

A HEALTH INSURANCE PLAN WITH WELLNESS FEATURES

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Employers are increasingly using wellness programs to improve health and lifestyle of employees. Many employers offer wellness programs to reduce health care costs. This dissertation examines enrollment in health insurance and medical utilization when a wellness program is offered by the employer. Using a unique dataset of health insurance choice and utilization, the study estimates the effect of peer choices and family health on the choice of a health insurance plan with a wellness program. The results show that a 10 percentage point rise in the peer enrollment in the wellness plan increases the likelihood of own enrollment by 1.4 to 3.7 percentage points. The presence of severe health conditions reduces the probability of enrollment by up to 4 percentage points, but more intense users of medical services have a higher probability of being enrolled in the wellness plan. Looking at the utilization of medical services, I use propensity matching mechanism to compare the sample of wellness member to non-members. The results suggest that following enrollment, wellness members tend increase the use of preventive care services. Use of emergency and inpatient hospital services declines in both expenditure and number of visits. However, overall, the growth in preventive care use offsets the decline in emergency and inpatient care use. These results suggest that, at least in the short to medium term, preventive care is not likely to moderate the growing medical expenditure. However, improved information about the benefits of wellness plans may result in wider gains in the longer term.

BIOGRAPHICAL SKETCH

Shooshan Danagoulian is a PhD candidate in the Department of Economics. Previously, she has earned a degree of Master of Arts from the Department of Economics from University of Pennsylvania, a degree of Master of Science in Global Market Economics from London School of Economics and Political Science, and a degree of Bachelor of Arts from Johns Hopkins University. She is married, with two children.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The increasing prevalence of lifestyle conditions such as inactivity, poor nutrition, and tobacco and alcohol use in the United States have spurred major policy changes on both federal and local levels (McGinnis and Foege, 1993). The impetus for policy stems from the evidence linking the lifestyle conditions to chronic diseases such as diabetes, heart disease, and chronic pulmonary conditions. These conditions, previously limited to individuals near or at retirement, are affecting working age Americans adding an economic burden through reduced productivity and increased lifetime medical care. A report released by the Milken Institute estimated that the cumulative health care costs associated with chronic disease totaled around \$277 billion (Mattke et al. 2013).

The rising health care costs of chronic medical conditions are reflected directly in the health insurance cost born by employees as well as employers. As a result, employers, in cooperation with insurers have tried various insurance programs to direct the medical care utilization by the insured. The health maintenance organizations (HMO), in the 1990s, were intended to place the primary care physician in charge of directing and coordinating the medical care received by the patient. The primary care physician (PCP) was the first point of contact for the patient in medical care, and acted to both coordinate and regulate the flow of medical services. Over time, however, HMO's become less popular as patients disliked the constraint on choice. Glied (2000) provides a

comprehensive overview of HMO's.

Wellness programs have become a new way for employers to motivate healthier lifestyle and better medical utilization. A wellness program is a set of financial incentives, resources, and health screenings offered alongside or independently of health insurance, which may include gym membership discounts, counseling for nutrition, smoking cessation, and diabetes management, as well as a health risk assessment. Wellness plans have gained notoriety in media as some employers have made enrollment mandatory in such plans. A *New York Times* article in September 2013 described a stand-off between the faculty and administration in a large university, as the faculty protested the mandatory wellness plan. The objection focused on the mandatory nature wellness questionnaire which, though containing health information, is not protected by the Health Insurance Portability and Accountability Act of 1996 (HIPAA). The protest instigated a Congressional review of workplace wellness questionnaires (Singer, 2013).

A RAND Survey of Employers in 2013, approximately 50% of US employers offer a wellness program to employees. These programs can be offered independently or as part of the health insurance benefits, either as a mandatory or an optional component of health insurance. Wellness programs can include screening activities, such as a health risk assessment, as well as interventions, such as discounts and incentives for healthy lifestyle. According to the survey, 72% of employers who offer a program combine both screening and intervention features (Mattke et al. 2013).

The wellness program studied here was introduced by a large self-insured employer in 2008 as part of the health insurance benefits available to all eligible employees. The wellness program was

integrated into a health insurance plan, Aetna Wellness. It was offered in parallel to an Aetna plan with an identical structure but without the wellness benefits. Aetna Wellness offered gym membership discounts, counseling for smoking-cessation, nutrition, diabetes, and stress management. It required members to select a primary care physician (PCP), and to complete an online health risk assessment questionnaire.

The aim of Chapter 1 is to describe Aetna Wellness and place it in the broader context of employer wellness programs. Section 2 will discuss the economic underpinnings of prevention. Section 3 will address the laws and subsidies governing wellness programs on the federal and state level. Section 4 will describe all the health insurance plans offered by the employer. The details of Aetna Wellness program will be introduced in Section 5. That section will also discuss how the plan was introduced to employees. Section 6 will discuss the benefit structure administered by the employer. Section 7 will preview the subsequent chapters.

1.2 Economics of Wellness

The Grossman (1972) health capital model provides the theoretical underpinnings for demand for wellness and preventive care. As the health capital deteriorates, the individual has incentive to invest through preventive activities. Though preventive care comes at a cost of consumption as well as time, at the optimum, the individual equates the marginal return to the investment with the marginal cost of preventive care. Thus, the model informs us that as the cost of engaging in preventive care declines, the optimal level of preventive care increases.

Demand for preventive care, therefore, is indirect as it increases the health capital stock, resulting in greater individual utility and ability to engage in market and non-market production. The return to preventive care, however, has substantial time dynamics associated with it. Not only is the return to preventive care uncertain, but it can also be substantially deferred in time. Preventive care could be most effective when the health capital stock is high, but its returns are also most deferred. The lower the health capital stock, the lower the return to preventive care, but any gains have almost immediate effect.

From a health policy perspective, the uncertainty and deferred nature of the returns calls into question the cost effectiveness of prevention. Kenkel (2000), however, argues that the appropriate metric for evaluating preventive care is in terms of life years saved. From societal viewpoint, in addition to the explicit medical care costs, the individual utility gains from the extended life years must be accounted in the cost-effectiveness analysis. Kenkel (2000) cites Russell (1986) conclusion that while there are exceptions, "prevention usually adds to medical expenditures, contrary to the popular view that it reduces them."

This dissertation studies a wellness program, including preventive care, as part of a health insurance plan by a large self-insured employer. While from a social point of view, the cost of preventive care are offset by the life years extended, for the employer the benefits of preventive care must be in the form of reduced costs or improved productivity. Since the life years gained are at the end of an employee's life, the employer does not benefit from them. However, improved employee health would translate into reduced absenteeism and presenteeism – both of which reflect the productivity of the employee.

Ehrlich and Becker (1972) examine the implications of moral hazard of employer provided health insurance. In particular, the authors emphasize *ex ante* moral hazard which arises as the individual has reduced incentive to engage in self-protective behaviour. As the employee enrolls in health insurance, he/she is less likely to stop smoking or reduce weight as the cost of curative care decreases on the margin. This externality imposed by the employee on the employer takes the form of decreased productivity and increased event based medical care – emergency room use and hospitalizations.

Bhattacharya and Bundorf (2005) building on the evidence of higher medical expenditure for obese individuals by Finkelstein et al. (2003), explore whether the higher cost is born primarily by the employer or employee. Comparing employee wages among employer who do and do not provide insurance, the authors find that obese workers earn on average \$1.42 less per hour than non-obese workers among insured employees. The difference in these cash wages can be explained by the difference in the expected medical care costs between these two groups. Their results suggest that while employers cannot price insurance on the basis of employee characteristics, they do not bear the additional cost of medical care for obese employees.

While obesity is easily observed by the employer, Bhattacharya and Bundorf (2005) concede that for less observable health characteristics, such as smoking and diabetes, the employer is unable to transfer the higher medical costs to the employee through lower wages. In this setting, therefore, the higher medical cost would be shared by the employer and employees.

To summarize, the health capital model predicts that the individual undertakes preventive care

to the point where the marginal benefit of the care equates to the cost. As the cost of prevention declines, the optimal level of preventive care increases. The choice in the level of health capital, however, affects employee's productivity at work and, thus, acts as a negative externality on the employer. The introduction of employer provided health insurance further increases the wedge of the externality by further reducing employee incentive to invest in health stock. Thus, the employer has an incentive to correct the externality by encouraging or mandating preventive care – to increase employee productivity and to reduce utilization of medical care.

Without addressing the issue of moral hazard, this dissertation examines the choice and utilization of a wellness program. Chapter 2 examines how employees choose among health plans with the wellness option. Since the wellness program reduces the time cost of engaging in preventive activities, all else equal, demand for the plan should be high. Despite an additional \$1,500 in incentives, enrollment in the health plan with wellness features has grown very slowly. The chapter explores two factors in this puzzle of plan choice: peer enrollment in Aetna Wellness, and family health.

The chapter extends the model developed in Abaluck and Gruber (2011) for choice of a health insurance plan. In the model, preferences is represented by a constant absolute risk aversion (CARA), where utility is a function of the cost if insurance. The costs are characterized by premium and out-of-pocket medical expenditure, as well as non-financial time costs described by the hassle associated with learning about and fulfilling requirements of the plan. Therefore as the cost of learning about the wellness plan declines, probability of enrollment should increase. Peer enrollment in the health plan with wellness acts to reduce the cost of learning, as the employee finds out about the effort required through the experiences of their peers. The *hassle* costs are also a function of the

health status of employee and family, which may affect their ability to fulfill the requirements of the wellness plan. The health status may also make wellness less salient to the employee.

