health care through the ESI program for the 2005 policy year. Thus, this is an aggregate measure and includes the primary subscriber plus all eligible dependents under their health plan. Four quartiles will be created based on the population's cost sharing distribution once data is collected. Quartiles are chosen based on hypotheses developed in Chapter 3 for cost sharing that test lowest prior cost sharing, and lower prior cost sharing. Quartiles simplify assessment of the lower two quartiles for hypotheses H2.1 and H2.2. Unlike earnings, which are more evenly distributed, prior cost sharing demands larger ranges between categories due to the large number of enrollees who have very little prior cost sharing. Thus, quartiles allow a better categorization to test the related hypotheses. Dummy variables will be created for the four categories.

Total prior cost sharing is comprised of variable and fixed components, such as:

$Prior\ Cost\ Sharing_{2005} = Variable\ Cost\ Sharing_{2005}\ (Allowed\ Provider\ Charges_{2005}$ - *Net*

Provider Charges$_{2005}$*) + Fixed Cost Sharing*$_{2005}$ *(Employee Premium Contributions*$_{2005}$*).* Prior cost sharing is aggregated for each primary subscriber contract for all enrollees covered by that contract to comprise total prior cost sharing. Variable cost sharing is a continuous measure in dollars for the full 2005-policy year at the contract level. It increases or decreases based on the amount and cost of health care used by enrollees, and is derived by subtracting net from allowed charges. Allowed provider charges are the amount the provider is owed under the insurance contract and net allowed charges are the amounts paid to providers less out-of-pocket costs (e.g. deductibles, co-pays, co-insurance…). Employee premium contributions is the fixed component of total cost sharing, and is a continuous measure in dollars for the full 2005-policy year at the contract level. Employee premium contributions vary by plan coverage tier and range from $0 for HDHP plans to $217.50 for PPO Family coverage. Employee premium costs are illustrated in Appendix A. Data are not available to include medical use denied by the health plan. Variable and fixed components of total cost sharing are entered as separate variables in the model.

2) Prior FSA Use - a binomial variable and measures if funds were contributed to an FSA for any enrollees under each primary subscriber contract for the 2005 policy year. This binomial measure is based on hypotheses developed in Chapter 3 that test CDHPs association to prior FSA participation relative to plan PCA characteristics or lack thereof.
3) Relative Health Risk - a ratio measure of relative health risk at the contract level based on 2005 data. A RSS is calculated for each primary subscriber's contract. A weighted score is created using demographic categorization and Diagnostic Cost Grouping (DCG) captured from health care use, for every enrollee under each primary subscriber contract,

and compared to the mean score for the total ESI contract population. DCG is a proprietary algorithm based diagnosis cost grouping software developed by Verisk Health Inc. and employed by the data management firm.[30] The RRS incorporates age, gender, and Diagnosis Cost Groups (DCGs) based on past medical claims history of clinical hierarchies and interactions. Enrollees with no claims history are assigned a minimum score based on age, gender, and ESI population averages that contributes to the overall contract level RRS. Four quartiles are created to test hypotheses developed in Chapter 3. Quartiles are used for similar reasons as those for prior cost sharing. RRS has a distribution of values that demand larger ranges between categories due to the large number of enrollees who have very low RRS. Thus, quartiles allow a better categorization to test the related hypotheses. Dummy variables are created for each category. The RRS is similar to measures used for health risk by research discussed in Chapter 2 (Barry et al., 2008; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009).

Predisposing characteristics. There are six variables included in the predisposing characteristics construct: household size, marital status, ethnicity, employee exempt status, union status, and geographic region. These variables are described in Chapter 3 as individual level factors that "…enable or impede use, and … need for care" (Andersen, 1995, p. 1). This construct is comprised of six control measures.

1) Household Size - a discrete control variable and is measured by enrollment months at the contract level. 2005 Enrollment months is measured as the aggregate number of months for all enrollees under each subscriber contract (e.g. two enrollees enrolled for the full policy year and a child added at mid-year would represent 30 enrollment months). The

number of enrollees covered by each subscriber contract is unavailable, and would not account for partial year enrollees. This variable is important to control for the number of enrollees in a household, which is used as the level of measurement for the aggregate measures used in this study. Other studies estimating plan choice at the contract level did not account for enrollees that join or are removed from a contract during the policy period. Research discussed in Chapter 2 operationalizes coverage tier (employee, employee spouse, employee child, family coverage) as a control for household or family size. However, coverage tier does not account for the number of children or enrollees who are added or removed from a policy during the policy year (e.g. birth of a child, death of a spouse, etc.). A limitation of this measure is that it will not capture household members insured by other insurance. No data is available to address this limitation.

2) Marital Status - a categorical control variable. The following categories are captured by the employer and are the employee's status as of December 31, 2005: single, married, separated, divorced, and widowed. Dummy variables are created for this measure. Although marital status captures the legal marital status of employee primary subscribers, it fails to identify those primary subscriber contracts for which couples share similar circumstances yet are unmarried, or are in a domestic partnership common for gay or lesbian couples.[31] This is a limitation of the available data.
3) Ethnicity - a categorical control variable. The following categories are the employee's self-reported status as of December 31, 2005 captured by the employer: white, black/African American, Asian, American Indian/Alaska Native, Hispanic, Native Hawaiian/Other Pacific Island, two or more races (not Hispanic or Latino), and not specified. Dummy variables will be used for this measure.

4) Employee Exempt Status - a binomial control variable: exempt or non-exempt. Exempt generally refers to salaried earners and non-exempt hourly earners. This measure is the employee's status as of December 31, 2005. A dummy variable will be used for this measure.
5) Union Status - a binomial control variable: non-union or union. This measure is the employee's status as of December 31, 2005. Dummy variables will be used for this measure.
6) Region - a categorical control variable measured as an enrollee's geographic region of residence. Employees' three-digit zip codes are used to categorize enrollees' residences based on the United States Census Bureau classification for nine geographic regional divisions in the United States. The study employer has employees in four of these divisions: East North Central, South Atlantic, East South Central, and West South Central. These regions are included to account for health behaviors related to geographic variation in diet, unemployment rates, ethnicity, and lifestyle (Andersen & Newman, 2005; Arcury et al., 2005; Borders, Aday, & Xu, 2006; Al-Shaer & AbuSabha, 2005; Fiscella, Franks, Gold, & Clancy, 2000; Hargraves & Hadley, 2003; Probst, Moore, Glover, & Samuels, 2004). Geographic residence does not capture enrollees living outside the employee primary subscriber's home, but may be covered by the contract (e.g. employee child away at college). Data are unavailable to capture these enrollees. Dummy variables will be used for this measure.

Plan cost characteristics. There are three variables included in the plan cost characteristics construct: plan deductible, co-insurance rate, and annual out-of-pocket maximum. These variables are described in the theoretical model formulated in Chapter 3 as contract level

factors related to consumers' evaluation between plan purchase cost and the value received, and for premium risk adjustment used by employers to avoid risk segmentation. The three plan cost characteristics are controls and their measures are described next.

1) Deductible - measured as a discrete control variable. The plan deductible is the amount of money enrollees are required to pay out-of-pocket prior to the plan paying medical providers for medical care. Each plan's deductible is listed in Table 9, and is based on coverage tier. The deductible for the HRA is applied differently from the other plans. The HRA deductible is in effect after the HRA personal care account funds are exhausted. (e.g. if a single subscriber's HRA account balance is $3,000, the deductible of $500 would be in effect after $3,000 of medical care has been paid from the HRA funds by the enrollee.) The employer contributes the HRA funds. Thus funds used prior to the HRA deductible are not out- of-pocket for enrollees. Each plan specifies two deductibles per coverage tier, one for in-network and another for out-of-network provider care. In network deductibles are used in this study as they represent the value applied for the majority of medical care, and out-of network values are similarly proportional to in-network maximums across plans.

2) Co-insurance Rate - a ratio control variable. It is measured for each plan as a percentage of medical costs required to be paid to the provider for medical care used by enrollees after the plan's deductible is satisfied. Each plan specifies two co-insurance rates, one for in-network and another for out-of-network provider care. In network rates are used in this study as they represent the value applied for the majority of medical care, and out-of network values are similarly proportional to in-network maximum.

3) Annual Out-of-Pocket Maximum - a discrete control variable. Values are based on coverage tier and are listed in Table 9. Each plan specifies two values per coverage tier, one for in-network and another for out-of-network provider care. In network

Table 9

Health Plan Cost Structures

Coverage Tier: (S) = Subscriber, (SS) = S & spouse, (SC) = S & Child, (F) = Family			
Plan	PPO [a]	HRA	HDHP [b]
Deductible In- Network	$0	After HRA Exhausted $500 / S $750 / SS $750 / SChild(ren) $1,000 / F (In & Outside Network)	$2,100 / per enrollee[c] up to $6,300 / F
Outside Network	$300 / S $900 / F		$2,500 / S $7,500 / F
Co-insurance [c] Inside Network Outside Network	15% 30%	15% 30%	0% 20%
Out-of-Pocket Maximum In- Network	$2,000 / per enrollee[d] up to $6000 / F	$3,000 / S $4,500 / SS $4,500 / SChild(ren) $6,000 / F	$2,100 / per enrollee[d] up to $6,300 / F
Outside Network	$4,000 / SS $12,000 / F	$5,500 / S $8,250 / SS $8,250 / SChild(ren) $11,000 / F	$5,000 / SS $15,000 / F
Employer Contributions to PCA	$0	$1,000 / S $1,500 / SS $1,500 / SChild(ren) $2,000 / F * Used prior to deductible	$0

Notes.

[a] *The PPO plan also has co-pays for Primary Care Physician Visit = $20, Specialist Visit = $25, Emergency Department Visit = $50, Chiropractic Visit = $25.*

[b] *The HDHP has a cost structure that does not change based on funding or not funding an HSA.*

[c] *Co-insurance percentages are applicable after deductibles are met.*

[d] ***Up to the family level. The enrollee deductible is taken up to three enrollees.***

maximums are used in this study as they represent the value applied for the majority of medical care, and out-of network values are similarly proportional to in-network maximums across plans.

Reliability and validity of measures. As with prior CDHP choice research, the retrospective non-experimental ex-post-facto study design limits the ability to manage/control the reliability and validity of measures. However, steps can be taken to address deficiencies. These issues are discussed next.

Reliability of independent variable measures. Reliability relates to a measure's accuracy and how consistently it captures the attribute of interest (Polit & Beck, 2004). This study's measures possess good reliability. Variables in this study rely on standardized quantitative measures that have objective values such as dollars spent by enrollees on health care not covered by their insurance plan, dollar attributes of plan cost, demographic status of enrollees, or specific enrollee earnings in dollars, and are captured using standardized practices and systems. Most do not include subjective attributes, however there are still components of the measures that benefit from a discussion of reliability. Aspects of reliability discussed that affect this study's measures are internal consistency and equivalence. Polit and Beck (2004) describes them as follows. First, for instruments that use multiple items to measure a particular trait, their internal consistency relates to how well each of those items measure the intended trait. Second, equivalence deals with a measurement tool's consistent administration among users (e.g. consistent use of a measurement tool relies on one administrator recording the measure similarly to a different administrator). Table 10 lists how each variable measure is operationalized. The independent variables of prior cost sharing and relative health risk include multiple items that contribute to a composite measure of a trait, and both appear to have high internal consistency. Table 10 lists

Table 10

Variable Descriptions and Measure Methodology

Variables	Measure
• Primary Subscriber gross earnings as a Proxy for Income	Primary subscriber gross earnings: pre-tax wages, salaries, bonuses, commissions, and tips before payroll deductions (e.g. those used toward benefits for insurance, retirement, or other).
• Prior Cost Sharing	Dollars paid out-of-pocket by all enrollees under each primary subscriber contract that result from the access and use of health care through the ESI program for the 2005 policy year: $Prior\ Cost\ Sharing_{2005} = Variable\ Cost\ Sharing_{2005}\ (Allowed\ Provider\ Charges_{2005} - Net\ Provider\ Charges_{2005}) + Fixed\ Cost\ Sharing_{2005}$
• Prior FSA use	An FSA was funded in 2005 under the subscriber contract: yes/no
• Relative Health Risk	Relative Risk Score (RRS): A weighted ratio score is created using demographic categorization and Diagnostic Cost Grouping (DCG) captured from health care use, for every enrollee under each primary subscriber contract, and compared to the mean score for the total ESI contract population.
• Household Size	The aggregate number of enrollment months for all enrollees under each subscriber contract
• Marital Status	Categorical choice set: single, married, separated, divorced, and widowed
• Ethnicity	Self reported by employee primary subscriber from categorical choice set: Black/African American, Asian, American Indian/Alaska Native, Hispanic, Native Hawaiian/Other Pacific Island, two or more races (not Hispanic or Latino), and not specified
• Salaried v. Hourly Earners (Employee Exempt Status)	Exempt/non-exempt employee primary subscriber: exempt/salaried earner or non-exempt/hourly earner
• Union Status	Union or non-union employee primary subscriber
• Region	United States Census Bureau classifications for nine geographic regional divisions in the United States: East North Central, South Atlantic, East South Central, and West South Central

Table 4.5 continued…

Variables	Measure
• Plan Deductible	Dollar amount the amount enrollees are required to pay out-of-pocket prior to the plan paying medical providers for medical care
• Co-insurance Rate	Percentage of medical costs required to be paid to the provider for medical care used by enrollees after the plan's deductible is met
• Annual Out-of-Pocket Maximum	Maximum dollar amount enrollees must pay out-of-pocket for medical care

prior cost sharing measures including fixed cost sharing (employee premium cost in dollars) and variable cost sharing (out-of-pocket costs in dollars). Both are direct and objective components of cost sharing. Relative health risk is measured using proprietary algorithmic software that computes a Relative Risk Score (RRS). RRS is measured via Verisk Health Inc. DCG software that is also used by the Center for Medicare and Medicaid Services for analyses of the Medicare Choice Program and has been shown to be a measure with good reliability and validity (Wier & Jones, 2009).

The variable subject to equivalence error is ethnicity. This variable relies on each employee to choose from a fixed set of ethic categories and thus different interpretations of what category is most appropriate. Given that ethnicity categories are relatively distinct (see Table 10) and ethnicity is partly defined by what group an individual identifies himself or herself with, the measure represents high equivalence reliability.

Validity of independent variable measures. Validity describes how well a measure represents what it is intended to measure (Polit & Beck, 2004). Polit and Beck, (2004) discuss four types of internal validity for the measurement of independent variables: face, content, criterion-related, and construct validity. They describe these forms of validity as follows: 1)

Face validity is how well the measure appears at face value to represent what it is intended to measure. 2) Good content validity requires the construct of interest to be adequately accounted for via a sufficient number of items included in the measure. 3) A measure has high criterion-related validity if it is a good predictor of an external criterion that has also been demonstrated to be largely associated with the measure's intended purpose. 4) Construct validity relies on the ability to adequately measure the concept or idea the related construct is trying to represent in the theoretical framework.

The ability to manage the validity of measures in a retrospective cross-sectional non-experimental design is limited. There is no ability to retrospectively manipulate or alter the measurement tools, but this study attempts to identify concerns and address limitations that may exist. Concerns of validity are discussed next, and the sensitivity analyses to address them are discussed in the Sensitivity Analysis section of this chapter. Table 11 lists an assessment of validity for this study's measures. There are five variables that have low and two with moderate face, content, and criterion-related validity. First, income has low face validity because data limitations required a proxy (primary subscriber gross earnings) to be used that captures only part of a household's income. For similar reasons content and criterion-related validity suffer. Primary subscriber gross earnings do not include measures of other income, and therefore fails to be as robust as a measurement tool that does. This study suffers similar data limitations as other CDHP research do for income as a variable (Barry et al., 2008; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009; U.S. Government Accountability Office, 2006). Second, because this study examines CDHP choice at the household level, the control variable measures of ethnicity, exempt status, and union status also have low face, content, and criterion-related validity. These measures are at

the individual level (only available for primary subscribers) and are for a household level analysis. They do not represent a full sample of items that could capture intended attributes for a household and are limited relative to other possible composite household measures. Similar to income, this study suffers similar data limitations as other CDHP research for these measures.

Table 11

Validity of Variable Measures

Variable – Measure	Face	Con	Crit	Con
• Income: Primary Subscriber Gross Earnings is used	L	L	L	M
• Prior Cost Sharing – enrollee premium cost + out-of-pocket costs	H	H	H	M
• Prior FSA use – yes/no	H	H	H	M
• Relative Risk Score – RRS score	M	M	M	H
• Household Size – enrollment months	M	M	M	M
• Marital Status – categorical choice set	H	H	H	H
• Ethnicity – self reported from categorical choice set	L	L	L	M
• Salaried v. Hourly Earners (Employee Exempt Status) – exempt/non-exempt	L	L	L	M
• Union Status – union/non-union	L	L	L	M
• Region – categorical region	H	H	H	H
• Plan Deductible – dollar amount	H	H	H	H
• Co-insurance Rate – percentage rate	H	H	H	H
• Annual Out-of-Pocket Maximum – dollar amount	H	H	H	H

Relative health risk and household size have moderate face, content, and criterion-related validity. Relative health risk uses the RRS tool that fails to include an actual exam or self-report component that would capture a more direct measure for relative health risk. Similar to other research, household size suffers from data limitations. Enrollment months act as a proxy to measure the number of persons in each household, but fails to capture non-covered residents. The remaining variables listed in Table 11 suggest high face, content, and criterion-related

validity based on the fact they are direct measures with no subjectivity left to interpretation and are as robust as other potential measurement tools.

Table 11 lists seven variable measures with moderate and six with high validity. Assessment of construct validity is largely based on Andersen's development and use of the behavioral model (Andersen, 1995). Andersen uses many of the same, or close variations of, variables in this study. Income has moderate construct validity, as it is limited by capturing only one type of economic enabling resource, but Andersen suggests income is a critical factor for this construct (Andersen, 1995). Prior cost sharing and prior FSA use have moderate construct validity because they reflect health care need only through their prior experience of economic cost for prior health care use. However, this study is unique in its focus of evaluating health care need within that theoretical context. Enrollment months, ethnicity, exempt status, and unionstatus all reflect socio-demographic attributes under the predisposing characteristics construct that Andersen discusses within the behavioral model (Andersen, 1995). However, their imperfect measures impact construct validity similarly to the other forms of validity. The remaining variables and measures in Table 11 have high construct validity.

Overall this study's variable measures have good reliability and validity for a retrospective cross-sectional non-experimental design. An attempt to address the limitations that do exist is discussed in the Sensitivity Analysis section.

Analysis

Prior to analysis, all variables will be examined for completeness. The 'Missing Value Analysis' routine in SPSS will be used to address any missing cases, further discussed in Chapter 5 at the time of analyses. Next, each variable will be checked for variability to assure it does not behave as a constant in the model. Third, z scores will be assessed to screen for univariate

outliers that can lead to type I and type II errors. Fourth, independent variables should not be highly correlated or predictors of one another; thus they will be tested for multicollinearity by examining the correlation matrix and variance inflation factor (VIF) using SPSS. Finally, multivariate outliers will be examined when the model is estimated using Mahalanobis distance. Logistic regression is used for the model, which does not require the assumption of normal distributions or homoscedasticity.

Research question one. Research question one asks: "What are the utilization and distribution characteristics of various types of health insurance plans across the employee population?" This research question is answered using descriptive and univariate statistical analysis. First, frequencies of all categorical variables and enrollment for each plan are calculated. Second, descriptive statistics for study variables (mean, standard deviation, and the range) summarize characteristics of the study population at the employee and subscriber contract levels. Third, descriptive statistics for study variables (mean, standard deviation, and the range) of the study population are calculated and presented by health plan. No power analysis is conducted as this study analyzes all enrollees eligible within the study inclusion parameters and there are 9,617 observations, which provides more than ample power.

Research question two. Research question two asks: "What economic factors are associated with the choice of health plan type?" Multivariate analyses are used to answer this research question. First, bivariate relationships between independent variables and each plan chosen will be examined. Second, to test hypotheses developed in Chapter 3, generalized logistic regression is used to estimate the plan choice model. All forms of logistic regression estimate the odds ratio of a case belonging to a categorical outcome, then takes the log of the estimated ratios

to produce values that are symmetric around zero rather than one to assess directional estimation influences by model parameters (Flom, 2005).

Hypotheses from Chapter 3 test two different CDHPs versus a Managed Care plan. Binomial logistic regression can examine the choice between CDHP versus Managed Care, however it is not able to assess a trichotomous dependent variable as is the case in this study for which the two CDHPs are examined as separate and distinct options (PPO, HRA, or HDHP). Generalized logit regression is ideal to model choice outcomes among a discrete set of options (Agresti, 1996). A generalized logit model is used to estimate multiple discrete nominal outcomes using a function of characteristics for independent cases as the unit of analyses (So & Kuhfeld, 1995). This type of multinomial logit regression method is appropriate to analyze discrete nominal dependent variable responses simultaneously. This was chosen over an ordinal proportionate odds model because there is no natural ordering for the dependent variable of plan choice, and the outcomes are not categorized continuous variables (Flom, 2005). Although the hypotheses test if predictors are least or less associated to the Managed Care plan, the plans are not naturally defined ordinal outcomes (Kosmelj & Vadnal, 2003).

The dependent variable is a nominal categorical measure of choice among health plans (PPO, HRA, and HDHP). Contract level choices are estimated for one of three health plan options based on model parameters. Generalized logit models require a dependent variable reference category to be chosen. The reference category is used to compare odds ratios of non-reference categories against the reference group. In this study, the reference category is the Managed Care PPO plan based on hypotheses developed in Chapter 3. The PPO is chosen as the reference group first because it includes the most cases, and second the hypotheses are structured to test the CDHPs in relation to the Managed Care PPO plan. Non-reference group outcomes

within the plan choice set can be assessed for their relationship relative to the reference category, in this case the PPO. For example, as prior total cost sharing (predictor X_i) increases, it will have a positive, statistically discernable impact on the selection of the PPO plan (or k_i), where the PPO (category k_i) is set as reference category.

Relative risk ratios (not to be confused with the independent variable measure of relative risk score, RRS) are estimated for each case across the dependent variable categories relative to the reference category. The relative risk ratios represent the change in odds of being in each of the dependent variable categories (plan choice option), relative to the reference category, when there is a one-unit change associated with parameter coefficients.

For alternatives $j_{1\text{-}3}$ in choice set J, the outcome of plan choice for each household at the contract level is represented by h (described by the set of attributes X_h comprised of the covariates for h), and the model probability vectors are $\pi_{h1}, \ldots, \pi_{h3}$, where π_{hj} is the probability that alternative j was chosen by h from choice set J. Estimates are generated for $J - 1$ outcomes, with the reference category odds ratio of one. The mutually exclusive and exhaustive choice set of alternatives (j_1, j_2, j_3) for h is:

Choice Set J of Alternatives $j_1, \ldots, j_3 =$ $\begin{cases} j_1) \text{ HDHP}, \\ j_2) \text{ HRA}, \\ j_3) \text{ HSA}, \end{cases}$

and the probability that a given single household h chose alternative j (health plan), from J (set of plans):

$$\pi_j = \frac{\exp(\alpha_j + \beta_j x)}{\Sigma_h \exp(\alpha_h + \beta_h x)}, \quad j = 1, \ldots, J - 1$$

where π_j is the probability that household h selected alternative j, and covariates of h are represented by x. $\beta_1, \ldots, \beta_h$ are regression vector parameters, and $\Sigma_j \pi_j = 1$.

Generalized logistic regression is a non-parametric statistical method that requires basic assumptions to be met. The method is appropriate for this study, as it meets those assumptions. First, plan choice categorical responses are non-linear, discrete, and nominal. Second, the sample size should provide ample power to test goodness of fit of the model to the data via the Hosmer-Lemeshow test (Field, 2005; Tabachnick & Fidell, 2001). Sample size should be greater than 400 cases when multiple predictor variables are included (Field, 2005; Tabachnick & Fidell, 2001). The study sample exceeds the size recommended for the Hosmer-Lemeshow test, and includes more than 9,000 cases. Third, observations must be independent and each independent variable must have one value for each case (Field, 2005; Tabachnick & Fidell, 2001). Each case in this study is an independent observation for a given household and each variable has case specific values. Fourth, the dependent variable cannot be perfectly predicted from the model's variables for any individual case. Fifth, collinearity between independent variables is expected to be relatively low. Collinearity will be tested and the model adjusted as needed when the data are examined in Chapter 5. Sixth, the odds of alternative outcomes do not depend on non-relevant alternatives not in the model, referred to as Independence from Irrelevant Alternatives (IIA). It is assumed in this model that each categorical outcome is unique, can be independently evaluated by each set of decision makers, and the same set of choices is present for all cases (Hensher, Louviere, & Swait, 2000). Unlike probit models, no assumptions are required regarding the normal distribution of dependent variables in logistic regression (Field, 2005; Tabachnick & Fidell, 2001).

Estimation methods. Two primary types of inferential tests are performed, those for the intercept only model verses the full model, and those for individual predictors. Comparison

between the constant-only model and full model, is made first. After models are assessed, tests of individual predictor variables are examined.

The model is first estimated with the constant only, which is compared to the full model. The model will be tested for goodness of fit, first by examining the Log-likelihood (LL), which represents the difference between predicted and actual outcomes across cases (Tabachnick & Fidell, 2001). LLs are compared between the constant-only and the final model to determine if the independent variables enhance the model's ability to predict the outcome of plan choice. Next, the chi-square value is assessed. Two times the difference between constant-only and the full model LL values produces a chi-square (χ^2) value:

$$\chi^2 = 2[(\text{log-likelihood for model}) - (\text{log-likelihood for constant-only model})].$$

The chi-squared value is evaluated with degrees of freedom calculated by deducting the constant only model's one degree of freedom from the number of predictors plus constant. The chi-squared value is significant if p is less than .05, indicating the model has greater predictive value when it includes the independent variables.

A third step to test the goodness of fit will be to examine standardized residual values between predicted and actual values for outcomes of each case. An analysis of residuals will identify cases that fall outside three standard deviations (outlier cases).

Finally, the Homer-Lemeshow, Cox & Snell's R^2_{CS}, and Nagelkerke'sR^2_N statistics are evaluated. The Homer-Lemeshow statistic is used to evaluate the percentage of correctly classified cases by creating groups ordered by deciles-of-risk. The Homer-Lemeshow statistic is calculated as: R^2_L = *-2LL(Model) / -2LL (Original).* The Cox & Snell's R^2_{CS} statistic is used to evaluate the difference of LLs between the models and constant-only model. The Cox & Snell's R^2_{CS} statistic, with sample size n, is calculated as: R^2_{CS} = *1-e[-2/n (LL(Full Model) - LL*

(Constant Only Model). Finally, the Nagelkerke's R^2_N statistic is a variation of the Cox & Snell's R^2_{CS} with sample size n, but accounts for Cox & Snell's statistic never reaching its theoretical maximum of one. Nagelkerke's R^2_N statistic is calculated as: $R^2_N = R^2_{CS} / 1\text{-}e[2(\text{Constant Only Model}) / n]$. A non-significant Chi-square for these three values indicates a good fit.

Next, each variable's coefficient is divided by its standard error to calculate the Wald statistic. The Wald statistic of each independent variable tests if its predictive value is significantly greater than a coefficient of zero (Tabachnick & Fidell, 2001). In the event the absolute value of any coefficients is large, enhancing the possibility of a type II error due to an inflated standard error and underestimated Wald statistic, the likelihood-ratio test will be performed to supplement findings produced by the Wald statistic (Field, 2005; Tabachnick & Fidell, 2001). Significant parameters are those with a p value of .05 or less, within a 95% confidence interval.

After assessing significance of individual variables, the change in odds is reviewed for each by examining the value of the coefficient (Exp B). The proportionate change in odds for each predictor indicates the direction of the variable's influence on the outcome. If the odds are greater than one, as it increases, the outcome's likelihood increases (Field, 2005).

When examining odds ratios that estimate categorical outcome membership for a given plan *h* in generalized logit regression, the reference category has a ratio of one. The other categories produce an odds ratio of membership compared to the reference category. Comparing odds ratios of non- reference categories of plan choice to the reference plan tests hypotheses. Therefore, odds ratios are for HRA and HDHP outcomes are relative to the PPO reference category. Each predictor variable's regression coefficient, or multinomial logit estimate, will indicate that for a unit change in its value, the logit of choosing the plan (HRA or HDHP)

compared to the PPO plan (DV reference group) should change in the direction of the coefficient by that coefficient estimate, holding all else constant. The odds ratio for predictor variables will indicate the likelihood of the DV outcome falling in the DV comparison group (HRA or HDHP) or the reference group (PPO). A ratio of greater than one suggests as the variable increases, the likelihood of the outcome falling in the comparison group verses the reference group increases. Thus, the coefficients and odds ratios will indicate greater or less likelihood for an outcome to fall in each comparison group relative to the reference group, and will provide a factor of such change that suggests a greater or lesser risk of such outcome between groups relative to the reference group, holding all other variables constant.

Sensitivity analyses. The dependent variable of plan choice is estimated as a contract level outcome. The data include four individual and eight contract level measures listed in Table 12. Individual level measures from the employer's personnel files are only available for employee primary subscribers. Although measured for individual employees, household size, marital status, and region do not differ from contract level measures. However, the remaining individual level measures of primary subscriber gross earnings, ethnicity, employee exempt status (salaried v. hourly earners), and union status do not control for all household members in the model. Although the dependent variable is a household level outcome, these individual level measures are used for two reasons. First, primary subscriber gross earnings is a key predictor, but is not available for sources other than the study employer; and data are not available for enrollees other than the employee primary subscriber for the control variables. Second, each of these variables are expected to control variance related to the dependent variable more than their absence in the model, and may be representative of household measures. However, to test for the effects of error related to the level of measurement, a sensitivity analysis is performed that

estimates the model a second time with only single subscriber enrollees. The second analyses will be conducted to examine differences between results from the primary analyses that include the whole study population, and the single subscribers unaffected by individual level measures.

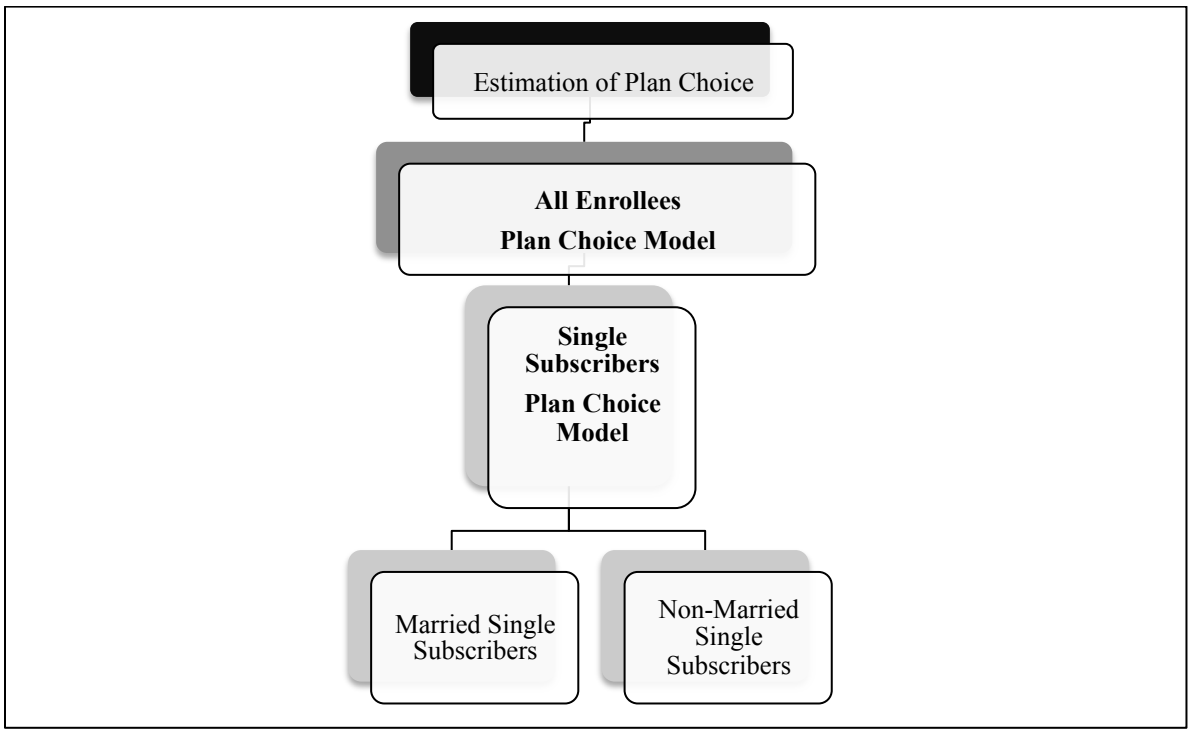
Table 12

Employee Vs. Contract Level of Variable Measurement

Employee Individual Level	Contract Level
• Primary Subscriber Gross Earnings • Ethnicity • Salaried v. Hourly Earners (Employee Exempt Status) • Union Status	• Relative Risk Score • Prior Cost Sharing • Prior FSA use • Household Size • Marital Status • Region • Plan Deductible • Co-insurance Rate • Annual Out-of-Pocket Maximum

Figure 8 illustrates study population groups used to estimate plan choice. The primary estimation of plan choice includes all eligible enrollees in the study sample. A second is used to estimate the same outcomes for single subscribers within the study population. Single subscribers are enrollees that chose to insure only themselves via the employer's benefits plan. The employee only subscriber group is split into two strata, married and non-married. Two strata of single subscribers are created based on marital status. These strata will be compared to assess confounding effects caused by other sources of income or available ESI benefits offered by a source other than the study employer. No data are available that measure other available household income or benefits. This analysis does not however address un-married single subscribers who are cohabitating with another individual who contributes gross earnings to the household or other sources of income of the employee subscriber. This is a study limitation.

Figure 8. Study Groups and Strata for Estimation of Model



Chapter Summary

This chapter describes a cross sectional non-experimental ex post facto design to examine plan choice between Managed Care and CDHPs in an ESI program. One full year of secondary convenience data is collected from two sources for a single employer for this analysis. Generalized logit regression analysis is used to examine primary subscriber gross earnings, prior FSA participation, prior cost sharing, and relative health risk as independent predictors and control variables relative to a dependent variable of plan choice. Hypotheses are tested using these methods to answer research questions 1 and 2.

Chapter 5 presents results of the analyses for the aforementioned descriptive and multivariate methods. This study concludes with Chapter 6 that discusses findings and practical implications that can be drawn from it, as well as overall study limitations.

Chapter 5 – Results

This study examines household health plan choice from a choice set that includes Managed Care and CDHPs. Statistical analyses, guided by the theoretical model developed in Chapter 3 and the methodology of Chapter 4, are performed, and the results are detailed in this chapter.

Study Data

The following Data Set section details how data was merged, fitted to the study inclusion parameters, and how missing cases were managed. A Variable Analyses section then assesses the variables to identify potential univariate and multivariate outliers and addresses possible multicollinearity.

Data merged. Password protected data sets from the study employer were received in de-identified form after a third party data management firm added a unique family identifier (Fam ID) and removed all Health Insurance Portability and Accountability Act (HIPAA) personal health identifiers as discussed in Chapter 4. In order to capture enrollment months, gender, and in some cases multiple three-digit zip codes for households that had a change of address between 2005 and 2006, variables for health plan data were to be aggregated for each employee's household. Data is not available to identify prior address versus current address between 2005 and 2006 so the first listed three-digit zip code was used when aggregating the data. After aggregating the data to one Fam ID for each case (household), the Human

Resources Information System (HRIS) and health plan data were merged using the unique Fam IDs.

Data fitted to study inclusion parameters. Inclusion parameters described in Chapter 4 were applied to the data. Health plan data contained only cases (Fam IDs) of employee primary subscribers in 2006 (the plan choice year of analysis) who were continuously enrolled for five years (2005-2009). Data from 2005 was used for predictors of 2006 plan choice. The HRIS data included all employees enrolled in a plan for 2005 and 2006. The first parameter resulted in the elimination of all cases from the HRIS data that were not part of the data set limited to those cases (households) continuously enrolled between 2005-2009, as listed in Table 13. Next, the data was sorted to account for different plan choice sets offered in various geographic areas for 2006. All households in areas that were offered plan choices for the 2006 plan benefit year other than the study choice set PPO, HRA, or HSA eligible CDHP were cut from the data set (see Table 13). Third, all cases with employee primary subscribers 60 years of age or older were cut (see Table 13). Finally all part time employee primary subscriber households were cut. After cutting ineligible cases for this study 10,108 cases remained.

Table 13

Cases Removed to Fit Inclusion Parameters

# Cases Removed & Reason (19,856 original cases)	# Cases in Data Set Post Screening
5,997 cases not continuously enrolled from 2005-2009	13,859
1,434 cases offered different plan choice set	12,425
2,306 cases of employee primary subscribers $\geq$ 60	10,119
11 cases of part time primary subscribers	10,108

Missing data. The merged data was examined for missing cases. Table 14, illustrates cases with missing variable measures that were cut from the data. There were a total of 733 cases

out of 10,108 that were missing one or more variable measure. The largest group, that included 451 cases, was missing values for more than half of the variables. Due to the large number of missing values, these cases were cut from the data set. Prior to cutting the 451 cases, they were assessed for possible disparate affects due to potential patterns of missing data within the full data set. Of the available data, the cut cases had a greater frequency of residence in the South Atlantic United States (31% versus 20%) and a lower frequency in the East North Central United States (31% versus 48%). The other notable difference was between allowed and net amounts of medical costs paid to providers by the health plans. The 451 cut cases had a larger mean allowed medical fee amount of $19,545 versus $8,473, and larger mean net paid medical costs of $15,520 versus $7,003. As variable cost sharing equals allowed less net medical costs, the cut cases mean was nearly three times that of the final data set at $4,029 versus $1,470. It is of note that the data set had a mean allowed amount of $8,973, which decreased to $8,473 after cutting the 451 cases. Respectively the mean net payment went from $7,390 to $7,003, and the mean RRS from a score of 83 to 78. Although the differences are high in the cases that have missing values, they represent a relatively small part of the study population of the total number of cases (4.5percent), which should not significantly affect estimation results (Tabachnick & Fidell, 2001). The "Missing Value Analysis (MVA)" function in SPSS uses a 5% missing value threshold for analysis of systematic missing values. Thus the MVA was not performed. Additionally, alternatives to cutting cases such as inserting average measures, using missing value estimates, or performing pairwise exclusion would offer little benefit due to the large number of cases in the set (10,108) and the risk of an increased standard error (Field, 2005).

After cutting the 451 cases with multiple missing measures, an additional 31 cases with specific missing variable measures were cut. There were 22 cases missing fixed cost sharing, 7 cases

missing plan choice set offered for 2006, and 2 cases missing marital status (see Table 14). The small number of cases cut for these missing values offered little benefit to enter estimated or average values. Finally, there were 9 cases cut from the data that carried negative values for allowed and/or net paid amounts due to credits posted from 2004 allowed or net amounts.

Table 14

Missing Cases Cut

# Cases Cut & Reason	# Cases in Data Set After Cuts
451 cases missing multiple independent variables: gender, ethnicity, earnings, union status, exempt status, full or part time, FSA participation, marital status, dependents	9,657
22 cases missing 2005 fixed cost share	9,635
7 cases missing which plan choice set was offered	9,628
2 cases missing marital status	9,626

An exception to cutting cases with missing variable measures was made for 251 cases missing the Relative Risk Score (RRS) variable. It was determined that because the RRS is partly calculated by an algorithm that uses medical costs (allowed amounts), age, and gender, it would be reasonable to estimate the values that are missing using the SPSS estimation tool. SPSS uses linear interpolation that estimates missing values via ordinary least squares (OLS) regression using the other available variables. The final number of cases after all inclusion parameters were applied and cuts made is 9, 617 cases (Family IDs / households).