Chapter 3 evaluates the changes in utilization occurring as a result of enrollment in the wellness program. As the wellness program reduces the cost of preventive care, the number of visits should increase. Since the aim of the program is to reduce event based hospitalizations and emergency room use, this chapter examines the evidence in the form of composition of medical expenditure and visits. The results confirm Russell (1986), while emergency and inpatient care decrease, they are more than offset by the rising cost of preventive care.

Reflecting the discussion by Kenkel (2000), however, the benefits of the greater preventive care may not materialize in the short or medium term. Since the panel used in the present analysis covers a 6 year period, its conclusions are limited to the short-term effect of preventive policy. Thus, the analysis will be limited to the utilization of medical care in terms of cost and visits. The long term health effects of preventive care cannot be gleaned from the present data, and will be left to future analysis.

The conclusions of this dissertation provide further evidence to update Kenkel (2000). Preventive care and lifestyle changes impose non-financial costs on employees. As Chapter 2 show, information is a major obstacle in the participation in the wellness plan. Coupled with the \$1,500 financial incentive for family enrollment, experience based learning about the wellness plan results in much higher enrollment. However enrollment in a wellness plan does not necessarily translate into participation. As Chapter 3 suggests, in the short and medium window, uptake in preventive care

is significant, but it is not matched by sufficient changes in use of emergent and inpatient hospital care. Since this dataset does not provide metrics of health behaviours, a longer time window would be required to see the effects of increased preventive care on health outcomes.

1.3 Federal Policy

Because wellness programs include financial incentives, these programs are regulated on the federal level. Before the passage of the Affordable Care Act (ACA), the most significant federal requirement was the Health Insurance Portability and Accountability Act (HIPAA) which regulated health care access, portability and renewability of health insurance, as well as set in place nondiscrimination provisions. Under HIPAA, an individual cannot be denied eligibility for benefits or charged more for group health coverage based on any health factor. However, wellness programs are exempt from this provision as long as the reward is based on an individual satisfying a standard related to a health factor and participation is made available to all similarly situated individuals (Mattke et al. 2013).

The ACA states that wellness programs may provide financial incentives for satisfying standards related to a health factor if the following requirements are met:

- The total reward of all the plan's wellness programs that require a satisfaction of a standard related to a health factor must not exceed 20% of the cost of employee-only coverage under

the plan. If dependents may participate in the wellness program, the reward must not exceed 20% of the cost of the coverage in which an employee and any dependent are enrolled.

- The program must be reasonably designed to promote health and prevent disease.
- The program must give individuals eligible to participate the opportunity to qualify for the reward at least once per year.
- The reward must be available to all similarly situated individuals. The program must allow a reasonable alternative standard for obtaining the reward to any individual for whom it is unreasonably difficult because of a medical condition, or medically inadvisable, to satisfy the initial standard.
- The plan must disclose all the materials describing the terms of the program and the availability of a reasonable alternative standard (Mattke et al. 2013).

The Affordable Care Act (ACA) raised the allowable incentive share to 30% of the cost of coverage in 2014, and provided federal discretion in raising the incentive share to up to 50%. Furthermore, ACA allows employers to charge tobacco users up to 50% more in premiums than nonusers, if they provide a smoking-cessation wellness program that would allow employees to eliminate the extra charge on the premium through participation.

Starting in 2018, the ACA will enact an excise tax, the "Cadillac" tax, of 40% on health insurance plans which cost more than \$10,200 for an individual and \$27,500 for a family, in 2018 dollars. These costs include both the employee and employer contribution toward the premium, and contributions to flexible spending accounts, health savings accounts, and health reimbursement accounts. A self-insured employer would be responsible for the tax associated with all costs exceeding the set limits. A 2011 Mercer survey of 2,844 public and private US employers found that 61% of those

companies surveyed said they would trigger the excise tax unless they took steps to reconfigure their benefit offerings (Health Affairs Brief, 2013).

To avoid the effect of this excise tax, employers are building into their health insurance plans features to reduce medical utilization, and to improve the lifestyle choices of employees. While higher deductible and coinsurance rates are a direct way of affecting utilization, many employers are turning to wellness programs to make employees aware of the health risks, and shift the care for chronic conditions from high-cost hospital stays to the lower-cost office visits. Since Aetna Wellness was introduced in 2008, prior to the passage of the ACA, the imposition of the tax did not motivate the choice or structure of the wellness program.

Finally, the risk assessment questionnaires included as part of wellness programs are usually administered by third parties. While Health Insurance Portability and Accountability Act (HIPAA) protects most health information, it exempts workplace wellness programs if they are part of the employment information. In particular, "The Privacy Rule does not prevent your supervisor, human resources worker or others from asking you for a doctor's note or other information about your health if your employer needs the information to administer sick leave, workers' compensation, wellness programs, or health insurance" (www.hhs.gov, 2014).

1.4 Health Plans

In 2008, when Aetna Wellness became available to employees at the university I study, there were 5 health insurance plans on offer. In addition to Aetna Wellness, employees could choose from the standard Aetna plan, Aetna 80/20 Plan, a newly introduced Aetna Health Savings Account plan, and a Third Plan. All the plans on offer have similar coinsurance rates, and differ primarily on the premium, deductible and network of physicians and hospitals. All the health plans used the same pharmacy coverage. Table 1 presents a summary of the features of the plans for a family in the year 2012.

The Aetna plan has a preferred provider organization structure. A member of the plan can choose any physician from the national Aetna network of physicians and hospital without the need to choose a primary care physician or any referrals. For physicians outside of the network, the insurance would apply the out of network coinsurance rate on the usual and customary amount for the locality and speciality of the doctor. All charges above and beyond the usual and customary were the responsibility of the patient. In 2008, the coinsurance rate was 90% for in-network, and 80% for out-of-network care. The copay for all in-network office visits was \$12. The plan had a deductible of \$150 for individual and \$300 for family coverage, in network, and \$400 and \$800 out of network respectively.

The Aetna 80/20 plan did not rely on a network of physicians. Instead, it covered 80% of all usual and customary expenses for medical care irrespective of network status For physicians who were members of the Aetna network, the plan paid 80% of the negotiated charges. For out-of-network

care, the patient was responsible for the remainder of the coinsurance, as well as any costs in excess of the usual and customary. Thus, compared to Aetna, Aetna 80/20 did not increase the freedom of choice nor decrease the patient financial liability for medical care. The deductible for the plan in 2008 was \$550 for an individual and \$1100 for a family.

While the Aetna 80/20 plan was available to all employees, it was used by the employer as a transition health insurance for retiring employees. Upon retirement, all employees were transitioned to Aetna 80/20, and could no longer choose another plan. If the employees was less than 65 years of age, that is, they chose early retirement, Aetna 80/20 was their primary health insurance policy. Once the retired employee reached the age of 65, Medicare would become their primary health insurance, and Aetna 80/20 remained their secondary insurance. As a result, employees intending to retire transition to the Aetna 80/20 in enrollment period prior to retirement. Employees not retired at the age of 65 retained full choice of health insurance plan, but have Medicare as the secondary provider of health insurance.

The Aetna Health Savings Plan was introduced in 2008, in parallel to Aetna Wellness. The Aetna HSA was a high deductible plan using the Aetna network of physicians and hospitals. The plan had a deductible of \$1100 for an individual and \$2200 for a family upon introduction. The employee could choose to contribute on a before-tax basis to the health savings account, and pay for medical expenses from these savings without annual time constraints. The health savings account could be invested using Aetna's banking partner, J.P. Morgan Chase, for balances of \$2000 or higher. The employer contributed \$500 to the health savings account in the year of introduction to build up the savings. As a result, the Aetna HSA was an attractive option for individuals and families with low medical utilization, who would furthermore benefit from tax-deferred investment vehicle.

The last plan available to employees, labeled as Third Plan here, provides comparable benefits to Aetna. It is a preferred provider organization, with a network of physicians and hospitals different from the Aetna. To compare the networks, I conducted a search of in-network physicians in the geographically concentrated area where the employer and employees reside. The resulting lists had similar number of physicians, suggesting that the networks overlapped substantially. In network, the Third Plan has the same coinsurance (90%) and copay rates, but out-of-network, the coinsurance rate is lower in this plan at 70%. Prior to the introduction of Aetna Wellness, the Third Plan had the lowest deductible and premium among all the plans. In 2012, the deductible for in-network medical care was \$150 for an individual and \$300 for a family. Throughout the panel years of this data, the Third Plan has the highest share of enrollment. In 2013, the employer discontinued the Third Plan. The employees enrolled in the plan were required to select a plan among the remaining plans. Though a default was not advertised widely, any employee that failed to select a plan would automatically be enrolled in the Aetna plan.

1.5 Aetna Wellness

Aetna Wellness was introduced to employees in 2008. During the enrollment period in November 2007, the benefit brochure features a letter from the Vice President of Human Resources, which introduced and described the new health plans available. The wording of the letter laid out explicitly the changes and requirements of Aetna Wellness.