The final data set excludes 491 cases out of 10,108 that met study inclusion parameters due to missing measures, and estimates for 251 RRS values were used. It is of concern that the mean medical costs associated with the cut cases were much larger than the overall data set. The

reason for the difference cannot be determined and could influence study outcomes, but they represent a small part of the data set and represent a limitation of the study.

Variable analyses. Univariate outliers for each variable were examined next. First, all dichotomous variables were assessed to confirm the split between categories was not greater than 90-10, which would lead to a recommendation of cutting the variable due to truncated correlation coefficients between variables and the greater influence of the scores in the smaller category (Tabachnick & Fidell, 2001). Co-insurance Rate has the same value for over 90% of the data and thus was eliminated from the model. There were no other such splits between categories of dichotomous variables. Second, standardized z scores were examined to identify possible univariate outliers for continuous variables within each Dependent Variable (DV) group (PPO, HRA, HSA eligible CDHP). Using a two tailed test at $p < .001$, z scores greater than 3.29 for one or more variables represent possible univariate outlier cases (Tabachnick & Fidell, 2001). Each DV group assessed has a relatively large N: PPO N=5,577, HRA N=3,586, and HSA N=454. With larger data sets it is expected that some cases will have variables with z scores greater than 3.29 (Tabachnick & Fidell, 2001). Approximately 2-3% of the cases in each DV group had z scores greater than 3.29. Next, Mahalobis Distances within each Dependent Variable (DV) group were examined using SPSS to identify potential multivariate outliers. Between 4-5% of cases in each DV group had a Mahalobis Distance greater than 29.588 (based on 10 degrees of freedom and $p > .001$). When examining both z scores for possible univariate outliers and Mahalobis Distances for potential multivariate outliers each DV category shared some cases that fell into both categories as listed in Table 15 (PPO 161 cases, HRA 88 cases, and HSA 22 cases). Although these scores are indications of possible outliers, there are several factors to consider prior to excluding such cases from the data set. First, the variable measures were reviewed and

Table 15

Potential Outliers

DV Category (Plan/Total Cases)	#Cases z scores > 3.29	# Cases Mahalobis Distance >29.588	# Cases > Both
PPO / 5,577	144	233	161
HRA / 3,586	398	148	88
HSA /454	38	24	22

all appear to represent valid measures. As expected with a large population, most of the potential outliers were for high earnings, high medical cost sharing related to large medical care costs, and high Relative Risk Scores (RRS) which are indicative of medical costs. One percent of Americans represented 21.8% of all medical costs nationally in 2009 and incomes for a large corporation include some highly compensated executives (Cohen & Yu, 2012). Additionally, the data are made up of the entire employee population for the employer (except for cases cut because they are outside study inclusion parameters) and thus represent a census rather than a sample population. Finally, the Z scores assume a Normal distribution, which in this case is not true. The data in this study do not follow a perfect Normal distribution. If the cases with Z scores that suggest univariate outliers were cut, the results in this census study would not properly generalize to the full population. Due to these factors it was determined to run the analyses without cutting the potential outliers (N=9,617).

Analyses

Utilization and distribution characteristics. Research question one asks: "What are the utilization and distribution characteristics of various types of health insurance plans across the employee population?" This research question is answered via descriptive and univariate statistical analysis at the employee and subscriber contract (household) levels. Frequency and

percentage of enrollment for each plan are calculated first and are followed by the mean, median, standard deviation, and the range of the study population for all variables grouped by the DV (2006 health plan choice). No power analysis is conducted as this study analyzes all eligible enrollees within the study inclusion parameters and N= 9,617 which provides more than ample power.

Variable frequencies. Table 16 details the number and percentage of cases that fall into each categorical variable for the study population (N=9,617), including healthcare plan enrollment for 2006. The study population is predominantly male (82%), married (79%) (second most single 12.3%), white (86%) (second most common ethnicities are Hispanic and African American 6% each), hourly or non-exempt (60%), non-union (71%,), and reside in the East North Central part of the United States (48%) (second most residing in the West South Central 27% and third in the South Atlantic 20% regions). Of the 9,617 households in the study 58% chose the PPO, 37% chose the HRA, and 5% chose the HSA eligible CDHP. Coverage tiers within each health plan do not reflect any significant differences when compared to all plans in the study. The PPO has fewer single coverage, and the HSA eligible CDHP has fewer households enrolled as employee plus children and family. Finally, 18% funded an FSA in 2005 prior to the plan choice for 2006.

Variable descriptive statistics. Table 17 lists the mean, median, standard deviation and range for employee age and continuous variables in the model. The mean age for employees for the study employer shows a mature workforce at nearly 50 years old with a median of 51. The average number of enrollment months is 35 with a median of 36 suggesting the average household had roughly 3 persons enrolled for full year policy periods (35 member months / 12 months per year = 2.9 persons). The out-of-pocket maximum and deductible are reflective of

Table 16

Variable Frequencies (N=9,617)

Variable	Percent %	Frequency # N=9,617
Employee Gender		
Male	82.5	7,933
Female	17.5	1,684
Ethnicity		
White	86.4	8,309
African American	5.6	537
Asian	0.9	84
American Indian/Alaska Native	1.1	101
Hispanic	5.7	547
Native Hawaiian/Other Pac. Isles	0.0	1
Two or more	0.3	31
Not Stated	0.1	7
Hourly/Salaried		
Hourly	60.1	5,783
Salaried	39.9	3,834
Union Status		
Union	29.1	2,797
Non-Union	70.9	6,820
Region		
Region 1 – New England	0.0	0
Region 2 – Mid Atlantic	0.1	10
Region 3 – East North Central	47.9	4,609
Region 4 – West North Central	0.5	46
Region 5 – South Atlantic	19.5	1,877
Region 6 – East South Central	4.3	414
Region 7 – West South Central	27.1	2,604
Region 8 – Mountain	0.0	0
Region 9 – Pacific	0.6	57
Plan Chosen 2006		
PPO	58	5,577
HRA	37.3	3,586
HSA Eligible CDHP	4.7	454
FSA Participation 2005		
Yes	17.7	1,701
No	82.3	7,916
Marital status		
Single	12.3	1,186
Married	79.0	7,597
Separated	.0	1
Divorced	8.3	793
Widowed	.4	40

Table 16 continued…

Coverage Tier All Plans 2006		
Self	17.4	1,669
+ Spouse	21	2,022
+ Children	11	1,057
+ Family	50.6	4,869
Coverage Tier PPO Only		
Self	15.3	854
+ Spouse	23.2	1,294
+ Children	10.8	603
+ Family	50.7	2,826
Coverage Tier **HRA Only**		
Self	19.2	688
+ Spouse	17.2	615
+ Children	12.1	433
+ Family	51.6	1,850
Coverage Tier **HSA Eligible CDHP Only**		
Self	28	127
+ Spouse	24.9	113
+ Children	4.6	21
+ Family	42.5	193

Notes:
[a] Regions based on the U.S. Census Bureau regional divisions

Table 17

All Enrollees' Descriptive Statistics

Variable	Mean	Median	Std. Deviation	Range
Employee Age (as of 1/06)	50	51	7	42
Member Months 2005	35	36	17	143
Out-of-Pocket Maximum	$4,871	$6,000	$1,391	$4,300
Deductible	$524.30	$0	$1,056	$6,300
Employee Earnings 2005	$69,615	$66,181	$36,853	$1,026,421
Variable Cost Sharing 2005	$1,470	$995	$3,750	$332,031
Premium Fixed Cost 2005	$1,817	$2,120	$673	$4,524
Relative Risk Score 2005	78	46	101	978

the plan cost characteristics. The average values are a composite of the plans such as the HSA eligible plan's zero coinsurance, and the PPO's zero deductible that lead to large standard deviations. The median deductible is zero and the out-of-pocket maximum is $6,000 reflecting the larger PPO population with no deductible and higher out-of-pocket maximums. Average earnings for employees is $69,615 with a median of $66,181; average variable and fixed cost sharing for 2005 were $1,470 and $1,817 respectively with medians of $995 and $2,120. Mean total cost sharing (fixed and variable costs combined) was $3,286. The standard deviation for the variable cost sharing (out-of-pocket costs for medical care) part of total cost sharing suggests greater differences for that of fixed cost sharing (plan premiums). However, all variables have a large range and standard deviation. The large range suggests there is a great deal of total variation in the measures, and the standard deviation suggests the average variation is also large. This suggests the means are not good predictors for variables in the model as there is a lot of variation that impacts the mean scores. Thus, a multivariate predictive model is indicated.

Table 18 lists descriptive statistics for each group of enrollees by the plan they chose in 2006. Employees in the three plans share similar mean ages and maximum out-of-pocket costs. The out-of-pocket maximum costs across plans are similar and are reflective of a plan structure for which the study employer chose to have some consistency in out of pocket exposure for their enrollees across all plans. The deductible and premium fixed cost reflect differences across plans cost structures. The PPO enrollees do appear to have greater variable cost sharing and higher RRS, which suggests poorer health on average compared to the other two plans. The HSA eligible CDHP enrollees had the lowest RRS and FSA contributions, which suggests they are healthier on average and had set fewer funds aside in a tax deferred FSA for out-of-pocket costs than the other two plans. Thus, the utilization and distribution characteristics of various types of

Table 18

Descriptive Statistics for Each Plan

Variable	Mean	Median	Std. Deviation	Range
PPO Plan:				
Member Months 2005	35	36	16	131
Out-of-Pocket Maximum	$4,824	$6,000	$1,481	$4,000
Deductible	$0	$0	$0	$0
Employee Earnings 2005	$68,435	$66,072	$31,848	$888,924
Variable Cost Sharing 2005	$1,633	$1,194	$1,765	$42,860
Premium Fixed Cost 2005	$1,906	$2,120	$580	$4,524
Relative Risk Score 2005	91	55	111	978
HRA Plan Only:				
Member Months 2005	35	36	17	95
Out-of-Pocket Maximum	$4,979	$6,000	$1,167	$3,000
Deductible	$830	$1,000	$195	$500
Employee Earnings 2005	$70,751	$65,958	$43,635	$1,016,553
Variable Cost Sharing 2005	$1,248	$748	$5,682	$332,031
Premium Fixed Cost 2005	$1,801	$2,120	$669	$4,524
Relative Risk Score 2005	60	35	80	920
HSA ELIGIBLE CDHP:				
Member Months 2005	30	24	17	83
Out-of-Pocket Maximum	$4,487	$4,200	$1,755	$4,200
Deductible	$4,487	$4,200	$1,755	$4,200
Employee Earnings 2005	$75,147	$70,102	$34,915	$368,676
Variable Cost Sharing 2005	$1,210	$508	$1,953	$16,478
Premium Fixed Cost 2005	$851	$767	$950	$3,165
Relative Risk Score 2005	57	22	97	582

health insurance plans across the employee population suggests that although plan characteristics are similar in terms of exposure to maximum out-of-pocket costs, the PPO appears to attract less healthy enrollees and those earning less than the CDHPs. Research question two is discussed next via multivariate analyses.

Multivariate analyses. Research question two asks: "What economic factors are associated with the choice of health plan type?" Multivariate analyses are used to answer this research question. First, bivariate relationships between independent variables (IVs) and each plan chosen will be examined. Second, generalized logistic regression is used to estimate the full plan choice model and IVs and their relationships are examined. Third, the model is estimated with some modifications to test hypotheses developed in Chapter 3.

Bivariate variable relationships between IVs and each plan are examined to determine if there is evidence to support a significant association between each plan choice and the IVs. Point biserial correlation is used to compare dichotomous and continuous variables for statistical significance via the Pearson Correlation coefficient. This is conducted for the five continuous IVs with each plan (Table 19). The Phi coefficient is used to assess the bivariate relationships for dichotomous IVs and each plan, and Cramer's V for the remaining multiple category nominal IVs with each plan.

The relationship between employee earnings and the plan chosen for 2006 is statistically significant for each plan. Employee earnings has a negative association with PPO Managed Care plan enrollment and a positive association for the two CDHPs (HRA and HSA eligible CDHP). Total cost sharing is statistically significant for each plan. It has a negative association with the CDHPs and a positive relationship with PPO Managed Care plan enrollment. No prior participation in an FSA has a statistically significant negative association with HSA eligible CDHP enrollment, and a positive association with HRA choice. Those who chose to enroll in the HSA eligible CDHP, which does not require a funded health savings account, were more likely to fund an FSA, but those who chose the HRA and are required to manage the HRA medical

Table 19

Bivariate Relationships

Variable	PPO Managed Care Plan	HRA	HSA eligible CDHP
Employee Earnings [a]	-.038 **	.024 *	.033 **
Total Cost Sharing [a]	.076 **	-.047 **	-.070 **
No Prior FSA Participation [d]	-.011	.022 *	-.025 *
Relative Risk Score [a]	.153 **	-.136 **	-.047 **
Member Months [a]	-.008	-.014	.051 **
Salaried (non-hourly) [d]	-.102 **	.065 **	.090 **
Non-Union [d]	-.054 **	.035 **	.045 **
Out-of-Pocket Maximum [a]	.040 **	.064 **	.053 **
Ethnicity [e]	.062 **	.064 **	.061 **
Marital Status [e]	.073 **	.062 **	.041 **
Region [e]	.161 **	.139 **	.074 **

Notes.
[a] Pearson coefficient used to test bivariate relationship for continuous and dichotomous IVs.
[d] Phi coefficient used to test bivariate relationship for two dichotomous IVs.
[e] Cramer's V coefficient used to test bivariate relationship for dichotomous and nominal IVs
* Correlation between the DV and IV is significant at the 0.05 level (2-tailed).
** Correlation between the DV and IV is significant at the 0.01 level (2-tailed).

account are less likely to have previously funding an FSA. Enrollment in the PPO and FSA is not statistically significant.

Relative Risk Score is similar to total cost sharing as it is statistically significant for all plans and has a negative association with the CDHPs, but positive with PPO Managed Care plan enrollment. This is aligned with findings discussed in Chapter 2 that suggest CDHPs may enjoy favorable selection. Member months are positively associated with HSA eligible CDHP enrollment, which suggests as the household size increases (member months represents household size) employees are more likely to enroll in a HSA eligible CDHP. PPO Managed Care plan enrollees are more likely to be union members and hourly employees, while CDHP enrollees are more likely to be salaried and non-union. Out-of-pocket maximum is statistically significant for all plans and is positively associated with each. The Phi coefficient suggests

higher maximums are most associated with the HRA and least associated with the PPO Managed Care plan. Ethnicity, Marital status and region are statistically significant for all plans.

The full predictive model is run next to further examine its overall soundness and its predictive value and that of each parameter estimate. The model is also examined for possible multicolinearity and multivariate outliers.

Regression analyses. A generalized logit multinomial regression was used to estimate the model described in Chapter 3. The dependent variable is a nominal categorical measure of choice among health plans (PPO Managed Care plan, HRA, and HSA eligible CDHP). Contract / household level choices are estimated for one of three health plan options based on model parameters. The estimation was executed multiple times with modifications in order to first examine the full model and its predictors then each hypothesis. The full model is assessed first utilizing predictive variables: employee gross earnings, prior total cost sharing, and RRS as continuous predictors, prior FSA participation as dichotomous, and the remaining control IVs in their measured form. Employee gross earnings will be referred to as earnings through the remainder if this study. The estimations used to test some hypothesis require employee earnings, total prior cost sharing and RRS variables to be transformed into dichotomous form after grouping them by quintile or other cut points to be defined. These changes are described under each respective hypothesis section. The reference category is the Managed Care PPO plan.

There are two modifications to the predictive model. First, fixed and variable cost sharing are combined and entered into the model as a single variable of total cost sharing. This variable was created to test hypotheses H2.1 and H2.2 that relate to total cost sharing. Second, plan deductible is eliminated from the model as a control variable. The plan deductible variable values were asymmetric and a possible complete separation in the data occurred for which the

log-likelihood values approached zero (Allison, 2008). Thus the only plan cost characteristic that remains in the estimation model is out-of-pocket maximum. The estimation results are presented next.

The model presented in Chapter 4 is expressed as: $Choice_{2006} = a_0 + \beta_1 EER_{2005} + \beta_2 SPN_{2005} + \beta_3 PC_{2005} + \beta_4 PCC_{2005} + e$, where Choice is the health plan chosen by employees for the 2006 benefits year; EER is a construct of Economic Enabling Resources measures; SPN is a construct of enrollees' Self Perceived Need for healthcare; PC is a construct of enrollees' Predisposing Characteristics measures; and PCC is a construct of Plan Cost Characteristics measures; and e is error. The modified model limits the PCC construct of Plan Cost Characteristics measures to the single variable of out-of-pocket maximum. The multivariate estimation results for the full predictive model are presented next.

Full model estimation. The model likelihood ratio chi-square of 1178.97 with a p-value of .000 indicates the final model fits better than the intercept only, or "Null" model (Table 20). The null model is based on the PPO reference category of the DV, which represents 58% of the plan choice outcomes. The full model predicted PPO choice 84.6% correct and the HSA eligible CDHP 7.9% correct versus the Null model's 58% and 5% respectively (Table 21). However, Table 21 shows this model poorly predicts HRA plan choice. Prediction for HRA plan choice is32.1% correct and HSA 7.9% correct, offering less accurately than the observed membership of 37% and 5% respectively. Furthermore, it appears the full model only explains between 11.5% and 14.3% of the variation (Table 22). Although these are indicators of predictive accuracy, the standard to determine if a multinomial model is helpful rest on its ability to predict category membership 25% better than pure chance (Schwab, 2012). Proportional by chance accuracy is calculated by taking the square product of the proportion of cases in each plan (DV category),

Table 20

Full Model Intercept Only Versus Final Model

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Significance
Intercept Only	15925.05			
Final	14746.08	1178.97	34	.000

Table 21

Full Model Classifications of Health Plan Outcomes

Observed		Predicted			
		HSA	PPO	HRA	Percent Correct
PPO	N = 5,577 (58%)	2	4719	856	84.6%
HRA	N = 3,586 (37%)	13	2422	1151	32.1%
HSA	N = 454 (5%)	36	263	155	7.9%
Overall Percentage		.5%	77.0%	22.5%	61.4%

Table 22

Full Model Pseudo R-Square

Pseudo R-Square	
Cox and Snell	.115
Nagelkerke	.143

summing them and multiplying by 1.25. If the product is less than the overall percent correct in Table 21, the model is a better predictor than chance alone. By chance accuracy is calculated as follows: plan membership HSA $4.7\%^2$ + PPO $58\%^2$ + HRA $37.2\%^2$ = .486 X 1.25 = 60.75% which is less than the percent correct of 61.4% from Table 5.9. Thus, the classification accuracy is greater than chance by the model.

The statistical significance of association between each IV and the DV is assessed next via likelihood ratio tests. As illustrated in Table 23, three predictor variables are statistically significant with $p < .05$, but employee earnings is not.

Table 23

Full Model Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	14746.08[a]	.000	0	.
Earnings-quintiles	14748.66	2.58	2	.275
Total Cost Share-quartiles	15049.05	302.98	2	.000
FSA Participation	14755.24	9.16	2	.010
RRS-quartiles	14841.20	95.13	2	.000
Member Months	14777.55	31.47	2	.000
Marital Status	14842.63	96.55	4	.000
Ethnicity	14784.76	38.68	8	.000
Union	14803.07	56.99	2	.000
Exempt Status Status	14746.66	.59	2	.745
Region	14908.51	162.43	6	.000
Out-of-Pocket Maximum	14894.51	148.43	2	.000

Notes: The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.
[a] This reduced model is equivalent to the final model because omitting
[b] The effect does not increase the degrees of freedom.

Employee gross earnings may not be significant due to measurement limitations of employee only earnings without accounting for other sources of income. This possibility will be examined later in a sensitivity analysis as described in Chapter 4. Of the control variables, all are statistically significant except union status. Full predictive model parameter estimates are discussed next prior to examining hypotheses. Table 24 lists the regression results for the predictive model with the Managed Care PPO plan as the reference dependent variable category.

Table 24

Full Model Parameter Estimates

Plan Chosen 2006 (DV)	Independent Variable	B	Std. Error	Wald	Sig.	Exp(B)
HSA eligible CDHP[a]	Intercept	-2.096	.302	48.044	.000	.
	Employee Earnings	*.000*	*.000*	*2.994*	*.084*	*1.000*
	Total Cost Sharing	*-.001*	*.000*	*263.774*	*.000***	*.999*
	FSA Participation: No	*.445*	*.153*	*8.400*	*.004**	*1.560*
	FSA Participation: Yes	*0*[b]	.	.	.	.
	RRS	*.002*	*.001*	*8.572*	*.003***	*1.002*
	Member Months	.003	.005	.269	.604	1.003
	Out-of-Pocket Max	.000	.000	20.099	.000**	1.000
	Marital Status Single	-.252	.162	2.147	.120	.777
	Marital Status Other	-.847	.221	14.739	.000**	.429
	Marital Status Married	*0*[b]	.	.	.	.
	Ethnicity African Amer	-.313	.240	1.692	.193	.731
	Ethnicity Asian	.810	.377	4.604	.032*	2.247
	Ethnicity Hispanic	-1.035	.404	6.547	.011*	.355
	Ethnicity other	.576	.348	2.732	.098	1.779
	Ethnicity White	*0*[b]	.	.	.	.
	Exempt Status Salary	.855	.137	38.659	.000**	2.351
	Exempt Status Hourly	*0*[b]	.	.	.	.
	Non-Union	-.002	.157	.000	.989	.998
	Union	*0*[b]	.	.	.	.
	Region Census Div 5	-.883	.172	26.396	.000**	.414
	Region Census Div 7	*-.298*	*.133*	*4.996*	*.025**	*.743*
	Region Census Other	*-.138*	*.226*	*.375*	*.540*	*.871*
	Region Div 3	*0*[b]	.	.	.	.
HRA[a]	Intercept	-1.226	.145	71.800	.000**	.
	Employee Earnings	*.000*	*.000*	*.082*	*.774*	*1.000*
	Total Cost Sharing	*.000*	*.000*	*28.512*	*.000***	*1.000*

Table 24 continued…

Plan Chosen 2006 (DV)	Independent Variable	B	Std. Error	Wald	Sig.	Exp(B)
HRA[a]	*FSA Participation: No*	*.011*	*.062*	*.030*	*.863*	*1.011*
	FSA Participation: Yes	*0[b]*	.	.	.	.
	RRS	*-.003*	*.000*	*70.305*	*.000[**]*	*.997*
	Member Months	-.011	.002	28.525	.000[**]	.989
	Out-of-Pocket Max	.000	.000	139.355	.000[**]	1.000
	Marital Status Single	.650	.083	61.664	.000[**]	1.915
	Marital Status Other	.356	.084	17.778	.000[**]	1.427
	Marital Status Married	0[b]	.	.	.	.
	Ethnicity African Amer	.109	.097	1.259	.262	1.115
	Ethnicity Asian	.546	.251	4.731	.030[*]	1.726
	Ethnicity Hispanic	.354	.102	11.932	.001[**]	1.424
	Ethnicity other	-.143	.190	.568	.451	.866
	Ethnicity White	0[b]	.	.	.	.
	Exempt Status Salary	.311	.060	26.708	.000[**]	1.364
	Exempt Status Hourly	0[b]	.	.	.	.
	Non-Union	-.046	.060	.578	.447	.955
	Union	0[b]	.	.	.	.
	Region Census Div 5	-.724	.064	127.099	.000[**]	.485
	Region Census Div 7	*-.137*	*.057*	*5.787*	*.016[*]*	*.872*
	Region Census Other	*-.547*	*.105*	*26.880*	*.000[**]*	*.579*
	Region Div 3	0[b]	.	.	.	.

Notes:
[a]The reference category is: PPO.
[b]This parameter is set to zero because it is redundant.
[*]Parameter is significant at the 0.05 level (2-tailed).
[**]Parameter is significant at the 0.01 level (2-tailed).

Consistent with findings from the likelihood ratio tests, employee earnings is not found to be a statistically significant predictor for either the HSA eligible CDHP (p=.084) or HRA plans (p=.774) versus the PPO managed Care plan. Enrollees with greater prior total cost sharing are slightly less apt to choose the HSA eligible CDHP (B coefficient = -.001) and slightly more likely to choose the HRA (B coefficient = .000) versus the PPO Managed Care plan, however the

Managed Care plan effect is minimal. Enrollees who did not previously participate in an FSA are more likely to choose the HSA eligible CDHP (B coefficient = .445) versus the eligible CDHP (B coefficient = .002), but slightly less likely to choose the HRA (B coefficient = -.003) versus the PPO Managed Care plan. PPO Managed Care plan, but FSA participation for HRA enrollees is not statistically significant (p=.863). Those who are less healthy (higher RRS) are slightly more likely to choose the HSA.

Enrollees with more member months are less likely to choose the HRA versus the PPO Managed Care plan, but is not statistically significant for the HSA eligible CDHP (p=.604). Out-of-pocket maximum has minimal affect (HSA eligible CDHP and HRA: B coefficient = .000), but greater levels are associated with CDHP choice. Enrollees who are single or other are more likely than their married counterparts to choose the HRA (single B coefficient = .650 and other B coefficient = .356), but less likely to choose the HSA eligible CDHP versus the PPO Managed Care Plan (single B coefficient = -.252 and other B coefficient = -.847).

Union status and the ethnicities of African American and other relative to whites are not statistically significant for either the HSA eligible CDHP or the HRA relative to the PPO Managed Care plan with p values greater than .05. The finding for union status is consistent with the likelihood ratio tests. Findings for ethnicity are mixed. Although African Americans and "other" are not significant controls, Asian enrollees are more likely than whites to choose the HSA eligible CDHP or HRA over the PPO (B coefficients of .810 and .546 respectively), while Hispanics are more likely than whites to choose the HRA (B coefficient = .354) and less likely than whites to choose the HSA eligible CDHP versus the PPO (B coefficient = -1.035). Finally

In regards to geographic residence, enrollees who live in the South Atlantic and West South Central versus the East North Central United States are more likely to choose the PPO

Managed Care plan verses a CDHP (B coefficients of -.883 and -.298 for the HSA eligible CDHP and -724 and -137 for the HRA). Those who live in other regions are more likely than East North Central residents to choose the PPO Managed Care plan versus the HRA (HRA B coefficient = -.547), but those in other regions are not statistically significant for the HSA eligible CDHP versus the PPO (p=.540).

Prior to examining hypotheses, the IVs are examined for multicolinearity. No standard errors of coefficient β in Table 24 are greater than 2, which suggest no multicoliniarity between IVs (Washington, Karlaftis, & Mannering, 2003). No control variables in the model have standard errors of coefficient β nearing or greater than 2.

Residual scores were examined next. To assess standardized residuals in multinomial logistic regression using SPSS it is necessary to perform a binomial regression for each DV category versus the base PPO category and save standardized residual scores between predicted and actual cases (Washington, Karlaftis, & Mannering, 2003). Less than 1.7 percent of the cases had scores exceeding three standard deviations. Additionally, no individual cases had abnormally high leverage values. Cases with residuals greater than 2.58 or less than -2.58 (z score for p = .01) were removed and the model was run again to compare the classification accuracy. The accuracy for the model with potential outliers removed was less than 2 percent more accurate in category classification (63.2% correct versus 61.4%), which is at the threshold for using a model with the possible outliers removed. The outliers included the highest total cost sharing ($334,404.87 versus a mean of $3,286.61) and RRS (978 versus a mean of 78.07). However, the predictive difference without the possible outliers is not large enough to eliminate those cases, as there is no reason to expect the measures for cases removed were incorrect and the data are a census set. It was determined to keep all cases in the data set. It is of note the likelihood ratio for

employee earnings is statistically significant in the model estimation when the outliers are removed, but not when the model is estimated with the full data set. Next, the predictive model was estimated to examine each set of hypotheses H1.1 through H4.2.

Estimations of model to test hypotheses. As outlined in Chapter 4, the continuous predictors were grouped first by quartile or quintile to identify lowest, lower, middle, or highest groups to test their respective hypotheses. Prior to estimating the model to test hypotheses, the data were evaluated for distribution and cut points relative to the most effective grouping. That grouping of data was evaluated prior to estimating the model for each set of hypotheses and adjustments were made; those adjustments will be discussed under each hypothesis section.

Likelihood ratio tests for the estimated model and each predictor are examined for statistical significance prior to testing hypotheses. The Wald test will be used to test if each IV is statistically significant for each specific hypothesis. Each variable's regression coefficient and relative risk ratio are used to assess study hypotheses. Regression coefficient (B) represents the change in relative log odds (increase or decrease) of belonging to that DV category versus the DV base category (PPO) associated with a one-unit increase of that variable's coefficient (B), holding all else constant. The Exp(B) represents the relative risk ratio, or odds, for each variable in its given DV category (plan) relative to the comparison DV category (PPO Managed Care plan). Employee earnings are examined first to assess hypotheses H1.1, H.1.2 and H1.3. Hypotheses H2.1 through H4.2 are then examined in order.

Hypotheses H1.1, H1.2 and H1.3. Although employee earnings are not statistically significant in the full model, this variable's measure is modified from continuous to dichotomous to test hypotheses H1.1 through H1.3. Thus, employee earning are examined again. Hypotheses H1.1 examines "highest" employee earners, H1.2 "lowest" employee earners and H1.3 assesses

the remaining earners not in the lowest and highest groups. To perform these analyses the IV of employee earnings is transformed into a dichotomous variable for H1.1 and H1.2, and is evaluated as a continuous IV for H1.3. Each change is explained for its respective hypothesis. Prior Total Cost Sharing and RRS were entered as continuous variables along with all other IVs in their original form as in the full model for hypotheses H1.1- H1.3.

Hypothesis H1.1 states: Enrollees with the highest employee earnings are less likely to choose an HRA or HSA eligible CDHP (CDHP) versus a Managed Care Plan (PPO). Chapter Four outlined a plan to group employee earnings (EE) by quintile to test the top quintile as "highest" EE. Employee earnings for the top quintile have a large range from $84,644 to $1,034,415. To evaluate a better distribution of EE to test hypothesis H1.1, a dichotomous employee wage variable was created to measure membership (yes or no) in the top ten percent of cases for employee earnings. Ten percent was chosen because a split between categories for dichotomous variables should not be greater than 90-10 due to the potential for truncated correlation coefficients between variables and the greater influence of the scores in the smaller category (Tabachnick & Fidell, 2001). The top ten percent ranges from $98,679 to $1,034,415. Real median national income for 2005 was $46,326 with a mean of $60,999, and the top 10 percent of households earned greater than $118,000 (Webster & Bishaw, 2006). Median employee earnings for the study population is slightly higher compared to the national figures at $66,181 with a mean of $69,615. The top 10% of the study population earned between $98,679 and $1,034,415 with a median of $113,445. Highest earnings is defined as those in the top ten percent of employee wage earners, which closely resembles high wage earners in the United States' population.

The model to estimate plan choice that includes the dichotomous variable of membership in the "highest" employee earners group is statistically significant with a Chi-Square of 1188.47 and p = .000. Belonging to the "highest" employee earner group is significant as a variable in the likelihood ratio tests with a Chi Square of 12.074 and p = .002. The Wald test was examined next to determine if highest EE is statistically significant in differentiating between groups as defined by plan enrollment. Table 25 lists regression coefficients (B), standard errors, Wald tests, significance measures, and exponents (B) for highest EE. The Wald test is statistically significant for the HSA eligible CDHP, but not for the HRA (Table 25). The regression coefficient (B) for "highest" EE for enrollment in the HSA eligible CDHP versus PPO Managed Care plan is .522 and the Exp (B) risk ratio for enrolling in the HSA eligible CDHP versus the PPO Managed Care plan for those in the highest EE group is 1.685. Thus, if an enrollee is in the top ten percent of EE, ("highest" employee earners), the relative risk of choosing a HSA eligible CDHP versus the PPO Managed Care plan increased by 1.685. Otherwise stated, holding all else constant, if an enrollee household is in the highest ten percent of EE they are approximately 1.7 times more likely to choose the HSA eligible CDHP over the PPO Managed Care plan.

Enrollees who are the highest earners are more likely to choose a HSA eligible CDHP than a PPO Managed Care plan. Additionally, the HRA is not found to be statistically significant. Thus, the null hypothesis cannot be rejected for H1.1. Highest earners are more likely to choose the HSA eligible CDHP rather than the PPO Managed Care plan, and there is no support for the highest EE to choose the PPO Managed Care plan over the HRA as it is not statistically significant.

Table 25

Parameter Estimates H1.1

Plan Chosen 2006 (DV)	Earnings Group	B	Std. Error	Wald	Sig.	Exp(B)
HSA eligible CDHP [a]	Top 10% EE	.522	.154	11.483	.001 [b]	1.685
HRA [a]	Top 10% EE	.147	.080	3.373	.066	1.158

Notes.
[a] The reference category is: PPO.
[b] Statistically significant at p = .05

Hypothesis H1.2 states: Enrollees with the lowest employee earnings are more likely to choose an HSA eligible CDHP rather than a Managed Care Plan (PPO). **"**Lowest" earnings is measured as a dichotomous variable similarly to hypothesis H1.1. Employee earnings is measured as membership (yes or no) in the "lowest" ten percent of employee earners (EE). The bottom ten percent of employee earners in this study ranges from $7,994 to $37,249. The bottom twenty five percent of United States households in 2005 earned between $0 - $22,500, thus it should be noted that the range of earners for the bottom 10% of the employer study group is substantially above a similar range of earners for the U.S. population as a whole (US Census, 2006).

The model to estimate plan choice that includes the dichotomous variable of membership in the "lowest" employee earner group is statistically significant with a Chi-Square of 1205.41 and p = .000. Belonging to the "lowest" EE group is significant as a variable in the likelihood ratio tests with a Chi Square of 29.023 and p = .000. The Wald test was examined next to determine if lowest EE is statistically significant in differentiating between groups as defined by plan enrollment. Table 26 lists parameter estimates for lowest EE.

The Wald test is statistically significant for the HRA, but not for the HSA eligible CDHP (Table 26). The regression coefficient (B) for "lowest" EE for enrollment in the HRA versus the

Table 26

Parameter Estimates H1.2

Plan Chosen 2006 (DV)	Wage Group	B	Std. Error	Wald	Sig.	Exp(B)
HSA eligible CDHP [a]	Bottom 10% EE	-.197	.214	.847	.358	.821
HRA[a]	Bottom 10% EE	.401[b]	.079	25.790	.000	1.493

Notes.
[a] The reference category is: PPO.
[b] Statistically significant at p = .05

PPO Managed Care plan is .401 and Exp (B) produces a risk ratio of enrolling in the HRA versus the PPO Managed Care plan for those in the lowest EE group of 1.493. Thus, if an enrollee is in the lowest ten percent EE group, the relative risk of choosing a HRA versus the PPO Managed Care plan increased by 1.493. Otherwise stated, holding all else constant, if an enrollee household is in the lowest ten percent of EE they are approximately 1.5 times more likely to choose the HRA over the PPO Managed Care plan.

Enrollees who are the lowest earners are more likely to choose the HRA than the PPO Managed Care plan. Additionally, the HSA eligible CDHP is not found to be statistically significant. Thus, the null hypothesis cannot be rejected for H1.2. Lowest employee earners are more likely to choose the HRA rather than the PPO Managed Care plan, not the HSA eligible CDHP, and there is no support for the lowest EE to choose the PPO Managed Care plan over the HSA eligible CDHP as it is not statistically significant.

Hypothesis H.1.3 states: Enrollees with middle employee earnings are more likely to choose a CDHP (HSA eligible CDHP or HRA) than a Managed Care Plan (PPO) as earnings increase. This hypothesis, by definition, tests only cases not included in hypotheses H1.1 and H1.2. "Middle" employee earners is operationalized as a continuous variable. "Middle" employee earners (EE) was measured in dollars, however cases in the "lowest" and "highest" ten

percent of employee wage earners (examined in H1.1 and H1.2) were excluded from the data. Middle EE included only cases in the middle eighty percent of employee earners.

The predictive model used to estimate plan choice for H1.3 only includes households with enrollees considered to be "middle" earners. This model is statistically significant with a Chi-Square of 943.68 and p = .000. However, the EE predictor variable in this model is not significant. The likelihood ratio tests for EE, comprised of only "middle" earners for this model has a Chi Square of 2.995 and p = .224. Thus, since EE in this model is not a significant predictor, no further testing of hypothesis H1.3 was considered.

Since enrollees who are the middle employee wage earners group are not statistically significant as a predictor, the null hypothesis cannot be rejected for H1.3. The predictor of prior total cost sharing is tested next by hypotheses H2.1 and 2.2.

Hypotheses H2.1 and H2.2. Hypothesis H.2.1 states: Lowest prior total cost sharing is most likely associated with enrollment in an HSA eligible CDHP versus a PPO. Prior total cost sharing (PTCS), which includes out-of-pocket medical costs and insurance premium costs, is difficult to compare to the national average. This is because the study employer's benefits plan, as described in Chapters 3 and 4, is relatively generous. In 2005 insurance premium costs averaged $2,713 nationally and average out-of pocket costs were approximately $741 for a PTCS of $3,454 (The Henry J. Kaiser Fmily Foundation, 2012; Paez, Zhao, & Hwang, 2009). Mean insurance premium costs for the study population is $1,817 with a mean out-of-pocket cost of $1,470. The median prior total cost sharing for the full data set is $3,033 and the mean is $3,287 with a range of $0 to $334,405. The mean of $3,287 is similar to the national average of $3,454. For reasons similar to those used for determining "lowest" earners, the bottom ten percent of cases was chosen to represent "lowest" PTCS (Tabachnick & Fidell, 2001). The bottom ten

percent of prior total cost sharing cases in this study include values from $0 to $1,093. PTCS was entered in the model as a dichotomous variable with 0 = membership in the lowest PTCS group and 1 = not belonging in the lowest PTCS group. Employee earnings and RRS were entered as continuous variables along with all other IVs in their original form.

This model is statistically significant with a Chi-Square of 1311.66 and p = .000. Lowest prior total cost sharing is significant as a variable in the likelihood ratio tests with a Chi Square of 435.671 and p = .000. The Wald test was examined to determine if lowest PTCS is statistically significant in differentiating between groups as defined by plan enrollment. Table 27 lists parameter estimates for lowest PTCS under H2.1.

Table 27

Parameter Estimates H2.1

Plan Chosen 2006 (DV)	Wage Group	B	Std. Error	Wald	Sig.	Exp(B)
HSA elig. CDHP [a]	Lowest PTCS	3.284[b]	.166	390.499	.000	26.690
HRA[a]	Lowest PTCS	.958[b]	.095	102.294	.000	2.605

Note.

[a] The reference category is: PPO.

The regression coefficient (B) for "lowest" PTCS membership and enrollment in the HSA eligible CDHP versus PPO Managed Care plan is 3.28 with an Exp(B) of 26.69. Thus, if an enrollee is a member of the lowest ten percent PTCS group, the relative risk of choosing a HSA eligible CDHP versus the PPO Managed Care plan increased by 26.69. Otherwise stated, holding all else constant, if an enrollee household is in the lowest ten percent of PTCS they are approximately 26.7 times more likely to choose the HSA eligible CDHP over the PPO Managed Care plan.

Estimated enrollment in the HRA versus the PPO Managed Care plan is similar to that for the HSA eligible CDHP. The regression coefficient (B) for "lowest" PTCS for enrollment in the HRA versus PPO Managed Care plan is .958 with an Exp(B) of 2.605. Thus, if an enrollee is in the lowest ten percent PTCS group, the relative risk of choosing the HRA versus the PPO Managed Care plan increased by 2.605. Otherwise stated, holding all else constant, if an enrollee household is in the lowest ten percent of PTCS they are approximately twice as likely to choose the HRA over the PPO Managed Care plan.