The letter started by emphasizing that Aetna Wellness was introduced in addition to all existing

plans. Aetna Wellness was designed to "help [sic.] staff and faculty address concerns about well-ness [sic.]: Aetna Wellness helps support you in your effort to pursue a more healthful lifestyle" (Overview of Endowed Benefit Plans, 2007).

The brochure continues with an in-depth description of Aetna Wellness. Each page contains an inset with a summary of most important facts and features of the program. The description of the plan contains bullet point list of features and requirements:

- All family members who choose to enroll must pick a primary care physician (PCP) from a list on the enrollment site or the plan web site. The list of participating PCP's was limited in both number and geographically.
- The member and the enrolled family members would be given a web site to access in order to complete a health risk assessment questionnaire.
- The PCP will conduct an annual physical exam and set wellness goals for the year. The PCP will also refer the member to wellness programming to help achieve the wellness goals. With the referral, the member will receive discounted rates at participating resources.
- If the member has medical complication or needs special attention, the PCP will refer the member to local resources for expert help in wellness counseling.
- At the beginning of the following year the member and the PCP will review effort and re-set the goals for that year

The brochure goes on to emphasize that in other ways the plan works just like the other plans on offer. There is a network of physicians and specialists that is provided by the nationwide Aetna

network. The visits to the PCP which are not wellness-related are covered in the same way as with other plans, and no formal referral is needed to see a specialist.

The brochure concludes that if the employee is willing to commit to a wellness improvement plan, if he or she is willing to choose a primary care physician from a list of participating physicians, and if he or she is able to encourage the family members to engage in wellness improvement as well, then they would benefit from Aetna Wellness. In a table at the end of the introduction, the features of the plan and the associated copays are listed. The initial routine physical exam, review of the health risk assessment, and the development of the wellness plan are covered at full. A \$12 copay is associated with PCP referrals for further appointments, counseling, or therapy for wellness improvement. The available referrals are in health behaviour assessment, health risk assessment interpretation, nutrition therapy, medically supervised exercise, team conference, preventive medical counseling, diabetes education, smoking cessation, and stress management.

No penalty is mentioned for failure to complete the health risk assessment, or having a physical exam with the PCP. The financial benefits of Aetna Wellness - the lower premium, deductible, and out-of-pocket maximum - remain in effect independently of member's effort in the wellness plan. The brochure makes a side-by-side comparison of the health plans, allowing the employee to clearly see the lower plan premium, no deductible for in-network care, and lower out-of-pocket maximum at all levels of coverage. In other aspects, Aetna Wellness has identical settings as Aetna.

In 2013 the employer removed the PCP requirement from Aetna Wellness. The employee could still enroll in Aetna Wellness and take advantage of the close to \$1400 savings in premium and

deductible, but they were not required to select a primary care physician. However, if a PCP was not selected, the employee could not take advantage of the special discounts for gym membership and preventive services. The difference between Aetna Wellness and Aetna Enhanced Wellness is subtle. For example, Enhanced Wellness allows for more child well exams per year, removes the limit on number of visits for nutrition counseling, smoking cessation counseling, and alcohol/drug abuse counseling. This change coincides with the discontinuation of the Third Plan, and a resulting sharp increase in the enrollment of Aetna Wellness.

To the employer, the Aetna Wellness plan was associated with greater expense. The gym membership discount as well as the additional counseling incur additional costs to the health insurance plan. The risk assessment questionnaire is administered by a contracted party. Finally, the physical examination with the primary care physician is billed at a higher rate since the visit is contracted to be longer than the standard Aetna allocated office visit. Even before any selection and moral hazard associated with the particular features of the plan, Aetna Wellness is more expensive for the self-insured employer to operate.

1.6 Benefit Structure

All employees eligible for benefits are required to select a health insurance plan during the open enrollment period in November of each year. During the month, the employer provided brochures as well as information sessions for employees to make a selection from available plans. The employees were aware of the default option: if the employee did not make an official selection

of a health plan, they would remain enrolled in the current plan. With the exception of the 2013 discontinuation of the Third Plan, during the panel, an employee may have chosen to default in the same plan throughout the panel period.

New employees are required to choose a health insurance plan within the first 30 days of employment. For new employees, no default option exists. If the employee does not select a health insurance plan within that period, the employee will not be able to enroll in a plan until the following November enrollment period.

Figure 1 plots the out-of-pocket expenses for each plan as a function of total medical expenditure for a family in-network expenses in 2012. The total medical expenditure is on the horizontal axis, while the vertical axis plots the share of the total medical expenditure, including the premium and deductible, and the employee would have to pay. Three of the health insurance plans are plotted, with the Aetna Wellness represented by the blue line. As can be seen from the plot, at every level of medical expenditure, Aetna Wellness has the lowest out-of-pocket share of medical expenditure compared to the other plans. Since this includes both premium and deductible, Aetna Wellness is clearly the least expensive health plan among all the plans.

Figure 2 plots the difference in cost to employee between Aetna and Aetna Wellness for a family in 2012. The horizontal axis represents the years since introduction of Aetna Wellness. The vertical axis represents the difference in dollars between Aetna and Aetna Wellness. The lowest solid line is the difference between the Aetna deductible and Aetna Wellness deductible. The difference in deductible is positive and increases between 2009 and 2011. The dotted line is the difference in the

premium, which increases steadily. The top dashed line is the sum of the difference in the premium and deductible. Over time, as the difference between the deductible and premium, both, grow the overall cost difference in enrollment between Aetna and Aetna Wellness increases. At its peak, in 2012, the difference in cost between Aetna and Aetna Wellness is \$1550 for a family.

Despite the price difference, enrollment in Aetna Wellness was slow to grow. Table 2 lists the enrollment numbers for each plan across the years. In the year of introduction, 402 employees enrolled in Aetna Wellness. The enrollment grew slowly until 2011, when it increased by around 330 employees. The next largest increase occurred in 2013 when the Third Plan was discontinued. Looking at the enrollment in Aetna, its enrollment remains steady in the first two years after the introduction of Aetna Wellness, and declines only modestly prior to 2013. As the Third plan is discontinued, the enrollment in Aetna increases sharply as well.

The table also includes the enrollment for Aetna 80/20 and the Aetna HSA plan. Though the Aetna HSA plan included some incentives for enrollment, its premium was well above other plans, rendering this plan particularly unappealing to employees. As a result, it is not surprising that enrollment in the plan remained very low and did not grow over the years. Finally, the Aetna 80/20 enrollment remained constant throughout this period. In 2013, the enrollment in the plan was halted for non-retired employees, reflected in the decline in enrollment. Because of the idiosyncratic structure and low enrollment, both of these plans are generally excluded from subsequent analysis.

Figure 3 depicts the share of enrollment between Aetna Wellness, Aetna, and the Third Plan.

While enrollment in Aetna Wellness increases during the time period, enrollment in Aetna does not change much. Enrollment in the Third Plan declines substantially, suggesting that much of the switch into Aetna Wellness was from the Third Plan. This pattern is confirmed in Figure 4. It plots only the individuals who switched into Aetna Wellness from Aetna or Third Plan. Each bar represents the number of switchers as a share of their original plan. Thus, in 2008, around 6% of Aetna members and 4% of Third Plan member switched into Aetna Wellness. This number fell sharply in 2009 for both groups, though in subsequent years, the share of switchers grew slowly. Though the share of switchers from Third Plan seems to be smaller or comparable to Aetna, since the total number of enrollees was larger in the Third Plan it represents a larger number of switchers.

1.7 Preview of Results

In the chapters that follow, Aetna Wellness is analyzed from the point of view of plan selection and utilization. The aim of the chapters is to study the factors in the selection of Aetna Wellness by employees, and to characterize the subsequent utilization of the plan.

In Chapter 2 of this dissertation I study the choice of health insurance following the introduction of Aetna Wellness. More than half of US employers offer a wellness plan as part of benefits to employees in hopes of reducing the total cost of health insurance. While it was priced much lower than its non-wellness counterparts, the majority of employees actively chose away from Aetna Wellness. If employees consider the wellness features as a cost, and do not use them, the intended cost savings will not materialize. The paper looks at two factors in this decision: the effect of peer

choices and family health status on plan choice. I compare two identical plans – Aetna Wellness and Aetna, and focus on a subsample consisting of new employees.

I find that peer choices affect own choice of health insurance: a 10 percentage point rise in peer enrollment in Aetna Wellness increases the probability of own enrollment in the plan by 1.4 to 3.7 percentage points. I use the Charlson index, and an index of medical resource utilization intensity generated by the ACG software developed at Johns Hopkins University to measure family health status. A 1 point rise in the Charlson index leads to up to 4 percentage point decline in probability of enrollment in Aetna Wellness. The index captures employees with more severe health conditions. A 1 point rise in the resource utilization band, which captures more routine medical utilization, results in up to 8 percentage point rise in probability of enrollment. The results suggest that an effective information campaign of the benefits of a wellness program could potentially increase the employee participation and improve long term outcomes of the plan. The program, however, does not appeal to employees and families with severe medical conditions which might benefit most from regular outpatient care.