Comparing the Odds for the HSA eligible CDHP and HRA versus PPO Managed Care plan enrollment, 3.284 versus .958 and risk ratios of 26.69 versus 2.61 respectively, enrollees with the lowest prior total cost sharing are "most" likely to choose the HSA eligible CDHP versus the PPO Managed Care plan. The null hypothesis is rejected for H2.1.

Hypothesis H.2.2 states: Lower prior total cost sharing is more likely to be associated with enrollment in an HRA versus a PPO. "Lowest" PTCS was operationalized as the bottom ten percent of prior total cost sharing. To identify "lower" PTCS, the variable was first treated as an ordinal variable grouped by quintile, then operationalized as a dichotomous variable to represent membership in the "lower" two quintiles (bottom 40%) of PTCS households. Grouping PTCS by quintile provides a natural split that captures the bottom two quintiles as households with "lower" PTCS, the third quintile as a "middle" grouping for PTCS and the fourth and fifth as higher and highest PTCS groups. This model is statistically significant with a Chi-Square of 1130.71 and $p = .000$. Lower prior total cost sharing is significant as a variable in the likelihood ratio tests with a Chi Square of 254.72 and $p = .000$. The Wald test was examined to determine if lower PTCS is statistically significant in differentiating between groups as defined by plan enrollment. Table 28 lists parameter estimates for lower PTCS under H2.2.

Table 28

Parameter Estimates H2.2

Plan Chosen 2006 (DV)	Wage Group	B	Std. Error	Wald	Sig.	Exp(B)
HSA elig. CDHP [a]	Lower PTCS	1.832[b]	.135	183.050	.000	6.248
HRA[a]	Lower PTCS	.661[b]	.061	115.799	.000	1.938

Note.

[a]The reference category is: PPO.

The regression coefficient (B) for "lower" PTCS and enrollment in the HSA eligible CDHP versus the PPO Managed Care plan is 1.832 with an Exp(B) of 6.248. Thus, if an enrollee is in the lower forty percent PTCS group (bottom two quintiles), the relative risk of choosing a HSA eligible CDHP versus the PPO Managed Care plan increased by 6.248. Otherwise stated, holding all else constant, if an enrollee household is in the "lower" PTCS group, they are approximately 6.25 times more likely to choose the HSA eligible CDHP over the PPO Managed Care plan.

Estimated enrollment in the HRA versus the PPO Managed Care plan is similar to that for the HSA eligible CDHP. The regression coefficient (B) for "lower" PTCS membership and enrollment in the HRA versus PPO Managed Care plan is .661 for choosing an HRA with an Exp(B) of 1.938. Thus, if an enrollee is in the lower two quintiles of PTCS, the relative risk of choosing the HRA versus the PPO Managed Care plan increased by 1.938. Otherwise stated, holding all else constant, if an enrollee household is in the "lower" PTCS group they are almost twice as likely to choose the HRA over the PPO Managed Care plan.

Comparing HSA eligible CDHP and HRA versus PPO Managed Care plan enrollment, coefficient B of 1.832 versus .661 and risk ratios of 6.248 versus 1.938 respectively, enrollees with lower prior total cost sharing are "most" likely to choose the HSA eligible CDHP versus the PPO Managed Care plan. Although it can be stated that enrollees are "most" likely to choose the

HSA eligible CDHP versus the PPO Managed Care plan, it can also be stated that they are "more" likely to enroll in the HRA versus the PPO. Therefore, the null hypothesis is rejected for H2.2. The predictor of prior participation in a Flexible Spending Account (FSA) is examined next by hypotheses 3.1 and 3.2.

Hypotheses H3.1 and H3.2. Hypothesis H3.1 states: Enrollees who previously participated in an FSA are most likely to choose a HSA eligible CDHP than a PPO. Flexible Spending Account (FSA) participation is operationalized as a dichotomous variable and all other IVs are entered into the full model in their original forms to include employee earnings, PTCS and RRS as continuous variables. Not previously participating in an FSA = 0 and Prior FSA participation = 1 in the estimation model.

This model is statistically significant with a Chi-Square of 1178.970 and p = .000. Prior FSA participation is significant as a variable in the likelihood ratio tests with a Chi Square of 9.1645 and p = .010. The Wald test was examined to determine if prior FSA participation is statistically significant in differentiating between groups as defined by plan enrollment. Table 29 lists parameter estimates for prior FSA participation under hypothesis H3.1.

Table 29

Parameter Estimates H3.1

Plan Chosen 2006 (DV)	Wage Group	B	Std. Error	Wald	Sig.	Exp(B)
HSA eligible CDHP [a]	No Prior FSA	.445[b]	.153	8.400	.004	1.560
HRA[a]	No Prior FSA	.011	.062	.030	.863	1.011

Note.
[a]The reference category is: PPO.

The regression coefficient (B) for not previously participating in an FSA and enrollment in the HSA eligible CDHP versus PPO Managed Care plan is .445 with an Exp(B) of 1.560.

Thus, if an enrollee didn't previously participate in an FSA, the relative risk of choosing a HSA eligible CDHP versus the PPO Managed Care plan increased by 1.560. Otherwise stated, holding all else constant, if an enrollee household didn't previously participate in an FSA they are approximately 1.6 times more likely to choose the HSA eligible CDHP over the PPO. Prior participation in an FSA is not statistically significant for enrollment in the HRA versus the PPO Managed Care plan ($p = .863$).

Thus, Hypothesis H3.1 is not supported by the output. HSA eligible CDHP enrollees are most likely to not have participated in an FSA. The null hypothesis cannot be rejected for H3.1.

Hypothesis H3.2 states: Enrollees who previously participated in an FSA are more likely to choose a HRA than a PPO. Because FSA participation is not statistically significant for the HRA versus the PPO Managed Care plan, (Table 29), hypothesis H3.2 is not supported by the model. The null hypothesis for H3.2 cannot be rejected. The final predictor in the model is examined next by hypotheses H4.1 through H4.2.

Hypotheses H4.1 and H4.2. Relative Risk Score (RRS) in this study is based on the employer's population of insured persons and is not normalized to the United States national population. As the Relative Risk Score values increase, health status becomes poorer. Households in the lower RRS quintile Q1 represent the greatest average health status for household members as a whole (lower relative risk) than households in the top quintile Q5 of RRS. For example, a household with an RRS of 10.0 would be expected to use ten times the amount of medical resources as a household with a RRS of 1.0, which suggests poorer health. RRS was first treated as an ordinal variable grouped by quintile. It was then operationalized as a dichotomous variable to represent membership in a the lowest RRS group (Q1) for hypothesis H4.1, and for membership in the "lower" RRS group (Q1 and Q2) for hypothesis H4.2. This

grouping was chosen because the study RRS data are not normalized to he national population and quintiles represent a convenient grouping distribution to assess "lowest" and "lower" RRS groups. Households in the bottom quintile (Q1) represent lowest RRS (best overall health status), and households in the bottom two quintiles (Q1 and Q2) represent lower RRS. Mean RRS for the study population is 78.07 with a median of 45.50. The range in this study for RRS is from 2.0 to 980.0. Scores in the lowest RRS group (Q1) range from 2 – 14.60, those in, Q2 range from 14.67 – 33.75 (thus the "lower" RRS group range is 2 – 33.75), the middle quintile range is 33.8 – 60.33, Q4 is 60.40 – 114.12, and Q5 is 114.23 – 980.00.

Hypothesis H4.1 states: Lowest relative health risk is most likely associated with enrollment in a HSA eligible CDHP versus a PPO. "Lowest" RRS is defined as membership in RRS quintile Q1. This model is statistically significant with a Chi-Square of 1161.319 and p = .000. Lowest RRS is significant as a variable in the likelihood ratio tests with a Chi Square of 77.475 and p = .000. The Wald test was examined to determine if lowest RRS is statistically significant in differentiating between groups as defined by plan enrollment. Table 30 lists parameter estimates for lowest RRS under H4.1.

Table 30

Parameter Estimates H4.1

Plan Chosen 2006 (DV)	Wage Group	B	Std. Error	Wald	Sig.	Exp(B)
HSA eligible CDHP [a]	Lowest RRS	.518[b]	.122	17.900	.000	1.678
HRA[a]	Lowest RRS	.541[b]	.060	72.277	.000	1.672

Note.
[a]The reference category is: PPO.

The regression coefficient (B) for membership in the "lowest" RRS group and enrollment in the HSA eligible CDHP versus the PPO Managed Care plan is .518 with an Exp(B) of 1.678.

Thus, if an enrollee is in the lowest twenty percent RRS group (bottom quintile), the relative risk of choosing a HSA eligible CDHP versus the PPO Managed Care plan increased by 1.678. Otherwise stated, holding all else constant, if an enrollee household is in the lowest quintile of RRS they are approximately 1.7 times more likely to choose the HSA eligible CDHP over the PPO Managed Care plan.

Estimated enrollment in the HRA versus the PPO is similar to that for the HSA eligible CDHP. The regression coefficient (B) for membership in the "lowest" RRS group for enrollment in the HRA versus PPO Managed Care plan is .541 for choosing an HRA with an Exp(B) of 1.672. Thus, if an enrollee is in the lowest quintile of RRS, the relative risk of choosing the HRA versus the PPO Managed Care plan increased by 1.672. Otherwise stated, holding all else constant, if an enrollee household is in the lowest twenty percent of RRS they are approximately 1.7 times more likely to choose the HRA over the PPO Managed Care plan.

Comparing HSA eligible CDHP and HRA versus PPO Managed Care plan enrollment, coefficients of .518 versus .514 and risk ratios of 1.678 versus 1.672 respectively, enrollees with lowest relative risk score are slightly more likely to choose the HSA eligible CDHP versus the PPO Managed Care plan. Thus, it can be stated that enrollees are "most" likely to choose the HSA eligible CDHP versus the PPO Managed Care plan. Therefore, the null hypothesis is rejected for H4.1. Although the HRA is slightly more likely to be chosen, the difference between the two CDHPs is very minimal and it can be argued the null hypothesis should be accepted.

Hypothesis H.4.2 states: Lower relative health risk is more likely associated with enrollment in a HRA versus a PPO. "Lower" RRS is defined as enrollees in the first and second quartiles (Q1 and Q2) of RRS. This model is statistically significant with a Chi-Square of 1160.201 and p = .000. Lower RRS is significant as a variable in the likelihood ratio tests with a

Chi Square of 76.356 and p = .000. The Wald test was examined to determine if lower RRS is statistically significant in differentiating between groups as defined by plan enrollment. Table 31 lists parameter estimates for lower RRS under H4.2.

Table 31

Parameter Estimates H4.2

Plan Chosen 2006 (DV)	Wage Group	B	Std. Error	Wald	Sig.	Exp(B)
HSA eligible CDHP [a]	Lower RRS	-.019	.117	.027	.870	.981
HRA[a]	Lower RRS	.436[b]	.051	73.193	.000	1.547

Note.
[a]The reference category is: PPO.

Lower RRS is not statistically significant for enrollment in a HSA eligible CDHP versus the PPO Managed Care plan with p = .870, but is for the HRA versus the PPO Managed Care plan. The regression coefficient (B) for membership in the "lower" RRS group and enrollment in the HRA versus the PPO is .436 with an Exp(B) of 1.547. Thus, if an enrollee is in the lowe forty percent RRS group (bottom two quintiles), the relative risk of choosing the HRA versus PPO Managed Care plan increased by 1.547. Otherwise stated, holding all else constant, if an enrollee household is in the lower two quintiles of RRS they are approximately 1.5 times more likely to choose the HRA over the PPO Managed Care plan. It can be stated that enrollees are "more" likely to choose the HRA versus the PPO Managed Care plan. Therefore, the null hypothesis is rejected for H2.2.

Table 32 summarizes the results of each hypothesis H1.1 through H4.2. Table 32 is followed by a sensitivity analysis for employee earnings.

Table 32

Hypotheses Tests

Hypothesis	Results	Null Hypothesis
H1.1 Enrollees with the highest employee earnings are less likely to choose a HRA or HSA eligible CDHP (CDHP) versus a Managed Care Plan (PPO)	Enrollees in the highest employee earners group are more likely to choose the HSA eligible CDHP versus the PPO	Not Rejected
H1.2 Enrollees with the lowest employee earnings are more likely to choose an HSA eligible CDHP rather than a Managed Care Plan (PPO)	Enrollees in lowest employee earners group are more likely to choose the HRA versus the PPO	Not Rejected
H1.3 Enrollees with middle employee earnings are more likely to choose a CDHP (HSA eligible CDHP or HRA) than a Managed Care Plan (PPO) as earnings increase.	Enrollees in the middle employee earners group are not found to be statistically significant	Not Rejected
H2.1 Lowest prior total cost sharing is most likely associated with enrollment in an HSA eligible CDHP versus a PPO.	Enrollees in the lowest PTCS group are most likely to choose the HSA eligible CDHP versus the PPO	Rejected
H2.2 Lower prior total cost sharing is more likely to be associated with enrollment in an HRA versus a PPO	Enrollees in the lower PTCS group are more likely to choose the HRA versus the PPO	Rejected
H3.1 Enrollees who previously participated in an FSA are most likely to choose a HSA eligible CDHP than a PPO.	Enrollees who previously participated in an FSA are least likely to choose the HSA eligible CDHP versus the PPO	Not Rejected
H3.2 Enrollees who previously participated in an FSA are more likely to choose a HRA than a PPO.	Enrollees who previously participated in an FSA are not found to be statistically significant for HRA enrollment versus the PPO	Not Rejected
H4.1 Lowest relative health risk is most likely associated with enrollment in a HSA eligible CDHP versus a PPO.	Enrollees in the lowest RRS group are most likely to choose the HSA eligible CDHP versus the PPO	Rejected (minimal difference)
H4.2 Lower relative health risk is more likely associated with enrollment in a HRA versus a PPO.	Enrollees in the lower RRS group are more likely to choose the HRA versus the PPO	Rejected

Sensitivity analysis for earnings. A sensitivity analysis follows to examine possible effects of error related to the proxy measurement for income. This study examines plan choice at the household level. However, data only includes gross employee earnings from the study employer and does not include other sources of household income. The model is run next using two data sets, one with only non-married single subscribers and another with only married single subscribers. The two outcomes are then compared to examine possible effects due to the employee earnings measurement limitation. Measurement of household earnings for non-married single subscribers is expected to be a more accurate measure of household income than that for married single subscriber household income. This analysis is also to account for control variables measured at the employee level similarly to earnings, such as ethnicity, employee exempt status (salaried v. hourly earners), and union status.

Although the dependent variable is a household level outcome, these individual level measures above are used for two reasons. First, primary subscriber gross earnings has been found to be a key predictor in prior research discussed in Chapter 2, but is not available for sources other than the study employer; and data are not available for enrollees other than the employee primary subscriber for the control variables. Second, each of these variables are expected to control variance related to the dependent variable more than their absence in the model, and may be representative of household measures. Possible measurement corruption of the predictor employee earnings is of primary interest in this sensitivity analysis.

The two data sets are described next and compared to the full data set. Table 33 illustrates the single subscriber groups tend to be more similar to each other versus the full data set, however there are only a few notable differences. The notable difference between the full data set and the married single and non-married single groups is the percentage of female members.

Table 33

Sensitivity Analysis Variable Frequency Comparisons

Variable	Percent % Full Data Set	Percent % Non-married Single Coverage	Percent % Married Single Coverage
Gender			
Male	82.5	63.4	61.2
Female	17.5	36.6	38.8
Ethnicity			
White	86.4	85.1	87.6
African American	5.6	7.7	8.2
Asian	.9	1.1	.2
American Indian/Alaska Native	1.1	.8	.6
Hispanic	5.7	4.9	3.2
Native Hawaiian/Other Pac. Isles	.0	.0	.0
Two or more	.3	.3	.2
Not Stated	.1	.1	.0
Hourly/Salaried			
Hourly	60.1	62.0	57.3
Salaried	39.9	38.0	42.7
Union Status			
Union	29.1	24.6	22.5
Non-Union	70.9	75.4	77.5
Region[a]			
Region 1 – New England	0	0	0
Region 2 – Mid Atlantic	.1	.3	.2
Region 3 – East North Central	47.9	56.1	58.2
Region 4 – West North Central	.5	.7	.4
Region 5 – South Atlantic	19.5	16.4	14.8
Region 6 – East South Central	4.3	3.0	4.3
Region 7 – West South Central	27.1	22.7	21.7
Region 8 – Mountain	0	0	0
Region 9 – Pacific	.6	.7	.4
Plan Chosen 2006			
PPO	58	49.3	53.9
HRA	37.3	43.4	36.7
HSA Eligible CDHP	4.7	7.3	9.4
FSA Participation 2005			
Yes	17.7	11.2	11.2
No	82.3	88.8	88.8

Note.
[a] Regions based on the U.S. Census Bureau regional divisions.

The full data set included 17.5 percent female employees, while the non-married and married single coverage groups were 36.6 and 38.8 respectively, which could represent disparate wage

levels for women or represent a gender related influence for earnings and plan choice for women. Table 34 lists the mean, median, standard deviation and range for all data sets for continuous variables in the study. As expected, the non-married single enrollees are younger with a mean age of 45 and median of 43 years, as well as lower earnings with a mean of $56,398 and median of$53,009. The RRS for married single tier is higher with a mean of 83 and median of 37, which may suggest married persons may have been more likely to choose the study employer's generous benefits due to poor health versus other available coverage that may not have been as generous. Also of note, the standard deviation and range for employee earnings is lowest for the married group that may be explained by some potential similarity among those who are likely to be second income households. Cost sharing (fixed and variable) and out-of-pocket maximums are greater for the full set that includes households with more insured persons, which could be expected. Next results of the multivariate outcomes are discussed to evaluate possible disparate effects from using individual level measures for the household level analyses.

The full models are first run for both data sets (non-married single coverage and married single coverage) with employee earnings entered as a continuous variable. Then, each data set will be run operationalizing employee earnings in the same way as the main analyses: top 10%, lowest 10% and middle 80% of employee wage earners. To run the multivariate analysis it is necessary to exclude marital status and member months, as those control variables create singularities in the data because the data sets are comprised of all non-married or married single coverage employees. Additionally, four percent of ethnicities in the reduced data set are different from white and African American groups and caused singularities in the model. Thus, ethnicity must be further limited to a dichotomous variable of white and non-white.

Table 34

Sensitivity Analysis Descriptive Statistics Compared

Variable	Mean	Median	Std. Deviation	Range
Full Data Set:				
Employee Age (as of 1/06)	50	51	7	42
Member Months 2005	35	36	17	143
Out-of-Pocket Maximum	$4,871	$6,000	$1,391	$4,300
Deductible	$524.30	$0	$1,056	$6,300
Employee Earnings 2005	$69,615	$66,181	$36,853	$1,026,421
Variable Cost Sharing 2005	$1,470	$995	$3,750	$332,031
Premium Fixed Cost 2005	$1,817	$2,120	$673	$4,524
Relative Risk Score 2005	78	46	101	978
Non-married Single Coverage:				
Employee Age (as of 1/06)	45	43	9	33
Out-of-Pocket Maximum	$2,549	$2,100	$655	$4,000
Deductible	$405	$500	$596	$4,200
Employee Earnings 2005	$56,398	$53,009	$26,939	$317,036
Variable Cost Sharing 2005	$457	$211	$625	$4,150
Premium Fixed Cost 2005	$800	$859	$228	$2,374
Relative Risk Score 2005	73	26	118	978
Married Single Coverage:				
Employee Age (as of 1/06)	50	52	7	30
Out-of-Pocket Maximum	$2,687	$2,100	$910	$4,300
Deductible	$451	$0	$6,300	$850
Employee Earnings 2005	$62,260	$61,241	$22,065	$160,117
Variable Cost Sharing 2005	$579	$767	$4,558	$763
Premium Fixed Cost 2005	$791	$859	$2,374	$299
Relative Risk Score 2005	83	37	127	894

The intercept only, or "Null" model is based on the PPO reference category of the DV, which represents 47.6% of the plan choice outcomes for the non-married single coverage data set and 53.9% for the married single group. The full model for non-married single enrollees predict PPO choice 95.2% correct versus the Null model's 47.6% for predicted PPO choice, and 87.3%

correct versus the Null model's 53.9% for married single group (Table 35). The full model's predictive accuracy improved most for the HRA. Non- married single coverage enrollees were 100% accurate and married single coverage enrollees are 79.5% accurate compared to null model values of 44.4% and 36.7% respectively. The classification tables also show that the models are fair predictors for HSA eligible CDHP plan choice. Predictions for the HSA eligible CDHP are 36.6% and 34.1% correct for the non- married single group and married single groups respectively. The likelihood ratio chi-square 872.202 with a p-value of .000 for the single not married group and the likelihood ratio chi-square 222.546 with a p-value of .000 for the married single group indicate the final models for both groups fit better than the null models. It does, however, appear the full non-married single model explains between 63% and 75% of the variation and the married single model explains between 38% and 45% based on the Pseudo R-Square measures of Cox and Snell and Nagelkerke (Table 36). This preliminarily suggests the non-married single coverage group that is expected to have a more accurate measure for EE is a better predictor of plan choice.

Table 35

Sensitivity Analysis Classification

Plan	PPO	HRA	HSA eligible CDHP	Percent Correct
Non-Married Single Coverage				
PPO	401	18	2	95.2%
HRA	0	393	0	100%
HSA eligible CDHP	42	3	26	36.6%
Overall %	50.1%	46.8%	3.2%	92.7%
Married Single Coverage				
PPO	219	30	2	87.3%
HRA	30	136	5	79.5%
HSA eligible CDHP	20	9	15	34.1%
Overall %	57.7%	37.6%	4.7%	79.4%

Table 36

Sensitivity Analysis Pseudo R - Squares

Plan	PPO
Non-Married Single Coverage	
Cox and Snell	.627
Nagelkerke	.746
Married Single Coverage	
Cox and Snell	.380
Nagelkerke	.451

The overall effect of each employee earnings (EE) predictor is assessed next via likelihood ratio tests by the Chi-Square statistic for each variable in the models for both the married single coverage and the non-married single coverage data sets. Table 37 lists findings for each variable. The model is run three times for each data set (non-married single coverage and married single coverage) to assess employee earnings operationalized as a continuous variable, the top ten percent EE, the bottom ten percent EE, and the middle eighty percent EE as in the main analyses. All of the individual level EE measures are not statistically significant at $p < .05$. The only two statistically significant IVs are PTCS and out-of-pocket maximum.

Because all results for employee earnings for both data sets are not statistically significant, no further analyses is warranted. The reduced data sets based on coverage tier and marital status may cause limitations in variation of IVs, which limit the representativeness of the sample.

Table 37

Sensitivity Analysis Likelihood Ratio Tests

Effect	Married Single Coverage			Non-married Single Coverage		
	Model Fitting Criteria	Likelihood Ratio Tests		Model Fitting Criteria	Likelihood Ratio Tests	
	-2 Log Likelihood of Reduced Model	Chi-Square	Sig.	-2 Log Likelihood of Reduced Model	Chi-Square	Sig.
Intercept	638.600[a]	.000	.	1216.45[a]	.000	.
Employee Earnings[b] (continuous)	641.641	3.041	.219	749.863	.187	.911
Highest Employee Earnings[b] Top 10%	641.641	4.492	.106	749.863	.263	.877
Lowest Employee Earnings[b] Bottom 10%	641.641	.022	.989	749.863	.944	.624
Middle Employee Earnings Middle 80%	518.245	.124	.940	624.901	1.523	.467
Total Cost Sharing[c]	698.791	60.190	.000	827.011	77.335	.000
FSA Participation[c]	641.935	3.334	.189	750.106	.430	.807
RRS[c]	644.318	5.718	.057	753.190	3.514	.173
Out of Pocket Maximum[c]	770.978	132.377	.000	1421.472	671.796	.000
Region Code Reduced[c]	645.157	6.556	.354	753.353	3.676	.720
Union Membership[b c]	639.555	.954	.620	752.952	3.276	.194
Salary or Hourly[b c]	639.865	1.264	.531	757.802	8.126	.017
Ethnicity[b c]	639.435	.834	.659	751.231	1.554	.460

Notes: The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

b. Individual level measures

c. Values are based on the IV results from estimation of the full model with continuous measures of employee earnings, PTCS and RRS

Conclusion

First, the multivariate analyses shows employee earnings (EE) is a statistically significant predictor when entered as a dichotomous variable to estimate the predictive model hypotheses to test H1.1 and H1.2. Employee earnings (EE) is a statistically significant predictor for the HRA

versus the PPO Managed Care plan for the lowest 10% of EE, and the HSA eligible CDHP versus the PPO Managed Care plan is also significant for the top 10% of EE.

Next, the multivariate analyses also show that prior total cost sharing has a statistically significant predictive influence for plan choice between a PPO Managed Care plan, an HRA or HSA eligible HDHP when estimating the predictive model with IVs in their original form. Households with the lowest prior total cost sharing are most likely to choose the HSA eligible CDHP, and those with lower total cost sharing are more likely to choose the HRA plan versus a PPO Managed Care plan. This was predicted by hypotheses H2.1 and H2.2.

Third, prior FSA participation was statistically significant for assessing enrollment between the HSA eligible CDHP and PPO Managed Care plan, in predicting that not previously participating in an FSA was associated with HSA eligible CDHP enrollment. This makes it not possible to reject the null hypothesis for H3.1.

Fourth, enrollee households with lowest RRS (best health status) are most associated with HSA eligible CDHP enrollment versus the PPO Managed Care plan, and lower RRS (better health status) enrollees are more likely to choose an HRA versus PPO Managed Care plan.

Finally, the sensitivity analysis was conducted to help determine potential corrupted measurement effects for employee earnings as a predictor, as income from sources other than the study employer are not available. Married single coverage and non-married single coverage enrollees were compared for both the discrepancy between employee earnings (EE) measurement and EE's statistical significance. It would appear employee earnings measured at the individual level may add some level of false statistical significance in the full data set predictive model, or the greater number of females in the two single coverage groups affects the influence of employee earnings on plan choice. When examining single coverage employees,

regardless of married or non-married, employee earnings is not a statistically significant predictor in either group so parameter estimates were not examined for statistical significance. Employee earnings was not statistically significant in the data set including only the middle 80% of EE households, which assessed a large sample (n = 7694) while keeping the variable continuous. The sensitivity analyses may affirm that finding and suggest the employee earnings measure did not have a significant influence on the predictive model unless evaluating it in a modified dichotomous form for lowest and highest earners.

Outcomes derived from the use of the adapted behavioral model developed for this research are mixed. They suggest there are underlying influences relative to plan type, enrollee past experiences, and that the type of insurance plan is a factor which deserves consideration in an adapted behavioral model. However, limitations in the adapted model used in this study impact its predictive value for plan choice. Chapter 6 is presented next to review and discusses results of these analyses. Limitations of this study and additional consideration for future research are addressed.

Chapter 6 – Discussion

Introduction

CDHPs are the most recent large-scale change in health insurance plan design since Managed Care began to supplant Fee for Service through the 1980s and 1990s. The primary driver behind this plan design is the effort to restrain the rate of cost growth in a market for which it has consistently outpaced inflation for decades. Managed Care focuses on supply side controls, which was partly successful in reducing the rate of premium inflation and led to the domination of Managed Care plans over their Fee for Service counterparts in the Employer Sponsored Insurance (ESI) market. With the exception of government's role in the Patient Protection and Affordable Care Act (PPACA) signed into law in 2010, efforts to contain costs have recently focused on demand side controls of CDHPs as the key differentiator from Managed Care supply side designs. Even with government healthcare reform it is important to understand these influences because demand side controls will continue to be part of the landscape within the modified health care insurance markets.

It is important to understand possible influences to consumer behavior related to the use of medical services due to change in health plan design. It is also important to understand how consumers choose a plan when faced with different plan designs such as Managed Care and CDHPs. How consumers choose plans may influence the distribution of demographics, health

risk, and behavioral characteristics across plan types. This study explores the influence of employee earnings, prior health care use experience, and health risk on plan choice.

This chapter first reviews the implications of who chooses a CDHP versus a Managed Care plan. Next, results based on the theoretical model's constructs are discussed. Then, the results relative to the study hypotheses are examined. This chapter concludes with a discussion of overall implications, study limitations, suggested future research and concluding remarks.

Research Question One

The first research question: What are the utilization and distribution characteristics of various types of health insurance plans across the employee population? is assessed via descriptive statistics.

Enrollees in the two CDHPs have higher earnings, particularly for the HSA eligible HDHP. Of note, HRA mean earnings are similar to PPO Managed Care enrollee earnings, but the HRA has a notably larger standard deviation than other plans. Findings of higher mean and median employee earnings for the Health Reimbursement Account (HRA) and HDHP is consistent with research discussed in Chapter 2 (See Barry et al., 2008; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009; U.S. Government Accountability Office, 2006). Research suggests low-income persons are less likely to choose a CDHP with high initial cost sharing and less generous benefits, versus Managed Care plans with lower initial cost sharing and more generous benefits (Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004b, 2008; Tollen et al., 2004).

It is of interest that the HRA is most likely chosen by the "lowest" earners, but has higher mean earnings and lower mean TCS. However, the HRA also has the greatest standard deviation for these two measures. This may suggest that although lowest earners are most likely to choose

the HRA, the high standard deviations for earnings and TCS explain the higher mean HRA enrollee earnings and lower mean TCS compared to the PPO.

The PPO Managed Care plan has greater prior total cost sharing (TCS) than both CDHPs with a mean of $3,539 and median of $3,314. The HDHP has the lowest mean and median TCS of $2,061 and $1,275 respectively. The HRA's mean and median are $3,049 and $2,869. This suggests that the HDHPs enjoy favorable selection based on prior use of health services, and HDHP enrollment benefits most with the lowest TCS. Of note, HRA enrollees have the greatest TCS standard deviation. Five studies examine prior total healthcare spending, which is a similar proxy to TCS used to capture perceived need (Tollen et al., 2001; Parente et al., 2004[b]; Green et al., 2006; LoSasso et al. 2004; & Barry et al. 2008). The primary difference between prior total spending and TCS is that the later measures households' direct cost of healthcare use, whereas the former includes spending that is largely paid by the third party insurer. As with TCS in this research, these studies find prior total health care spending to be negatively associated with CDHP enrollment, which supports the study's findings of favorable selection based on prior health cost expenditures. Findings do not identify a significant distinction between total prior health care spending and enrollee prior spending. This may be due to enrollees' perceived need that is based on the related amount of health care used, which drives the related total cost and TCS, versus the actual out-of-pocket cost.

The PPO Managed Care plan's mean and median employees' Relative Risk Score (RRS) are substantially higher than employees in the other plans (RRS 91 and 55, versus the HSA eligible HDHP's 57 and 22, and the HRA's 60 and 35). This study finding compliments previous research. Studies discussed in Chapter 2 measure health status by the presence of one or more chronic conditions, self-reported health status, and an empirical score similar to the RRS

measure in this study. Six studies find the various measures of health status within the perceived need construct to be negatively associated with CDHP enrollment (Barry et al. 2008; Fowles et al., 2004; Green et al., 2006; Parente et al., 2004[b]; Parente et al., 2008; & Tollen et al., 2001). These findings are similar to those for TCS and suggest favorable selection for the CDHPs with the HSA eligible HDHP benefiting the most. Of note, the HRA total cost sharing and RRS means fall between the PPO and HSA, but the HRA has the highest TCS standard deviation and lowest RRS standard deviation. This may suggest that RRS and TCS are perceived differently by enrollees. TCS may represent realized perceived need and RRS may represent perceived potential need.

The HRA has the highest prior FSA participation (18.8), the PPO Managed Care plan second highest (17.3) and the HSA eligible HDHP lowest (13.4%). As noted in Chapter 2, Parente et al. (2004[b]) suggest FSA participation is linked to the willingness and intellectual ability to manage a medical savings account similar to those required or available to CDHPs. Although this study's HRA findings are consistent with Parente et al. (2004[b]), the HSA eligible HDHP enrollees' lowest prior FSA participation conflicts with these earlier findings. The choice set of plans in the research by Parente et al. (2004[b]) included only an HRA Consumer Directed Health Plan versus Managed Care plans and not an HSA eligible HDHP. It is possible that the type of CDHP affects enrollees' choices. An employer funded medical savings account is required for the HRA, however a medical savings account is optional for the HSA eligible HDHP. Furthermore, the medical savings account for an HSA eligible HDHP is enrollee funded, not employer funded. In other words, Parente et al. (2004 [b]) identify a positive association between HRA enrollment and prior FSA participation, but such an association may not exist for an HSA eligible HDHP. For an HSA eligible HDHP, potential influence from prior FSA

participation may be subjugated to other influences such as enrollee concerns for who funds the medical savings account, their anticipated need for medical care in conjunction with the generosity of the plan, and how much they must pay to enroll in the plan. HSA eligible HDHP enrollees may be attracted to its low premiums ($0), and may not anticipate the need for a medical savings account due to their lower prior TCS and RRS.

Enrollees in all three plans are predominantly white and enrolment patterns within different geographic regions are similar across plans. The PPO Managed Care plan includes the fewest Asians proportionately and the HSA eligible HDHP the fewest percentage of Hispanic enrollees. The CDHPs have fewer hourly enrollees. The HSA eligible HDHP has the lowest number of hourly enrollees, with 40% compared to the PPO Managed Care plan's 64.4%. Union status is similar to hourly status, with comparative enrollment proportions. Household size for the PPO Managed Care plan and HRA are the same, but the HSA eligible HDHP has lower mean household enrollees. This is consistent with marital status findings as the HSA eligible HDHP has the most non-married single enrollees. The HDHP has the largest proportion of residents in the east north central United States, who have single coverage and who report their marital status as single.

Interestingly, the HSA eligible HDHP also has the largest proportion of female primary subscribers. Research Discussed in Chapter 2 suggests a positive association between male enrollees and CDHPs (Tollen et al., 2001; LoSasso et al., 2004; Parente et al., 2008; U.S. Government Accountability Office, 2006). One possible explanation is that the HSA eligible HDHP covers preventive care with no out-of-pocket costs. Females generally utilize preventive care more regularly than men and the HSA eligible HDHP in this study represents generous coverage in that regard (Bertakis et al., 1999; Muller, 1992). Additionally, not only does the

HSA eligible HDHP have the largest proportion of female enrollees, but also includes the highest proportion of single coverage female prescribers. As discussed in Chapters 2 and 3, non-single enrollees are more likely to choose coverage with lower initial deductibles for concerns of greater cost related to healthcare needs associated with multiple family member households. Another possible contributing factor to the HSA eligible HDHP largest single female enrollee population could be that women often earn lower earnings than their male counterparts and the HDHP's free premiums is more appealing (Snell & Bholander, 2010). Single females may be attracted to the free premiums, free preventive care, and not have concerns of a high deductible that could be most costly for multiple enrollee households that are more likely to use more care than a single subscriber.

Employees in the three plans share similar mean ages and maximum out-of-pocket costs. The out-of-pocket maximum costs across plans are similar and reflect a plan cost structure for which the study employer chose to have some consistency in out of pocket exposure for their enrollees across all plans.

Study Results Guided by Andersen's Behavioral Model

An adapted Andersen model guides this study. This model focuses on enrollees' prior experience relative to the economic factor of economic enabling resources and choice factors of self-perceived need. As with the behavioral model, the adapted model suggests these factors determine how health care is accessed and used.

Findings for economic enabling resources suggest employee earnings influence the choice between a Managed Care PPO plan, HRA, and HSA eligible HDHP dependent on how the measure is operationalized. In the multivariate analyses, when employee earnings are entered in the model as a continuous measure, enrollee earnings (EE) is not statistically significant.

However, it is statistically significant when EE is entered in the model as a dichotomous variable to test the association between plan choice and membership in high and low employee wage groups. Furthermore, as in the full model, when EE is operationalized as a continuous variable for the middle wage employee group only, it is not significant.

These findings suggest a nonlinear relationship between employee earnings and plan choice. Prior research supports a positive association between EE and CDHP choice, but, that research examines EE operationalized as a continuous variable or as a categorical variable grouped by quartile or quintile (Barry et al., 2008; Fowles et al., 2004; Greene et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009; U.S. Government Accountability Office, 2006). Alternatively, this study suggests employees who earn the highest earnings (versus those who do not) are most likely to choose an HSA eligible HDHP, and the lowest wage employees are most likely to choose an HRA versus the non-lowest wage group. However, no statistically significant linear association across the continuum of earners from lowest to highest is found.

Parente et al. (2008) is the only study that included an HSA eligible plan in the choice set. They similarly found HSA choice to be most associated with high employee earnings. When more than one type of Consumer Directed Health Plan is available in the health plan choice set, it can be argued that they should not be generically grouped together just because they are CDHPs. It is possible that the different features of CDHPs, as between HRA and HSA eligible plans, influence plan choice. Green, et al. 2006 examined PPOs with HRA plans categorized as generous and less generous. Parente et al. (2008) also examined HRA plans categorized by generosity with the addition of an HSA eligible plan in the choice set. As described in Chapters 2 and 3, HRA plans include an *employer*-funded account whereas HSA accounts require *employee*

contributions. These distinctions likely change the perception of plan attributes relative to employee earnings, such as the interplay of premium contributions and out-of-pocket costs associated with each plan. Employee earnings are discussed in more detail under findings for hypotheses H1.1 through H1.3. Choice factors of self-perceived need are discussed next.

Choice factors of self-perceived need include prior total cost sharing (TCS), prior Flexible Spending Account (FSA) participation, and Relative Risk Score (RRS). The findings on prior total cost sharing and RRS support prior research indicating that CDHPs appear to enjoy favorable selection, with lower generosity CDHPs benefiting most. Alternatively, prior FSA participation findings offer no supporting evidence that enrollees who demonstrated planning for perceived needs are associated with CDHP choice.

Prior total cost sharing and RRS are proxies for health status. If enrollees have lower prior total cost sharing and relative risk, they are presumed to have better health. Prior total cost sharing has a significant negative association with CDHP choice. The least generous plan (HSA eligible HDHP) benefits most from enrolment by those with lower prior total cost sharing. This relationship is similar for RRS because the HSA eligible HDHP also benefits most from those with the lowest RRS. The lower spending and lower relative risk associated with the CDHPs, particularly the HSA eligible HDHP, suggests that favorable selection is present for these plans. Presumably, these associations are based on an enrollee trade off, with healthier enrollees seeking lower premium contributions because their risk to incur greater out-of-pocket costs with the high deductible plans (versus the Managed Care PPO) is lower than less healthy enrollees.

Prior FSA participation represents the willingness and ability to financially plan for minor health care costs associated with the perceived need to seek care. Prior FSA participation is not associated with the CDHPs. It may be that plan cost features are more critical to the choice

of an HRA or HSA eligible plan, and the ability to manage a health care spending account is not a key plan choice feature.

All predisposing characteristics except union status were statistically significant and consistent with the literature. The only plan cost characteristic that could be used in the model was annual out-of-pocket maximum, which was likewise statistically significant.

Study results for the theoretical model must be considered in the context that the model accounts for a moderate to low amount of variation. Other factors that may influence plan choice are not in the model. Additional variables, such as those under the dimension of environmental factors, are a relevant example. The environment dimension of the behavioral model includes the health care system and external environment. This study accounts for the penetration rate of in-network providers, however health care system characteristics unavailable to this study include the types of health service providers or facilities, the level of technology, and financial make-up (profit versus non-profit). Factors related to the external environment are addressed in this research by controlling for geographic region, but do account for the level of detail that includes physical (variations in diet, climate, and environmental conditions), political (financing and health education), regulatory (certificate of need programs, credentialing, or certification and licensing rules) and economic (unemployment, inflation rates, or strain on the availability of health care systems' resources) factors. Furthermore, other individual level factors such as age, education or enrollees' ability to process financial and health related information, behavioral characteristics for healthcare use or health related lifestyles, or need characteristics such as risk aversion characteristics are also not available for this study.