Chapter 3 shifts attention to the medical services utilization in Aetna Wellness. As the increasing prevalence of chronic health conditions is pushing health insurance costs up, Aetna Wellness is intended to encourage a change in lifestyle and use of medical care. I study medical expenditure and utilization following the introduction of Aetna Wellness. The analysis uses propensity score matching to compare employees who switch into Aetna Wellness to those who do not.

The results show that while overall medical expenditure may be increasing, the composition of

the expenditure and utilization changes. Aetna Wellness members use the emergency room less (9 percentage points less likely of a mean of 29%). On the other hand, the number of preventive visits increases (by more than 30%) as does the total outpatient expenditure (up to \$776). The results suggest that while the wellness program by this employer does not affect the overall expenditure, employees are engaging in more preventive care.

Table 1.1: Plan Comparison for a Family, All Plans 2012

	Aetna Wellness	Aetna	Third	HSA	Aetna 80/20
Premium	3515	4555	3828	3615	6133
Deductible					
<i>In Network</i>	0	500	300	2400	1100
<i>Out of Network</i>	800	900	900	4800	1100
Out of Pocket Maximum					
<i>In Network</i>	4000	4100	4100	5000	7100
<i>Out of Network</i>	7000	7100	7100	7000	7100
Coinsurance					
<i>In Network</i>	90	90	90	90	80
<i>Out of Network</i>	80	80	70	80	80
Network	Aetna	Aetna	PHCS	Aetna	Aetna
Must choose PCP	Yes	No	No	No	No
Enhanced Wellness Program	Yes	No	No	No	No

Figure 1.1: Out of Pocket Medical Expenditure for Family in 2012

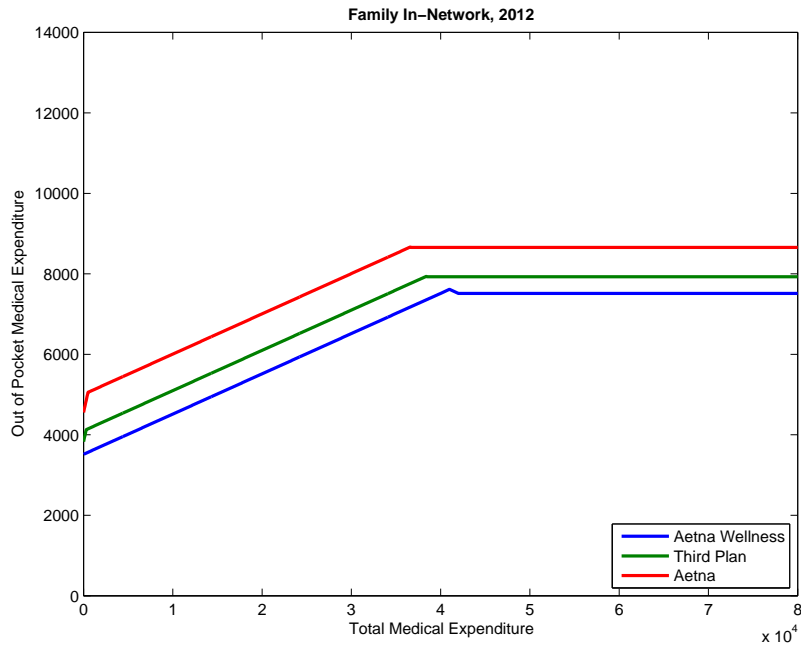


Figure 1.2: Aetna v. Aetna Wellness: Cost difference for a family in 2012.

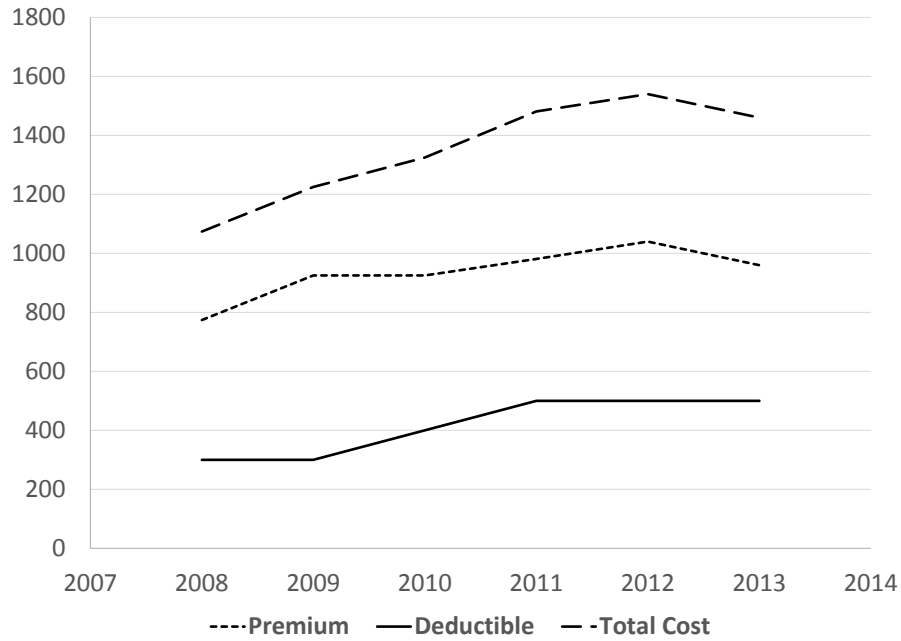


Table 1.2: Enrollment across years by numbers

	Aetna Well	Aetna	Aetna 80/20	Third	HSA
2007	.	763	205	2529	.
2008	402	982	287	3370	12
2009	619	920	265	3215	15
2010	857	819	241	2756	14
2011	1196	807	218	2451	18
2012	1462	778	216	2202	15
2013	2621	1017	152	.	26

Figure 1.3: Enrollment in Plans, 2007-2012

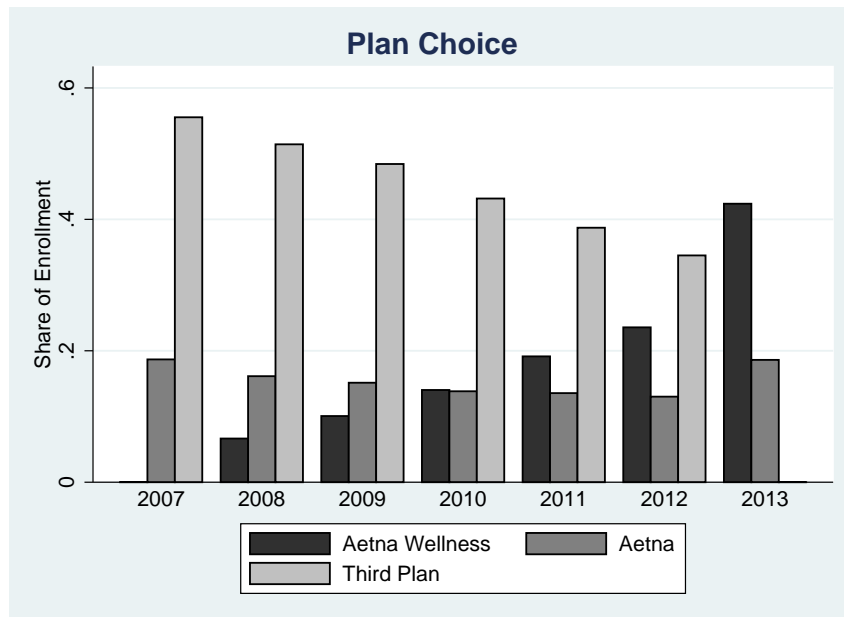
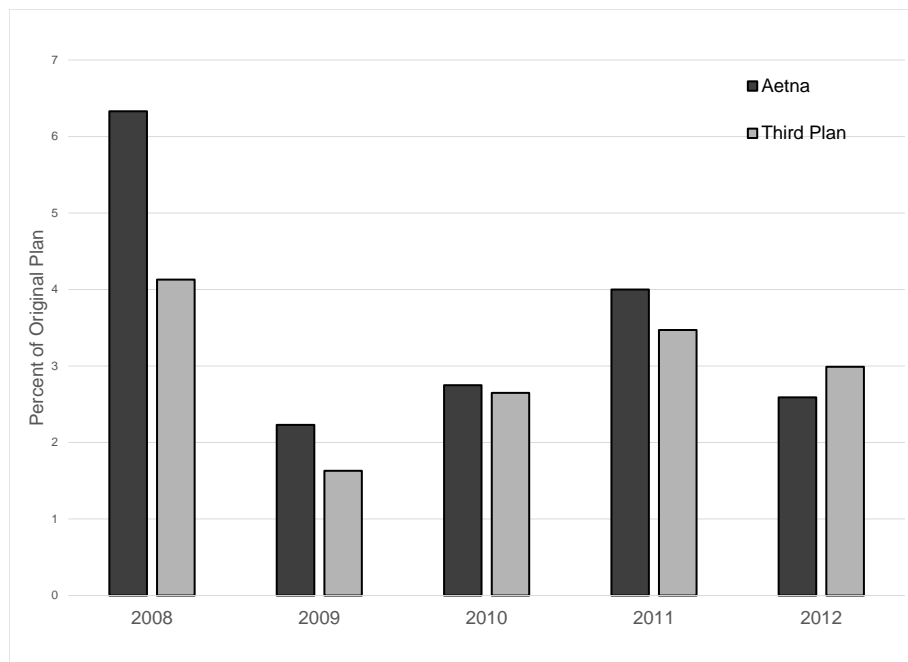


Figure 1.4: Switching into Aetna Wellness



CHAPTER 2

THE HASSLE OF WELLNESS: DO PEERS AND HEALTH STATUS MATTER?