This study uses an adapted behavioral model with a focus on the factors of enabling resources and need, which are interrelated with Andersen's dimensions of environment, health

behaviors and outcomes. Within this framework, Andersen identifies health insurance as one of the most important factors for potential access and use of health care related services. A health insurance plan provides a vehicle to make potential access more possible to a greater number of people than most other economic enablers, and the availability of insurance is key to Andersen's model. However, the inclusion of insurance coverage in the behavioral model presumes the form of coverage is not itself a key factor. This study suggests that the era of fee for service insurance plans that were dominant during the development period of the behavioral model has passed and the multitude of differentiated plan types should be a factor in an adapted behavioral model. Just as individuals have different health care seeking behaviors, individualized perceptions of need and or health, various risk tolerances for health and the related cost to insure for potential future needs, environments are unique in both geographically and health care markets, the type of health plan at a minimum shares similar attributes and possibly even modifies such behaviors, perceptions and markets.

Research Question Two

Hypotheses are used to examine the second research question: "What economic factors are associated with the choice of health plan type?" Table 38 lists hypotheses and results for this study. Four of nine hypotheses are accepted. Each set of hypotheses is discussed in order.

Hypotheses H1.1, H1.2 and H1.3: employee earnings. Hypothesis H1.1 examines whether enrollees with the highest employee earnings are *less* likely to choose the HSA eligible HDHP versus a PPO Managed Care plan. To the contrary, results indicate highest earning enrollees are *more* likely to choose the least generous consumer directed health plan (HSA eligible HDHP) over the PPO Managed Care plan. The HSA eligible HDHP is described as least

Table 38

Hypotheses Tests

Hypothesis	Results	Hypothesis
H1.1 Enrollees with the highest employee earnings are less likely to choose a HRA or HDHP (CDHP) versus a PPO Managed Care plan	Enrollees in the highest employee earners group are more likely to choose the HDHP versus PPO Managed Care plan	Cannot Reject Null
H1.2 Enrollees with the lowest employee earnings are more likely to choose an HDHP rather than a PPO Managed Care plan	Enrollees in lowest employee earners group are more likely to choose the HRA versus the PPO Managed Care plan	Cannot Reject Null
H1.3 Enrollees with middle employee earnings are more likely to choose a CDHP (HDHP or HRA) than a PPO Managed Care plan as earnings increase.	Enrollees in the middle employee earners group are not found to be statistically significant	Cannot Reject Null
H2.1 Lowest prior total cost sharing is most likely associated with enrollment in an HDHP versus a PPO Managed Care plan.	Enrollees in the lowest TCS group are most likely to choose the HDHP versus the PPO Managed Care plan	Reject Null
H2.2 Lower prior total cost sharing is more likely to be associated with enrollment in an HRA versus a PPO Managed Care plan	Enrollees in the lower TCS group are more likely to choose the HRA versus the PPO Managed Care plan	Reject Null
H3.1 Enrollees who previously participated in an FSA are most likely to choose a HDHP than a PPO Managed Care plan.	Enrollees who previously participated in an FSA are least likely to choose the HDHP versus the PPO Managed Care plan	Cannot Reject Null
H3.2 Enrollees who previously participated in an FSA are more likely to choose a HRA than a PPO Managed Care plan.	Enrollees who previously participated in an FSA are not found to be statistically significant for HRA enrollment versus the PPO Managed Care plan	Cannot Reject Null
H4.1 Lowest relative health risk is most likely associated with enrollment in a HDHP versus a PPO Managed Care plan.	Enrollees in the lowest RRS group are most likely to choose the HDHP versus the PPO Managed Care plan	Reject Null
H4.2 Lower relative health risk is more likely associated with enrollment in a HRA versus a PPO Managed Care plan.	Enrollees in the lower RRS group are more likely to choose the HRA versus the PPO Managed Care plan	Reject Null

generous due to its high deductible and no employer funding for the HSA. Hypothesis H1.1 findings are not statistically significant for the HRA.

Prior findings of a positive association between income and CDHP enrollment are partly supported by this study. This study supports a positive association between highest earners and the HSA eligible HDHP. However, where prior research finds a positive linear association between income and CDHP choice, this research does not. It is worth noting that this study and Parente et al. (2008) both find the HSA eligible HDHP to be most associated with high earners. Parente et al. (2008) is the only other study that examined a plan choice set that includes an HSA eligible HDHP.

Findings relative to the HRA are more similar with those of Green, et al. (2006), which do not find the more generous HRA to be significant. Similar findings between Green et al., (2006) and this work may reflect the similar study populations and choice sets as described under Research Question One. Both study populations are predominantly white, male, and share similar age, exempt status and employee earning distributions. The similar demographics and economic enabling factor of employee earnings between the two studies suggest consistency in the findings for the HRA plans.

Where H1.1 tests if the highest earners are more likely to choose the PPO Managed Care plan, Hypothesis H1.2 tests if lowest earning enrollees are more likely to choose the HSA eligible HDHP. This hypothesis is intended to assess if the lowest up-front cost plan (HSA eligible HDHP with no enrollee premium cost) represents a form of free catastrophic coverage to low-earning enrollees versus the PPO Managed Care plan that has the highest enrollee premium cost.

Findings for H1.2 indicate that lowest earning enrollees are not more likely to choose the HSA eligible HDHP, but they are more likely to choose the HRA than the PPO Managed Care plan. Results could suggest that low-earning employees seek the lower premium cost of the HRA versus the PPO Managed Care plan. Although the HSA eligible HDHP has the lowest premium cost to enrollees, it has a high deductible that must be funded entirely by the enrollee(s) if they incur medical costs, whereas the HRA's high deductible is partly offset by the employer funded spending account. This suggests enrollees may not want to risk the larger initial cost sharing that they perceive the HSA eligible HDHP to have due to the high deductible. They may also perceive their need for health care to be minimal and take the chance their costs, if any, will be covered by the employer-funded account. Premium contributions are markedly higher for the HRA than the HDHP (HDHP $0 versus HRA between $757 and 2,117), but the risk and uncertainty of incurring costs under a high deductible HDHP may be unattractive. Furthermore enrollees may lack the disposable income to self-fund the HSA to help offset costs in the HDHP. Qualitative findings by Green, et al. (2006) support these possible explanations. As in this study, Green, et al.'s (2006) research included a similar choice between lower and higher deductible CDHPs. They found enrollees who chose the higher deductible CDHP did not expect to need care and preferred a plan with low premiums. Those who chose the lower deductible HRA did so because its premiums were cheaper than the Managed Care option, but they expected the employer funded account to greatly assist with minimizing their risk of out-of-pocket costs (Green, et al. 2006).

Hypothesis H1.3 tests if enrollees with middle employee earners are more likely to choose a CDHP than a Managed Care Plan as earnings increase. This hypothesis examines a possible linear relationship for employees who are in the middle earnings group. Middle earners

are defined as the middle eighty percent of earners not including those in the highest and lowest ten percent tested in hypotheses H1.1 and H1.2. Results for those in the middle-earners group do not support prior research that finds a positive association between income and CDHP choice (Barry et al., 2008; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009; U.S. Government Accountability Office, 2006). However, the one study with similar choices across plan characteristics and study population finds income and CDHC choice not-significant as with Hypothesis H1.3 (Green et al., 2006).

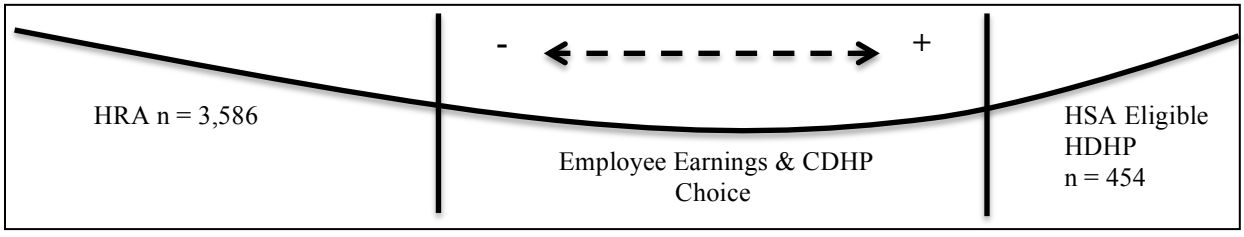
Although the null hypotheses for H1.1 through H1.3 are not rejected, findings lend support to the premise of a non-linear relationship between employee earnings and plan choice. The three EE hypotheses outcomes, considered together, provide insights to the relationship between CDHP choice and EE. First, outcomes for Hypothesis H1.1 do not support the idea that the highest earners are more likely to choose the PPO Managed Care plan that is described as most generous coverage with the highest premiums. As discussed above, the HSA eligible HDHP is more likely to be chosen, but only when examining membership or non-membership in the top 10% of wage earners. When employee earnings are operationalized as a continuous variable, no statistically significant linear relationship is found; there is only a positive bivariate correlation between CDHP choice and employee earnings.

Second, congruent with outcomes from H1.1, H1.2 does not reflect the HSA eligible HDHP as an attractive plan for the lowest earners to obtain free catastrophic health coverage. One possible explanation is that even the lowest 10% of the study employee population enjoys earnings that range from $7,994 to $37,249, with a median of $31,907, while the bottom twenty five percent of United States households in 2005 earned from $0 - $22,500. Thus, the range of

earnings for the bottom 10% of the employer study group is substantially above a similar range of income for the U.S. population as a whole and is not generalizable to lower income populations (US Census, 2006). Therefore, even the lowest 10% of earners in this study may feel they can afford a more generous coverage than the HSA eligible HDHP, but cannot risk the high initial out-of-pocket costs.

Third, no association is found between EE and plan choice when only middle wage earners are included in the sample. The finding of no association between employee earnings and plan choice is similar to when EE is operationalized for all cases as a continuous variable. These outcomes suggest there is only evidence to support an association between employee earnings and CDHP plan choice for enrollees in the lowest and highest earner groups. Furthermore, it cannot be stated that as earnings increase, the likelihood to choose a CDHP also increases. Thus, there is no evidence to suggest a linear relationship exists between enrollee earnings and plan choice. See Figure 9 which illustrates this point. Plan choice may have more to do with perceived risk of specific plan cost characteristics and perceived need than income or earnings relative to a general plan type such as Managed Care or CDHPs.

Figure 9. Association between CDHPs and Employee Earnings



Hypotheses H2.1 & H2.2: prior total cost sharing. To test Hypotheses H2.1 and H2.2, the predictive model was run twice. First, prior total cost sharing (TCS) was entered in the model as a dichotomous measure to tests enrollees with the "lowest" TCS (grouped as those in the

lowest ten percent of TCS or not) for Hypothesis H2.1. Second, TCS was entered as a a dichotomous measure that tests enrollees with "lower" TCS (grouped as those in the bottom two quintiles of TCS or not) for Hypothesis H2.2.

Hypothesis H2.1 examines whether enrollees with the *lowest* TCS are most likely to choose the HSA eligible HDHP because, although it has the highest initial cost sharing, it requires no enrollee premium contributions and they are least likely to require care. This hypothesis tests if enrollees with lowest prior total cost sharing perceive a lower need for health care services in the future, thus placing a greater importance on lower premium cost than plan generosity as characterized by initial cost sharing levels. If a person does not expect to need health care, it follows they would seek the lowest cost coverage and be willing to risk the un-anticipated health care needs that lead to high initial cost sharing with a lower generosity plan. Findings suggest that enrollees in the lowest ten percent TCS group are most likely to choose the HSA eligible HDHP versus the PPO Managed Care plan. This offers support that those who are most healthy are most likely to choose the lowest premium plan.

Hypothesis H2.2 is an extension of H2.1 and examines if enrollees with *lower* TCS, are more likely to choose the HRA over the PPO Managed Care plan. Lower TCS is defined as enrollees in the bottom forty percent (lower two quartiles). Hypothesis H2.2 findings show enrollees in the lower forty percent of TCS are more likely to choose the HRA.

These findings lend additional support to the literature that CDHPs enjoy both favorable selection and a positive association between lower premium cost and plan choice (Barry et al., 2008; Green, et al., 2006; Lo Sasso et al., 2004; Parente et al., 2004a; Parente et al., 2004b; Parente et al., 2008; Tollen et al., 2004). Findings suggest enrollment relative to TCS appears to be inversely hierarchal for enrollee premiums and generosity. As prior total cost sharing

decreases, enrollees are more likely to choose a plan with a greater emphasis on lower premium cost than greater benefit generosity. Alternatively, as TCS increases, the importance of plan generosity increases. The HSA eligible HDHP is a CDHP with lowest enrollee premiums and lowest generosity and is most associated with lowest TCS verse the PPO Managed Care Plan. The HRA is a CDHP that has moderate premiums and moderate generosity and is more associated with lower TCS enrollees than the PPO Managed Care Plan. The PPO Managed Care plan has the highest enrollee premiums and greatest generosity and is associated with the highest enrollee TCS. Thus, findings indicate that as prior total cost sharing decreases, enrollees are more likely to choose a plan with a greater emphasis on lower premium cost than greater benefit generosity. Alternatively, as TCS increases, the importance of plan generosity increases.

Hypotheses H3.1 & H3.2: prior Flexible Spending Account participation. Prior flexible spending account (FSA) participation was operationalized as a dichotomous variable. Hypotheses H3.1 and H3.2 test if enrollees whom previously participated in an FSA are positively associated with enrollment in a CDHP. An FSA is a form of personal care account (PCA) that allows individuals to set pre-tax funds aside to help finance and manage some initial health care needs. CDHPs include either a compulsory or optional PCA that facilitates similar features, albeit with greater levels of funding and rollover provisions that FSAs lack. Thus, hypotheses H3.1 and H3.2 assess if prior behaviors of setting funds aside to manage and finance some initial health care need helps explain enrollment decisions in plans with similar components.

Findings for Hypothesis H3.1 indicate that enrollees who previously funded an FSA were actually *less likely* to choose the HSA eligible HDHP versus the PPO Managed Care plan.

Furthermore, results for H3.2 that assess HRA choice and prior FSA participation are not statistically significant.

Those who choose the HDHP may place greater importance on zero enrollee premium contributions, the expectation they will not need to access care that exposes them to a high initial out-of-pocket cost, and a sense that their disposable income is sufficient to cover the high deductible without financially catastrophic effects. This is consistent with the descriptive and bivariate findings discussed earlier.

The non-significant association between the HRA and prior FSA participation may be due to the perception that the HRA account funded by the employer substitutes the need for an FSA. Thus, similar to the HSA eligible HDHP, premiums are more important than the ability to manage a personal care account and the prior FSA participation is not a factor.

These results may suggest that enrollees do not choose CDHPs due to a continued ability to use a personal care account (PCA). As suggested by research discussed in Chapter 2, enrollee premium cost, plan generosity levels and moral hazard may primarily drive plan choice decisions (Barry et al., 2008; Green et al., 2006; Parente et al., 2004a; Parente et al., 2008). Furthermore, prior FSA participants may have found the PCA unattractive to both fund and to manage with administrative and planning complexities. Although Parente et al. (2004b) find a positive association between prior FSA participation and CDHP enrollment, results may differ due to the choice set that included two Managed Care plans and an HRA as well as less than one percent enrollment in the CDHP option. This study and Parente et al. (2004b) have different study populations and the incongruent results may highlight the importance of generalizability when examining plan choice.

Hypotheses H4.1 & H4.2: Relative Risk Score. Hypotheses H4.1 and H4.2 test Relative Risk Score (RRS) and CDHP plan choice. They are an assessment similar to TCS for possible favorable selection and CDHP enrollment. Hypothesis H4.1 tests if enrollees with the *lowest* RRS are *most* likely to choose the HSA eligible HDHP than the PPO Managed Care plan. RRS is operationalized as a dichotomous measure of membership in the lowest twenty percent (bottom quintile) of RRS enrollees or not. Lower RRS represents better enrollee household health status. Findings indicate enrollees in the bottom twenty percent of RRS (those with the best household health status) are more likely to choose either a HSA eligible HDHP or HRA, but by a minimal extent are *most* likely to choose the HSA eligible HDHP versus the PPO Managed Care plan. Choice of either the HSA eligible or HRA by the lowest earners is nearly equal in likelihood.

Hypothesis 4.2 tests if enrollees with *lower* RRS are *more* likely to choose the HRA versus the PPO Managed Care plan. RRS is operationalized as a dichotomous measure of membership in the lower forty percent (bottom two quintiles) of RRS enrollees or not. Findings indicate that enrollees in this group are more likely to choose the HRA versus the PPO Managed Care plan. HSA eligible HDHP choice and membership in the lower forty percent of RRS is not statistically significant.

Of interest is that for *lowest* RRS (healthiest twenty percent), enrollees are more likely to choose either CDHP over the Managed Care plan. The coefficients and exponents (B) are very similar for the HSA eligible HDHP and HRA versus the PPO Managed Care plan. However, for enrollees in the *lower* RRS group (the healthiest forty percent), only HRA choice is significant. One explanation could be that when enrollees fall into the "healthiest" group, there is less concern for high initial out-of-pocket costs, but for enrollees in the group that has a broader range of RRS (forty percent versus twenty percent), the less generous HSA eligible HDHP

becomes less attractive than the HRA. As for hypotheses H2.1 through H3.2, the HRA in this study may represent a middle ground option between the high-risk high cost HSA eligible HDHP and the low-risk high cost PPO Managed Care plan.

Implications for ESI Programs and Benefit Design

Enrollees' perceived needs and economic resources should be considered when designing ESI programs. Findings suggest enrollees' prior total cost sharing experience and perceived health influence plan choice and leads to CDHP favorable selection. Additionally, enrollee earnings may be an important factor for plan choice relative to premium cost in conjunction with each plan's cost characteristics.

This study's findings support prior research that suggests there is favorable selection for CDHPs (Barry et al., 2008; Fowles et al., 2004; Greene et al., 2006; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004). Both the HSA eligible HDHP and HRA plans are associated with healthier enrollees verses the Managed Care PPO. The HSA eligible HDHP benefits most. The HRA plan benefits to a lesser extent from favorable selection verses the Managed Care PPO.

Research suggests CDHPs are associated with higher enrollee earnings (Barry et al., 2008; Lo Sasso et al., 2004; Parente et al., 2004a, 2004b, 2008; Tollen et al., 2004; U.S. Department of Health & Human Services, 2009; U.S. Government Accountability Office, 2006). Research also suggests enrollee earnings are associated with health, as individuals in higher socio-economic groups are generally healthier and require fewer health care services than those in lower socio-economic groups (Bloche, 2007; Hughes-Cromwick, Root, & Reohrig, 2007; Marquis & Kapur, 2005; Zaslavsky & Epstein, 2005). Thus, employee earnings and enrollee health may help explain the presence of favorable selection. However, factors that contribute to favorable selection in this study do not strictly adhere to these findings. Although both CDHPs

are associated with healthier enrollees than the Managed Care PPO, the HSA eligible HDHP is associated with highest wage enrollees and HRA enrollees are associated with lowest wage enrollees.

Findings of favorable selection for the HSA eligible HDHP are consistent with prior research in that the highest wage enrollees are also healthier. Healthier enrollees would have a lower perceived need for future health care, and the high initial cost sharing of the HSA eligible HDHP would be of less concern. However, this study's findings suggest there is a departure between the relationship of health and employee earnings for the HRA. To a lesser extent than the HSA eligible HDHP, the HRA also enjoys favorable selection, but is also associated with the lowest wage employees.

One possible explanation for the relationship between employee earnings and health of HRA enrollees may relate to their risk tolerance and perceived need relative to plan premiums and cost characteristics. Of the three plans, HRA enrollees earn the least but are healthier than those who chose the Managed Care PPO. Findings in this study suggest they are not as healthy as those who chose the HSA eligible HDHP. A critical factor may be that HRA enrollees perceive a need for more health care than HSA eligible enrollees, but less than Managed Care PPO enrollees. Premiums are higher for the HRA than the HSA eligible HDHP, but unlike the HSA eligible HDHP it provides employer funds to cover some initial routine and / or minimal care with no out-of-pocket costs. The HRA does have lower premiums than the Managed Care PPO, which has more generous benefits. This leads to three observations. First, the HRA covers some initial routine and / or minimal care at no additional out-of-pocket cost via an employer funded account. For the lowest earners who perceive limited or minimal health care need, this account minimizes their financial exposure for lower up-front premium cost than the Managed Care PPO.