2.1 Introduction

The recent RAND Employer Survey showed that approximately half of surveyed employers offer a wellness program to its employees. These programs are driven mainly by expectations of slowing growth of medical and insurance costs for the employer, as well as responding to a substantial tax incentive provided by the Affordable Care Act (ACA) of 2009. A wellness program can include a set of screening tools, such as a health risk assessment questionnaire (HRA), as well as interventions, such as nutritional and smoking-cessation counseling, a disease management program (diabetes, heart disease, chronic lung disorders, depression, cancer). The program structure can offer rewards, such as gym discounts, incentives for screening and participation in the programs, or be punitive, such as higher insurance rates for smokers. These wellness programs appear to be a benefit, but evidence suggests that there is substantial employee resistance to it.

Is the resistance to wellness programs driven by lack of experience with the program and its benefits? Or is it driven by genuine disutility from the features of the program? The RAND report cites that 72% of employers offering wellness plans offer screening and intervention based programs, and 31% administer it through their health insurance plan. However, only 46% of employees undergo the screening, and less than a fifth choose to participate in the interventions. In this paper, I study the effect of the introduction of an optional wellness plan on the health insurance

plan choice by employees of a large self-insured university. The analysis will focus particularly on two factors affecting choice: peer choices and own/family health on choice of health plan with wellness features. The data used for this estimation is uniquely suited for this study. First, the data tracks the introduction of a health insurance plan with wellness plan in parallel to and on the basis of an existing plan. This allows me to compare two near identical plans to isolate the effect of the wellness features on plan choice. Second, the data allows me to limit my analysis to a subsample of new employees, eliminating the bias introduced by switching costs and simultaneity of peer choices. Finally, the availability of claims data for employees allows me to define objective measures of employee and family health.

While on their own the wellness plans appear simply to be an under appreciated employment benefit, as part of the Affordable Care Act they are a policy tool to transform the way individuals utilize medical resources. As the managed care experience of the 1990's and 2000's suggested, patients want to remain in control of their health care. As the *New York Times* article of May 27, 2013 notes, to slow the growth of medical expenditures, employers are increasingly turning to wellness programs to make the employee an informed patient. The wellness program is intended to make the individual aware of their health risks, to improve the maintenance of existing health conditions, and to engage them in preventive care. Since the employee is the primary gatekeeper of the flow of health services, if the employee resist the wellness program, then it is unlikely to generate the expected behavioural changes. As the wellness programs become more prevalent, the success of the programs depend on overcoming this resistance. If the resistance is due to the genuine disutility from the features of the program, it can be overcome with greater financial incentives being directed at the employee. If, however, the resistance is due to perception and lack of information, it can be overcome with improved employee education about the true benefits and burdens of the program.

In 2008, a large self-insured university introduced a new plan, Aetna Wellness, as part of its health insurance benefits menu. Aetna Wellness, was derived from, and offered simultaneously with an identical Aetna plan. To encourage enrollment, the employer priced Aetna Wellness below all other plans on offer: lower premium, lower deductible, and lower annual out-of-pocket maximum. The plan had the same coinsurance rate, copay, and physician, hospital, and pharmacy networks as Aetna. Unlike Aetna, however, Aetna Wellness required its members to complete a health risk assessment questionnaire, and select a primary care physician (PCP). The PCP would review the questionnaire, schedule a physical examination, and develop a set of health goals for the employee to follow during the year. The employee and family did not need referral from the PCP for specialist care, and the PCP did not act as a gatekeeper of care in any way. Since Aetna Wellness was offered in parallel with Aetna, it was an optional choice.

Despite the large financial incentive and the increased choice set, the majority of employees did not choose Aetna Wellness in its first year of introduction. In the years that followed, many employees continued to actively choose away from the wellness plan. Most astonishingly, however, Aetna members switched in very low numbers. That is, those who had the closest comparison and the lowest cost of switching were less likely to switch to the new plan.

The aim of this paper is to explore two factors in this choice puzzle. I will estimate the effect of peer choices on own choice of health plan. Peers can affect the choice of health plan by helping the employee to overcome the informational barriers to choice. If health insurance is a reputation good, then learning about the experiences with and perceptions of the Aetna Wellness plan by peers can motivate the employee to choose for or against it. As defined by Satterthwaite (1979), a reputation good is any product or service for which seller's products are differentiated and con-

sumers' search among sellers consist of a series of inquiries to relatives, friends, and associates for recommendations. Instead of relying on plan menu brochure, employees rely on colleagues for evaluation of plan features and quality.

Second, I look at the role of health in the choice of health insurance. Employees and families with a greater number of health conditions may have direct disutility from a wellness plan. The disutility may stem from a lack of salience for the word "Wellness". Though the plan brochure emphasized the advisability of the plan for employees with health conditions, these employees may perceive the plan as intended for maintaining good health. Furthermore, less healthy employees and families may be averse to additional doctors' visits and testing.

Health insurance choice has become an important policy topic in recent years, as seen by the introduction of Medicare Part D and the expansion of coverage through the Affordable Care Act. The research in this field, however, has been constrained by a lack of data. As more data have become available in recent years, economists and epidemiologists alike have been able to estimate key components of choice of insurance.

The outcomes and utilization of wellness programs have been studied outside of economics. Osilla et al. (2012) conduct a systemic review of the worksite wellness program and find little to moderate gains in medical expenditure. Most of the studies they site, however, do not correct for selection into the program, or have a short follow-up period. Economic studies of wellness programs find temporary gains of modest magnitude, such as weight loss incentives offered by an employer or gym membership incentives (Cawley and Price, 2011; Royer, Stehr, and Sydnor,

2012).

While the utilization is the main motivator for employer adoption of wellness program, employee choices are not always optimal. Choices which appear suboptimal have been studied in consumer goods (Shum 2004, Dube et al. 2008), and financial decisions (Madrian and Shea 2001, Barseghyan et al. 2011). However, most pertinent to the present project is choice inconsistencies in health insurance (Handel 2011, Abaluck and Gruber 2011, Heiss et al. 2012, Kling et al. 2012, Ketcham et al. 2012). In this context, Handel (2011) and Abaluck and Gruber (2011) have shown that switching costs and inability to compare the plan features accounts for a substantial part of choices.

Handel (2011) considers plan choices in a setting similar to the one used here. An employer introduces a new health insurance structure forcing all employees to make new choices. Identifying from the variance in choice between those forced to choose a new plan, and those who can rely on the default plan, Handel estimates switching costs of up to \$2,000 for a family. The plans in the comparison differ in their coinsurance rates, making the counterfactual analysis difficult. To avoid this, Handel estimates a full structural model of plan choice, with risk aversion coefficients. The data used in this project circumvents the issue of switching costs and the counterfactual. It compares two near identical plans, which have identical coinsurance rates, removing the problem of the counterfactual. To avoid switching costs, this paper uses two subsamples: new employees and employees whose previous plan was discontinued.

Abaluck and Gruber (2011) study the choice of Medicare Part D plan choices by the elderly. As

the elderly parse through sometimes up to 40 different plans, Abaluck and Gruber note that they are unable to often compare the features of the plans. As a result, the authors estimate that approximately 30% of the choices in the sample were suboptimal, the result of excessive importance placed on the premium, and insufficient importance placed on the variance reducing features of the plans. I will be using the model described by Abaluck and Gruber as the starting point for the choice model.

Health insurance choice is subject to informational asymmetries, which have been studied since Akerloff (1970) and Rothschild and Stiglitz (1976) first formulated the market failure. In recent years, however, health insurance data has become increasingly available, allowing more accurate measurement of the magnitude of these effects. Among these, Einav, Finkelstein, Cullen (2010) and Einav et al. (2013) have used employee data from the aluminum manufacturer Alcoa to estimate the magnitudes and particularities in the effect of moral hazard and adverse selection. Einav, Finkelstein, Cullen (2010) find that the magnitude of adverse selection in their data is modest. In Einav et al. (2013), they go a step further to find evidence of selection in moral hazard in plan choice. In the present research, since Aetna and Aetna Wellness do not differ on the margin, moral hazard should be the same.

Finally, this paper relates to the literature on managed care. The introduction of primary care physician requirements and health risk questionnaires may have generated employee pushback associated with managed care. The experience and literature on managed care is summarized by Glied (2000) in a chapter of *Handbook of Health Economics*.

The contribution of this paper is threefold. First, I compare near identical plans to isolate the effect of wellness features on plan choice as it operates through peer effects and family health. This identification allows me to overcome the endogenous characteristic of choice, and attribute the difference in choice to preferences over wellness features of the plan.

Second, I am able to limit my analysis to a subsample consisting of new employees and employees whose health insurance plan was discontinued. As Handel (2011), switching costs are a significant barrier to optimal plan choice. By using this subsample, I eliminate the impact of switching costs on plan choice.

Finally, in addition to the health plan choice, the dataset includes every claim filed by the employee and family. The claims allow me to create an objective measure of health on the basis of diagnostic and pharmacy codes. To assess health status and predict future health resource utilization, I use ACG software developed by The School of Public Health at Johns Hopkins University.

The Affordable Care Act, combined with the changes to Medicaid have made health insurance choices by working age adults an essential component of policy outcomes. However, much of the literature uses Medicare data to analyze plan choice and utilization. The data used in this paper was obtained from a large employer, which, though not nationally representative, allows insight into the decisions by a part of the population affected by the ACA.

The remainder of this paper will proceed as follows. In Section 2 will introduce the health plans and compare their features. In Section 3 will introduce the data. Here, I will discuss the results

derived with the ACG software and definition of peer effects. Section 4 will introduce the model and discuss identification. Results will be presented and discussed in Section 5. Section 6 will conclude.

Health Plans

In 2008, in cooperation with the local area physicians, the employer introduced Aetna Wellness to the health insurance menu on offer to its employees. Aetna Wellness was derived from and offered simultaneously with the Aetna PPO plan. The aim of the Aetna Wellness plan was to include the primary physician more actively in the preventive health care for the member, to identify and treat health risks before they evolve into costly hospitalizations. The plan was also designed to encourage healthier lifestyle by offering discounts to the gym, counseling for obesity, smoking cessation, and stress management. To achieve these goals, the enrollees were required to choose a primary care physician (PCP) and complete a health risk assessment questionnaire. On the basis of the questionnaire, the PCP would conduct an annual physical examination. Beyond the initial examination, the PCP did not act as a gatekeeper for the health plan as the member could use any specialist services without referrals.

The employer designed the financial characteristics of Aetna Wellness to be comparable with and more appealing than existing plans. Table 1 presents a side-by-side comparison of all health insurance choices for a family in 2012. Compared to the Aetna plan, Aetna Wellness had the same coinsurance rate, the same network of physicians, hospitals, and pharmacies, and no refer-

rals were necessary for specialist visits. Aetna Wellness was better than Aetna because it had a lower premium, deductible, and annual out of pocket maximum across the years, and it offered health services such as discounted gym membership. However, upon enrollment in Aetna Wellness, the employee was required to select a primary care physician (PCP), and complete a health risk assessment questionnaire. These features constitute the additional non-monetary cost of Aetna Wellness.

The Aetna plan offers the closest comparison to Aetna Wellness, and the analysis will focus on the trade-off between these two plans. The Third Plan, however, was offered in parallel to both and had features similar to both plans. Compared to the Third Plan, Aetna Wellness had the same in-network coinsurance rate. Aetna Wellness had a lower premium, deductible, and annual out of pocket maximum (with the exception of 2008-2009 period). The Third Plan had a different network of physicians and a different out-of-network coinsurance. The Third Plan is of interest in our comparison because in 2013 it was discontinued, forcing its members to make a new choice. As such, this group of employees is a desirable subsample to study since the absence switching costs for them removes status quo bias.

Before proceeding, I would like to discuss the remaining two plans on offer to employees: the Health Savings Account (HSA) and the Aetna 80/20 account. The HSA was a high deductible plan, though it was initially introduced at a premium comparable to Aetna Wellness, by 2012 its premium was higher. Furthermore, the HSA account acted as a tax deferred investment mechanism, and thus was very different from the other health insurance plans on offer. As such, enrollment in the plan has been very low. The Aetna 80/20 plan was designed for retired and retiring employees, and it was intended primarily as supplemental insurance to Medicare. Enrollment in Aetna 80/20

was halted in 2013, and it is no longer in the menu of plans. When compared to Aetna Wellness, in every year both the in- and out-of-network coinsurance rates in Aetna 80/20 have been the same or worse.

Table 2 presents the enrollment in each plan across the years. As the HSA plan had very low enrollment, I drop it from all subsequent analysis. The Aetna 80/20 plan has substantial enrollment the vast majority of the enrollment is by retirees and pre-retirees. Nonetheless, I will include the Aetna 80/20 plan in some of the multinomial analysis of plan choice. From the other columns of Table 2, the Third Plan outstrips all other plans in enrollment, while Aetna Wellness and Aetna have comparable enrollments. A closer inspection reveals that the rise in enrollment in Aetna Wellness is matched closely by a decline in the Third Plan. Over this time period, enrollment in Aetna changes by comparatively little.

To explore this further, I compare the share of enrollment between Aetna Wellness, Aetna, and the Third Plan. Figure 1 describes the share of each of the three plans across time. The Third Plan is by far the most popular plan until its closure in 2013. However, as seen in Table 2, the growth in employee share of Aetna Wellness is due to a decline in Third Plan. The Aetna share of employment remains mostly unchanged throughout the years.

Aetna Wellness was priced to be attractive to employees, and the foregone savings from choosing Aetna are substantial. Figure 2 shows the difference in cost to the employee between Aetna Wellness and Aetna over time. The bottom line represents the cost difference between the Aetna and Aetna Wellness in deductible. The middle line represents the difference in premium. The

top line is the sum of premium and deductible. Since Aetna Wellness has a lower premium and deductible compared to Aetna in all years, the difference is always positive and growing over the years. Therefore, the incentive to switch from Aetna to Aetna Wellness increased over the years. By 2012, an employee choosing Aetna would see close to \$1500 in foregone savings as a result of their plan choice.

Upon its introduction in 2008, and in subsequent years, the benefits brochures provided by the employer highlighted the benefits of Aetna Wellness. The extensive introduction to the plan highlighted that it is a "great plan for faculty and staff members who want to pursue a wellness track to get and stay healthy". The brochure emphasized that regardless of current health, Aetna Wellness would help improve health. The requirements of the plan were listed on the first page: "All family members who choose to enroll in this plan, including children, must pick a primary care physician (PCP). You (and your enrolled family members) will be given a Web site to access in order to fill out a health risk assessment." The benefits of the program are listed in the same section, with referred services ranging from nutrition therapy to medically supervised exercise. In later pages, the Aetna Wellness plan structure is listed in an easy-to-read breakdown of services, allowing comparison to other plans on the menu.

Despite the favourable introduction and pricing of Aetna Wellness, enrollment increased unexpectedly slowly. Not only were employees choosing to remain with their previous plan, but Aetna members were choosing to actively again switching. Figure 3 tracks the switchers into Aetna Wellness by their plan of origin across time. Each bar represents switchers from Aetna or Third Plan as share of their original plan. Thus, in the initial year, a little over 6% of Aetna members switched into Aetna Wellness. The share declined sharply in 2009 and later years. While it appears

that switchers from the Third Plan have a comparable switching behaviour to Aetna members, it helps to keep in mind that the Third Plan had many more members, and thus each bar represents a much larger number of employees. Combined with the previous figures and tables, this figure highlights that Aetna members, who have the lowest cost of switching and the closest comparison to the Aetna Wellness plan are most reluctant to switch.

Thus, while Aetna Wellness was priced and designed to be salient and accessible to all, employee choices suggest that preferences over the characteristics of the plan are not homogeneous. To some, the costs of the plans are more prominent than its benefits. In the following section, I look at the characteristics of members in the plans. Are those who enroll in Aetna Wellness different from the member of the other plans?

Data

A large self-insured northeastern university granted me exclusive access to the health insurance plan choices and subsequent utilization of its employees between 2007 and 2013. The sample includes both salaried and hourly employees in academic, administrative, and union job types. All the employees in the sample are active, which excludes retired, on-leave, and suspended employees. Since the department of the employee is an important component of the estimation, all employees with missing department are excluded from the sample. While dependents are included in the raw data, all analysis is conducted on the family level, as the employee makes the decisions about plan types. The resulting sample consists of 13,450 employees tracked across an average 4.2

years. Of these employees, 9,632 enroll in a health plan at some point during the panel years.

Each November, during the open enrollment period, the employee selected among the five health insurance plans described in the previous section. These employees can choose to remain in their original plan or switch to another health plan. If the employee does not take action, their original health plan is continued into the following year. Because of this default option, any estimates using the total sample will suffer from *status quo* bias associated with switching costs.

To circumvent the problem of switching costs, I use two subsamples of employees. The first group are new employees. During this period, 4,716 new employees were hired by the university. To identify the effect of Aetna Wellness on plan choice, the preferred subsample is 1,771 new employees who select one of the available health insurance plans. I designate as a new any employee who started employment in mid-year after the open enrollment period for the current period, and before the following year's enrollment period. In the first month of employment, the employee was required to select a health insurance plan. If they did not select a plan, they received no health coverage until the next open enrollment period. The combination of no previous plan and no default option makes the new employees the ideal subsample for studying the choice of plans. While many of the results will be based on this sample, the sample size is an impediment to estimate precision. To supplement these results, I use a second subsample of employees.

In 2013 the Third Plan was discontinued and employees enrolled in the plan were required to select from the remaining three choices: Aetna Wellness, Aetna, and the HSA. While the letter of introduction and plan documentation stresses the requirement to choose a new plan, the Frequently

Asked Questions notes that if the employee does not take action, they will be moved to the Aetna plan. Thus, like new employees, this subsample does not suffer from *status quo* bias; however, unlike new employees, they have a default option. Employer records show, however, that very few of the Third Plan member from 2012 defaulted into Aetna in 2013. Nonetheless, though very small, the results may be affected by this small share of the defaults.