Second, the HSA eligible HDHP has the lowest premium cost but highest initial cost (un-subsidized high deductible) when health care is used. The healthiest enrollees who expect to only need routine preventive care perceive a low likelihood to incur high out-of-pocket costs. An association between high wage and healthier enrollees supports this. Additionally, the highest wage enrollees are also willing to risk out-of-pocket costs from unexpected health care needs due to their greater economic resources. Third, the Managed Care PPO has the highest premiums and most generous benefits. Enrollees who have the greatest perceived need for care prefer the more generous benefits. Additionally, they have sufficient economic resources (greater than the low wage group) to pay the higher premiums that accompany more generous benefits.

Based on the association between lowest earners and plan choice, the lowest earners in this study appear to desire more generous benefits while seeking lower premiums. These are incongruent goals. Thus, it is necessary for each enrollee household to seek a balance between their economic resources and perceived needs when choosing a plan. The employer funded HRA may represent an attractive choice for the lowest earners to cover initial healthcare needs, due to its employer subsidized high deductible (via an employer funded Personal Care Account), while its premiums are not as costly as more generous plans. Alternatively, the HSA eligible HDHPs may be attractive for highest earners because these enrollees are less concerned with the high deductible, and the plan offers the lowest premium cost. Although there is support for an association between high employee earnings and better health, the association between poorer health and lower employee earnings is curiously unclear in this study. It is possible that because this study's population has earnings above the national averages, it is not generalizable to the larger national population and the association between lower employee earnings and poor health does not hold. An additional possibility is that this study's lower wage population includes

younger entry-level employees who are healthier based on age. There is some evidence for this possibility, as the mean RRS for the lower five percent of earners is lower than that of others (mean RRS 73 versus 78).

The balance between plan premium cost and benefits generosity must be considered for ESI programs relative to whom are the high users of health care (including families verses single subscribers), and those with diseases and with chronic conditions. This can impact the viability of the program and the health of enrollees. If the cost and benefit generosity of the ESI program are not conducive to employee needs, enrollees could defer necessary care due to cost, miss early detection of more serious problems through avoidance of routine preventive care, or even choose to go without insurance coverage at all.

As discussed in Chapter 2, the idea behind CDHPs is partly based on neoclassical economic theory to guide enrollee health care related behaviors. Neoclassical economic theory posits that individuals will make purchase decisions in a way that maximizes their value gain, or personal utility (Folland, Goodman, & Stano, 2003; J. Goodman, 2007; Mankiw, 2004; Weintraub, 1993). However, one of the challenges for enrollee plan choice is the availability of the necessary information to make a rational choice. This study attempts to assess plan choice within the context of information available to enrollees through their past experience of available finances for health care use in the form of employee earnings (EE), prior health care out-of-pocket costs (TCS), willingness and ability to manage some initial care costs (prior FSA participation), health status (RRS), and the basic information on plan cost characteristics that are provided to enrollees during open enrollment.

As noted in Chapter 5, lowest total cost sharing in this study includes values from $0 to $1,093 and lower TCS from $0 to $2,729. If future levels of TCS are similar to prior TCS,

enrollees in the lower and lowest TCS values will incur the lowest future enrollee out-of-pocket cost if they choose one of the CDHPs based on the plan cost characteristics that include deductible, PCA funds, co-insurance, and co-pays (see examples in Appendix B - Healthcare Use Examples). Additionally, enrollees with moderate to high healthcare use generally benefit most if enrolled in the PPO Managed Care plan (Appendix B). Enrollees in this study who are not in the lower total cost sharing group had TCS from $2,730 to $334,405. Although the high end of this range represents the extreme, twenty six percent of this group incurred more than $4,000 in TCS and thirteen percent of this group above $5,000. Those not in the lower TCS group include the $5,000 level in Appendix B for which the PPO Managed Care plan is the lowest cost option for enrollees. Based on the plan choice set, enrollees appear to make a plan choice rationally based on their prior experiences and cost characteristics of the available plans. Thus, it is important for ESI programs to consider their enrollee populations' wage distribution, prior TCS, and health status when building a plan choice set within an ESI program. It is also critical that cost characteristics of each available health plan be explained in clear detail with examples of how such costs affect enrollees' anticipated needs and available economic resources.

Findings at both the household and ESI program levels raise concerns for risk pool segmentation. If the Managed Care PPO continues to attract less healthy enrollees while the CDHPs enjoy favorable selection, risk pool segmentation can occur. Such a trend would cause two negative outcomes. First, the Managed Care PPO plan costs would escalate due to higher costs related to greater health care use, and premium cost would increase. Second, healthier enrollees would migrate from the Managed Care PPO to one of the CDHPs. This would cause an increase in cost for the Managed Care PPO and could make the plan unaffordable. If the Managed Care PPO becomes unaffordable, the less healthy would also migrate toward the HRA

and cause its premiums to increase for the low wage earners. The cascading events, in turn, create a "death spiral" for the ESI program as described in Chapter 2, which makes the program non-viable (Davis, 2004; Shearer, 2004; Tollen et al., 2004). With favorable selection in the ever-growing CDHP segments of the ESI market, benefits programs are at risk for future risk pool segmentation, possible reduction in enrollee choices, increased long-term costs, or lower overall enrollment.

Limitations of This Study

This study's non-experimental research design is limited to inferential findings and cannot control outside factors or identify causation. The secondary convenience sample restricts available measures and provides little control over missing values that led to the need to exclude some cases from the study. Although CDHP enrollment data in an ESI market is very difficult to obtain for an experimental design, this study does allow for the examination of a large sample size (n=9617).

Proxy measures are used for household income, health status and financial planning or management of healthcare. Individual level measures are used where data was not available or it was not possible to include a household level variable. The proxy of employee gross wages (employee earnings) for household income suffers from low face, content and criteria validity. The use of employee earnings does not account for other sources of household income, the level of disposable income or relative wealth of enrollees. The use of a proxy for these factors likely limited the value of findings related to economic enabling resources and plan choice. However this study shares this measurement limitation with other studies related to CDHP choice: the difficulty in obtaining data. FSA participation, as a proxy for enrollees' ability of basic financial planning or management of healthcare, only possesses moderate construct validity. Prior FSA

participation is a marker for prior behavior that suggests some level of inherent willingness and / or ability to manage some initial health related financing of care. It was beyond the scope of this study to capture enrollees' aptitude, education, and experience related to health care knowledge and financial management. The demographic controls (i.e. ethnicity, exempt status and union status) also suffer from low face, content and criteria validity. Additional measures could have improved control of socio-demographic factors related to plan choice such as education level, health knowledge acuity, prior medical care experiences to include physician relationships, financial acuity, the number or ratio of gender in the household, the age of household members, and social and family support members.

Health behaviors are not available for this study. As discussed in Chapter 3, healthcare-purchasing behaviors may differ between individuals, and may influence their plan choice. Those who seek a low cost plan may also be less likely to seek routine preventive care. Lower RRS may be an indication of better health, but may also represent behaviors that avoid routine or needed care. Without some measure for healthcare use behaviors much of the variation cannot be explained. This study examines plan choice at a finite point in time. Such decisions can be complex, and make the measurement of relevant factors at a single point in time challenging. Those who make these decisions assuredly do so with a complex mix of personal experiences, perspectives on health care, finances and risk, as well as family, political and many other factors both impulsive and well deliberated. Identifying these factors is beyond the scope of this study.

The predictive model explains only a modest amount of variation in plan choice for the study population. As suggested above, limitations related to a non-experimental design, proxy measures and factors not available for this model are necessary to explain additional variation in plan choice.

Findings are only generalizable to populations that are similar to this study's employer. The non-experimental design with a secondary data set limits the sample population and does not allow for randomization. This study is representative of an employee population limited to similar demographics and ESI program structure. The study population is largely white, male, and employee earnings are above the national average. The plan choice set, for the timeframe examined, was slightly progressive for the inclusion of CDHPs, but is more representative of modern ESI markets as CDHPs have continued to become a more common offering.

Suggested Future Research

With the emergence of the Patient Protection and Affordable Care Act (PPACA) the Employer Sponsored Insurance (ESI) market will undoubtedly continue to change. That change will continue to create uncertainty and alter how health care is accessed, including new types of health care plan(s) and additional choices for consumers to evaluate. As with the introduction and expansion of CDHPs continued changes are likely and research into employee behavior relative to plan choice is necessary.

Qualitative research with employees and their households as well as further quantitative studies to determine factors affecting plan choice from the employee's perspective is crucial. One key area is the employee's perceptions of costs. Do enrollees fully examine or have sufficient information to attempt an assessment of plan choice via their economic resources, needs and abilities to process the available information within each health plan's cost characteristics and their health attributes? Similarly, do consumers have the ability to effectively manage the financing and coordination of health care use? Management of some initial health care costs through FSA participation, and now HRA and HSA participation, is challenging at

best due to information limitations on related health care costs, administration of accounts only partly controlled by enrollees, and the overall complexity of the health care market.

An examination of influences related to enrollee education during ESI open enrollment would add to plan choice literature. There is a lack of data available that confirms enrollees' understanding of how the plans' premiums and cost features affects them in conjunction with their past healthcare utilization and needs. This study assumes enrollees choose a plan to maximize their utility and welfare. If enrollees do not have a clear understanding of how different plans affect cost and access to care relative to their needs, they will be unable to maximize their household's utility and welfare.

Employees, with the assistance of their employers or plans, may have to be educated and have access to considerably more information to manage health care expenditures if moving to a system that requires more personal responsibility. Tools have been developed by insurers to assist them in choosing a plan. However, to what extent do those tools benefit the plan administrators more than the enrollees? Additionally, do enrollees understand what logic and assumptions these tools use to produce the recommendations of plan choice? To date the number of individuals that plan for their long-term health care needs has not come close to even the small part of the population that endeavors to manage their fiscal budget or financially plan for their retirement. The prospect of shifting to greater enrollee responsibility needs to be studied in addition to its practicality.

Findings related to plan choice for lowest earners highlights a need to better understand the role of variable cost sharing versus fixed enrollee premium contributions. Plan choice based on uncertain future costs versus certain costs may help explain plan choices that are not consistent with the lowest cost option.

Changing demographics and employees' health status may create an evolving ESI population that must also be understood. As rates of diabetes and obesity continue to increase, employers now offer programs to improve chronic disease management and healthy life style changes for employees. Changes in employee health over time likely influence plan choice, and these programs may have an impact on plan choice as well. Greater insights into these factors may help to understand enrollee behaviors and experiences that affect plan choice.

Additional research is necessary to examine different ESI populations. CDHP choice research is generally limited to employer populations that do not represent the ESI population at large. Furthermore, this study suggests a need for additional research of plan choice related to differing types of CDHPs such as HRAs compared with HSA eligible HDHPs. All CDHPs are not alike and often represent distinctly different choices.

Concluding Remarks

This study endeavors to provide evidence on factors that impact health plan choice. Health care plan choice is a function of many influences including economics, enrollee self-perceptions, demographic characteristics, personal behaviors and health care status, social influences, and environmental effects. Healthcare, and thus healthcare insurance, becomes a personal choice with serious ramifications that affect individuals and their dependents. This often makes it an emotional decision as well as one based on the admittedly limited information that can be known by the employee. Thus, it is difficult to capture all factors that can precisely predict plan choice. This study is a beginning exploration of a set of factors that existing research suggests is important for understanding plan choice. The results of the study provide additional evidence and suggest future directions to be explored.

Plans are increasingly diverse and include new and complex features that are difficult to communicate to many consumers. Given the attention to health care in the public policy sphere and in the health care insurance market, plan choice will also continue to evolve. Experimentation will continue with plan designs such as CDHPs, and it is important to seek a better understanding of how changes may affect the ESI market, enrollee healthcare choices, and ultimately employee productivity and health.

Endnotes

1. The employer uses PeopleSoft® for their HRIS.

2. ESI offers represent the number of health care benefit plans made available or offered to employees regardless of enrollment.

3. Exclusive provider network PPOs do not pay for care outside the pre-established provider network.

4. The Rand HIE did show some adverse health effects for lower socioeconomic groups in the 95% coinsurance plan, for certain chronic conditions such as hypertension and myopia.

5. Many employers dissolve funds back to the organization rather than allow employee use if they are no longer actively employed. This is left to employer discretion when designing the plan.

6. A previous employer who established an HRA may make funds available for a former employee, but the account itself is not transferrable.

7. Supports were web-based decision support, RN help lines, or health care provider cost and quality data.

8. Tiered networks offer incentive discounts linked to the use of health care providers within different tiers based on preferred cost and quality ratings.

9. Under the 1938 Fair Labor Standards Act (FLSA) an exempt employee does not receive overtime pay, "…must … be paid at least $23,600 per year… on a salary basis, and… perform exempt job duties,… (categorized as) …"executive," "professional," (or) "administrative" (http://www.flsa.com/coverage.html, accessed 1/2/2009)."

10. Parente et al. (2004b) used Johns Hopkins ASC illness burden software.

11. Parente et al. (2004b) and Green, et al. (2006) did not report findings related to coverage tier, but included the measure as a control variable

12. A separate category for primary subscriber plus spouse (or partner) was not specified by any of the research efforts.

13. The primary subscriber is the employee.

14. Software was used to estimate health risk using algorithms based on prior diagnosis, pharmaceutical use, and overall health care spending including adjustments for age and gender.

15. Tollen et al. (2004) used a pharmacy based predictive model created by Ingenix.

16. Parente et al. (2004b) used "…Johns Hopkins ACG software… (based on) ... ambulatory diagnostic groups (ADGs) and developed resource intensity estimates for each ADG to approximate severity." (p. 1197)

17. The contract level includes all members of the employee household that are insured under the health insurance policy.

18. Parente et al. (2008) used the RxRisk risk assessment instrument based on"… automated ambulatory pharmacy data to identify chronic conditions and predict future health care costs." (p.12)

19. The number of prescriptions filled was used by these studies to measure pharmaceutical use.

20. A separate category for primary subscriber plus spouse (or partner) or number of dependents was not specified by any of the research efforts.

21. Parente et al. (2008) referred to a low deductible CDHP with an employer funded HRA as "generous", and a high deductible CDHP as "less generous".

22. A separate category for primary subscriber plus spouse (or partner) was only specified by Barry et al.'s (2008) research.

23. The nearly 20,000 employees in the health benefit program do not include retiree plans.

24. For 2006 employees were offered one of the two PPOs. One PPO was the primary option, but for employees who lived in areas where the primary PPO had weak provider networks, an optional out-of-network access PPO plan was made available in place of the primary PPO plan. The HMO was offered in part of one East North Central state for 2006 based on health system strength and the employer accommodating employee requests.

25. Provider network strength was determined by a geo-access analysis of the number, type, and distance providers were from a minimum percent of the employee population based on zip codes.

26. The employer uses PeopleSoft® for their HRIS.

27. "Health Insurance Portability and Accountability Act of 1996… establish(ed) regulations for the use and disclosure of Protected Health Information…(e.g.) health status, provision of health care, or payment for health care that can be linked to an individual". http://en.wikipedia.org/wiki/Health_Insurance_Portability_and_Accountability_Act

28. Both data sets used in this study were authorized by a contract between the author and the study employer. All other parties involved in the data collection process acted on behalf of the employer under the terms of that contract.

29. The Consolidated Omnibus Budget Reconciliation Act of 1986 (COBRA) "…amends the Employee Retirement Income Security Act, the Internal Revenue Code and the Public Health Service Act to provide continuation of group health coverage that otherwise might be terminated (http://www.dol.gov/ebsa/faqs/faq_consumer_cobra.HTML, accessed 12/14/08).

30. Verisk Health Inc. DCG software is also used by the Center for Medicare and Medicaid Services uses the same for analyses of the Medicare Choice Program.

31. The ESI program as part of a coverage tier selection covers gay and lesbian couples.

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Appendix A

Enrollee Premium Contributions for Health Plans

Coverage Tier: (S) = Subscriber, (SS) = S & spouse, (SC) = S & Child, (F) = Family			
Plan	PPO	HRA	HDHP
Employee Premium Contribution (per month) Full-time Employees	$77.77 S $165.24 SS $130.03 SC $217.50 F	$63.07 S $134.01 SS $105.46 SC $176.39 F	$0 S $0 SS $0 SC $0 F

Appendix B

Healthcare Use Examples

Plan	PPO [a]	HRA	HDHP
Deductible	Single / Family $0 / 0	Single / Family $500 / 1,000	Single / Family $2,100 / 6,300
Employer Contributions to PCA	Single / Family $0 / 0	Single / Family $1,000 / 2,000 * Used prior to deductible	Single / Family $0 / 0
Out-of-Pocket Maximum	$2,000 / 6000	$3,000 / 6,000	$2,100 / 6,300
Healthcare Use / Cost Examples:			
Cost Due to Deductible with Healthcare Use / Cost:	Single / Family	Single / Family	Single / Family
$500	$0 / 0	Covered Under PCA	$500 / 500
$1,000	0 / 0	Covered Under PCA 500	1,000 / 1,000
$5,000	0 / 0	/ 1,000	2,100 / 5,000
$10,000	0 / 0	500 / 1,000	2,100 / 6,300
$20,000	0 / 0	500 / 1,000	2,100 / 6,300
$23,000	0 / 0	500 / 1,000	2,100 / 6,300
Healthcare Use / Cost:[bc]	15% Co-insurance	15% Co-insurance	0% Co-insurance Single / Family
	Single / Family	Single / Family	$0 / 0
$500	$75	Covered Under PCA	0 / 0
$1,000	150	Covered Under PCA	0 / 0
$5,000	750	$525 / 300	0 / 0
$10,000	1,500	1,275 / 1,050	0 / 0
$20,000	3,000	2,775 / 2,550	0 / 0
$23,000	3,000 max	3,000 / 3,000	
Employee Premium Annual Contribution:	Single / Family	Single / Family	Single / Family
	$933 / 2,610	$757 / 2,117	$0 / 0
Total Cost to Enrollees with Healthcare Use / Cost:	Single / Family	Single / Family	Single / Family
$500	$1,008 / 2,685	$757 / 2,117	$500 / 500
$1,000	1,083 / 2,710	757 / 2,117	1,000 / 1000
$5,000	1,683 / 3,360	1,782 / 3,417	2,100 / 5,000
$10,000	2,000 / 4,110	2,532 / 4,667	2,100 / 6,300
$20,000	2,000 / 5,610	3,000 / 5,669	2,100 / 6,300
$23,000	2,000 / 6,000	3,000 / 6,000	2,100 / 6,300

[a] *The* PPO Managed Care plan *plan also has co-pays for Primary Care Physician Visit = $20, Specialist Visit = $25, Emergency Department Visit = $50, Chiropractic Visit = $25.*

[b] *Co-insurance percentages are applicable after deductibles are met.*

[c] After HRA Exhausted

Vita

David W. Jordan was born August 5, 1969 in Pittsburgh, Pennsylvania. He graduated from Saint Joseph's High School, Natrona Heights, Pennsylvania in 1987. He received his Bachelor of Science in Management from the University of Pittsburgh, Greensburg, Pennsylvania in 1991 and his Master of Business Administration from the Joseph M. Katz Graduate School of Business, University of Pittsburgh, Pittsburgh, Pennsylvania in 1995. He has worked as a Senior Commercial Claims Representative for Nationwide Insurance in Butler, Pennsylvania, Greensburg, Pensylvannia, and Columbus, Ohio. He has also worked as a Account Executive for QRS Managed Care, Inc. and Corvel Corporation, and is currently a Regional Sales Executive for Procura Management, Healthcare Solutions, in the field of Managed Care cost containment in Pittsburgh, Pensylvannia. He is an Auditor for Upper Burrell Township, Pennsylvania. He is also employed as an adjunct instructor for The University of Pittsburgh, Greensburg, Pennsylvania, Pennsylvannia State University, New Kensington, Pennsylvania, and has previously served the same role for Robert Morris University, Pittsburgh, Pennsylvania. He resides with his wife and family in Upper Burrell, Pennsylvania.