To estimate the effect of health and peers on plan choice, I need to define measures of each. To define the health status of the employee and family, I make use of the available claims data, and generate three measures of health. The first, the Charlson Comorbidity Index, is an index which predicts the 10 year mortality of a patient who may have a range of comorbid conditions from a total of 22. Each condition is assigned a score 1, 2, 3 or 6 depending on the risk of dying associated with each one. For example, a score of 1 is assigned to myocardial infarct, congestive heart failure, peripheral vascular disease, dementia, cerebrovascular disease, chronic lung disease, connective tissue disease, ulcer, chronic liver disease. A score of 2 is assigned to hemiplegia, moderate or severe kidney disease, diabetes, diabetes with complication, tumor, leukemia, lymphoma. The maximum score is 16, and a higher score is associated with greater morbidity. The score is assigned on the basis of medical claims. The family health index is the sum of the Charlson index for the employee and dependents. In this sample 79% of families have a Charlson score of 0. Since the index is heavily skewed, it measures the plan selection on the more severe range of health conditions spectrum. To capture the middle of the health distribution, I use software developed at the Johns Hopkins University School of Public Health. This software is becoming increasingly used in economic analysis of health insurance utilization, such as by Handel (2011).

The Johns Hopkins ACG[®] software uses diagnostic codes from claims and case-mix methodol-

ogy to describe and predict population past or future health care utilization and costs. The Adjusted Clinical Groups (ACG) are a series of mutually exclusive health status categories defined by morbidity, age, and sex. They are based on the premise that the level of resources necessary for delivering appropriate healthcare to a population is correlated with the illness burden of that population. Thus, individual diseases or conditions are placed into diagnostic groups based on five clinical dimensions: duration of condition, severity of condition, diagnostic certainty, etiology of the condition (infectious, injury, other), and specialty care involvement. The software allows me to generate two measures of individual health: medical utilization intensity, predicted total cost band. The medical utilization intensity categorizes the individual according to current health services utilization:

- 0 - No diagnoses available
- 1 - Healthy Users
- 2 - Low Users
- 3 - Moderate Users
- 4 - High Users
- 5 - Very High Users

For the family, the individual medical utilization indices are summed. In the result, only 25% of the employees have a family score of 0, and the scores are well distributed in the healthy to low user range.

The software predicts individual total medical cost in the next year by generating predicted total cost bands. By taking the median of the band, and summing across family members, I generate a continuous measure of medical expenditure for the family for the next year. The average predicted annual medical expenditure in the sample is \$11,550, while the median is \$6,250. As expected, the distribution of this measure has a long right tail.

Since the data includes all employees, I can identify the department group for each employee. Using this grouping, I can generate the share of each health plan in the department of the employee. The share of plan j in individual i 's department at time t is defined as:

$$Peer_{ijt} = \frac{\sum_{l=1}^{D_{it}} \mathbb{1}\{Plan_{lit} = j\}}{D_{it}}$$

where D_{it} is the number of employees in i 's department at time t , and $Plan_{lit}$ is the plan enrolled by employee l in i 's department at time t . The peer measure could be further refined by additionally separating the peer group by job family (faculty vs. administrative). The data does not lend itself to such refinement, since some department are entirely administrative, while others have only a handful of administrative staff, making peer groups too small for analysis.

In defining peer effects thus, I recognize that the peer group of the employee is not exogenously determined. As employees are involved in the hiring decision of the department, the composition of the department is not random. As a result, the estimates here do not identify the causation of peer choices on employee plan choice. I will interpret the coefficient as associations between the peer group and individual choices.

Table 3 provides summary statistics for the entire sample. Compared to Aetna members, more

young female employees join Aetna Wellness. Consistent with the youth of Aetna Wellness members, they tend to have lower earnings compared to Aetna. The comparison of health shows that compared to other plans, Aetna Wellness members and families are healthier, and the predicted total cost for them is lower. Aetna Wellness members also appear to have a lower medical utilization intensity, as well as a lower predicted total medical cost than other plan members.

The summary statistics for new employees are presented in Table 4. The pattern is similar among new employees. Aetna Wellness members tend to be younger compared to other plans, and they earn significantly less than Aetna members. Based on the subsequent utilization, Aetna Wellness families are healthier and are less intense users of medical services.

The summary statistics suggest that Aetna Wellness members are healthier. Furthermore, the consistency of the pattern of choice between Aetna Wellness and Aetna among all employees and new employees suggest that peer suggestions play an important role. In the next section I discuss the model of plan choice which informs the estimations which follow.

Model

When describing the plan choice decision of the individual employee, I am constrained by similarity of Aetna Wellness and Aetna. In particular, since the co-insurance and copay are the same for both plans across the year for in-network and out-of-network visits, on the margin, demand for

medical services is the same for both plans. This lack of variability does not allow for identification of a risk aversion coefficient. As a result, a model such as the one defined by Handel (2011) cannot be estimated using the data on hand.

The model presented here will inform the reduced form analysis by describing the mechanisms through which health and peer effects operate. I will use a variation of the Abaluck and Gruber (2011) model.

The employee i is choosing among plans using a constant absolute risk aversion (CARA) utility for plan j at time t :

$$U(C_{ijt}) = -\exp(-\gamma(W_{ijt} - C_{ijt})) \text{ where } C_{ijt} \sim N(\mu, \sigma^2) \quad (2.1)$$

Here, W_{ijt} is wealth and C_{ijt} is cost of insurance. Insurance costs are characterized by P_{jt} , premium, and M_{it} , medical expenditure, and hassle associated with satisfying plan requirement and learning about plan features, H_{ijt} .

$$H_{ijt} = f(F_{jt}, Peers_{it}, h_{it}, \eta_t) \text{ where } \eta_t \sim N(\mathbb{H}, \sigma_\eta^2) \quad (2.2)$$

$$C_{ijt} = P_{jt} + \kappa M_{it} + H_{ijt} \mathbb{1}\{I_{it} \neq I_{it-1}\} \quad (2.3)$$

The hassle of a plan can be affected by the plan features, peer group of the employee, and their own/family health. Plan features, F_{jt} , include choice of primary care physician (PCP) and completion of health risk questionnaire. Deviating from usual definition of peer effect, I assume that

the peers inform the employee about the real burdens and benefits of the plan features. The peer effect is captured by $Peers_{it}$, and it is a vector of shares of peers in insurance plans. h_{it} is the health status of employee/family. I hypothesize that there are three avenues through which employees and families with worse health have a higher cost to learning about health plans. First, having a more regular relationship with a physician, they may be reluctant to experience changes to that relationship. Second, they may be weary of additional medical visits and testing, even if the testing will result in improved medical care. Third, they might perceive that a plan with emphasis on wellness is not designed with their needs in mind. I am unable to differentiate between these three avenues of effects.

Following the first order Taylor expansion of indirect utility, I derive the conditional logit model of plan choice, where the utility of individual i from plan j is given by:

$$u_{ijt} = \alpha + \delta_0 P_{jt} + \delta_1 E[M_{ijt}] + Peers_{it} \delta_2 + \delta_3 h_{it} + \delta_4 F_{jt} + x_{it} \lambda + \epsilon_{ijt} \quad (2.4)$$

where x_{it} is a vector of individual characteristics, $E[M_{it}]$ is the expected medical expenditure for individual i . To estimate the peer and health effects on plan choice, the coefficients of interest are δ_2 and δ_3 .

The identification of the peer and health effects has challenges. First, peer effects are recognized in literature to have two problems. Reflectivity of peer choices occurs when a causality loop exists, where friends affect each other's choice, biasing estimates upwards. By using the new employees as my preferred sample I break the causality loop. Because new employees make health insurance choices after the traditional enrollment period, the choices of existing employee cannot

be affected by new employees. Another problem associated with peer effects is that peer groups tend to be endogenous to individual characteristics. While I cannot overcome this problem in the current context, compared to peer groups of friends, department peers tend to have fewer common unobservable factors.

The second challenge to identification is the endogeneity of plan choice. The endogeneity arises when the individual choice of plan is affected by the unobservable characteristics. The endogeneity results in a different pattern of utilization of health services. To overcome the endogeneity I compare near identical plans. Aetna and Aetna Wellness have the coinsurance rates and physician networks, so that I can confidently assume that the counterfactual and actual expenditure between the two plans would be identical. Since, controlling for financial attributes, the only difference between Aetna Wellness and Aetna is the wellness features, the unobservable characteristics which determine the choice between two plans reveal preferences over wellness features. Thus, peers and health affect plan choice operate through individual preferences on the wellness features.

Results

Before proceeding with the estimation of the model, I need to determine the selection occurring when looking at the sample of employees who choose insurance. To do this, I will estimate the following binary choice model of insurance enrollment:

$$Pr(Insurance) = \alpha_0 + x_{it}\alpha_1 + Peer_{it}\alpha_2 + \alpha_3h_{it} + year + \epsilon_{it} \quad (2.5)$$

where x_{it} is a vector of individual characteristics, $Peers_t$ is a vector of shares of peers in insurance plans, h_t is the health status of employee/family. The analysis will be conducted for both the entire sample, the subsample of employees with discontinued insurance, and the sample of new employees.

The regression results are presented in Table 5. The first column of the table lists the coefficient estimates for the entire sample. Overall, it appears that the total sample has substantial selection occurring. The second column are the estimates for employees whose plan was discontinued. The last column are the estimates for the new employees. Here, while some selection does occur, it is smaller and less significant. This is further evidence that the sample of new employees is best suited to estimate the model.

Pairwise Comparison

The analysis will begin with pairwise comparisons between Aetna Wellness and Aetna, and then Aetna Wellness and the Third Plan. In the next section, a multinomial analysis will allow the integration of the entire choice set of employees. To estimate the binary choice relationship between Aetna Wellness and the other plan of comparison, I adapt the model equation (4) and define the probability of choice as:

$$Pr(AetnaWellness) = \alpha + Peers_{jt}\delta_2 + \delta_3h_{it} + \delta_0P_{jt} + \delta_1E[M_{it}] + x_{it}\lambda + \epsilon_{ijt} \quad (2.6)$$

where $E[M_{it}]$ is the expected medical expenditure for the household. To estimate the effect of health on plan choice, I will be using h_{it} and $E[M_{it}]$, as measured by the Charlson index, the

resource utilization bands, and the predicted total costs. In particular, the ACG software generated predicted total costs allows me to match the expected medical expenditure component of the model closely.

Table 6 presents the results of the linear probability of choosing Aetna Wellness for the total sample. The model is estimated using the various measures of health: medical resource utilization intensity (columns (1) and (2)), predicted total cost (columns (3) and (4)), and the Charlson index of comorbidities (columns (5) and (6)). The coefficients on interest are peer effect Aetna Wellness and the measures of health. Since the peer effect is defined as the share of the department, it ranges from 0 to 1. Therefore, the coefficient in column (2) can be interpreted as a 10 percentage points rise in the Aetna Wellness enrollment in department increases own probability of enrolling in Aetna Wellness by 2.2 percentage points. The health effect differs by the measures used. The probability of enrolling in Aetna Wellness increases 1 pp with a point rise in the resource utilization, and declines 2 pp with a point rise in the Charlson index.

Table 7 repeats the analysis for the subsample of employees with discontinued insurance. Here, once again, each column represents a separate regression with one of the three measures of health. Peer effect is significant, with a 10 pp rise in peer enrollment increasing own enrollment in Aetna Wellness by 1.7 pp. While the effect of health is similar in magnitude and direction as in Table 6, the estimates are not significant at conventional levels.

The estimates for the sample of new employees confirms the same trends in Table 6, however the sample size sharply increases the standard errors resulting in lost statistical significance. The peer

effect of Aetna Wellness enrollment is 1.0 pp, and a point rise in the Charlson index decreases the probability of enrollment by 4 pp.

The model is next estimated as a logistic regression. Table 9 presents the results for the total sample. A 10 pp rise in peer enrollment in Aetna Wellness increases own probability of enrollment between 2.4 and 2.6 pp. A one point rise in the intensity of medical utilization increases the probability of enrollment by 1 percentage point a point rise in the Charlson index decreases the probability by 2 pp. For employees with discontinued insurance, in Table 10, the peer effect is between 1.8 and 1.9 pp, while the Charlson index decreases the probability by 2 pp.

The preferred specification is presented in Table 11, limiting the sample of new employees. As the sample size declines sharply, the increased noise of the standard errors does not allow for reliable statistical inference, however, the magnitude and direction of the effect remain consistent with the previous results. A 10 percentage point rise in the peer enrollment in Aetna Wellness increases own probability of enrollment between 0.9 and 1.0 percentage points. While the intensity of medical utilization does not affect probability of enrollment in this sample, the Charlson index does. A 1 point rise in the severity of medical conditions is associated with a 4 pp decrease in probability of enrollment.

I next compare Aetna Wellness and the Third Plan. The comparison in this case is not as close. The Third Plan had a different network, and a different coinsurance rate on the out-of-network medical services compared to Aetna Wellness. A cursory comparison of the networks in the geographical area of the employer, however, yields only small differences between the networks.

Since the Third Plan was discontinued in 2013, all analysis here is limited to pre-2013 sample, and therefore precludes the subsample used in the previous comparison.

Table 12 contains the estimates of a linear probability of choice of Aetna Wellness compared to the Third Plan. The peer effect is similar in magnitude and sign to the previous analysis, with a 10 pp rise in peer enrollment in Aetna Wellness increasing own probability of enrollment between 2.3 pp and 2.5 pp. A one point rise in the intensity of medical resource utilization and the Charlson index lead to a 1pp decline in probability of enrollment. Table 13 present the estimates for the subsample of new employees, and the results are near identical to the comparison between Aetna Wellness and Aetna.

The results of the logit specification are in Table 14 and 15. As before, the dependent variable is the probability of choosing Aetna Wellness, when faced with the choice with the Third Plan. The peer effect has similar magnitude and sign, with a 10 pp rise in the peer enrollment in Aetna Wellness increasing own probability of enrollment by 2.6 to 2.8 pp. The probability declines by 1 pp for a one point rise in the medical utilization intensity, and declines by 2 pp for a point rise in the Charlson index.

Extended Choice Set

The pairwise comparison of the health plans, however, assumes independence among the alternatives. If this assumption does not hold, then the relevant choice set are all health plan options faced by the employee. In this section, I will re-estimate the model using a multinomial logit specification and a mixed logit specification.

A multinomial logit model is used when the regressors are individual specific. The probability of choosing Aetna Wellness from the choice set is defined as:

$$p_{ij} = \frac{\exp(x_i' \beta_j)}{\sum_{l=1}^m \exp(x_i' \beta_l)} \quad (2.7)$$

where x_i are the individual specific regressors, and $j = \{\text{plan choice set}\}$. To ensure identification β_j is set to zero for one of the categories, though the average marginal effect can be estimated for all categories.

In the section describing the plans, I described the Aetna 80/20 plan which was intended for pre-retirees and retirees. In the first multinomial logit, I will consider the choice set including the Aetna 80/20 plan. Thus, in Table 16, the choice set is $j = \{\text{Aetna Wellness, Aetna, Aetna 80/20, Third Plan}\}$. Because of this definition of the choice set, the analysis is limited to 2007-2012 time period, and excludes the subsample of employees with discontinued plan. Aetna Wellness is the base category in all regressions, but the second, fourth, and sixth column present the marginal effects of the regressors on the probability of choosing Aetna Wellness only. The estimates for peer effect and health are quantitatively and qualitatively identical to the previous results. However, looking at the coefficient for Aetna 80/20, I see large standard

errors and small coefficients, which is due to the very small sample of employees enrolled in the plan. In the following regression, presented in Table 17, I drop Aetna 80/20 from consideration and add no insurance, and my coefficients are largely unchanged for the probability of choice of Aetna Wellness.

In Table 18, I estimate the multinomial logit model for new employees. The choice set is $j = \{\text{Aetna Wellness, Aetna, Third Plan, and no insurance}\}$, and the addition of no insurance to the choice set has a significant impact on both peer and health effect. Peer effects range from 1.3 pp to 2.5 pp in this estimate, depending on which measure of health is used. A \$1,000 rise in the predicted total future medical cost increases the probability of enrolling in the plan by 9 pp. Given that the sample used here includes all new employees who chose not to have insurance, the changes in estimates can be attributed to this choice.

While the multinomial logit allows a comparison of a wider choice set, it makes use of the observed choices of employees. It does not incorporate the attributes of the alternatives in the choice sets, and limits regressors to the employee characteristics. In this dataset, however, I have more complete information about the characteristics of all the alternatives in the choice set. To take advantage of this information, I use a mixed logit specification, described as alternative specific conditional logit in Stata. Expanding on McFadden (1973), Cameron and Trivedi (2010) describe the alternative specific conditional logit as combining both plan characteristics and individual attributes, defining the probability of choice of plan j :

$$p_{ij} = \frac{\exp(z'_{ij}\beta + x'_i\gamma_j)}{\sum_{l=1}^m \exp(z'_{il}\beta + x'_i\gamma_l)} \quad (2.8)$$

where

$$j = \{\text{plan choice set}\}$$

$$z_{ij} = \{\text{premium, deductible, peer effects}\}$$

$$x'_i = \{\text{demographics, family health}\}$$

I estimate the mixed logit using the alternative specific conditional logit command in Stata[®].

Table 19 presents the results from the mixed logit regression with the choice set of Aetna Wellness, Aetna, Third Plan, and no plan. In this table, each section divided by a line is a separate regression specification. The columns, as before, separate the results by sample. The first two columns reflect the estimates for the total sample, while the last two columns limit the sample of new employees. Only the coefficient of interest are listed from each regression. The marginal effects are calculated manually, and the significance can be judged by the coefficient. Looking at the second and fourth column, the peer effect for Aetna Wellness is somewhat larger from the previous estimates, ranging from 4.4 pp for the first specification to 5.9 pp in the last specification. While the health measures have changed in magnitude as well, the results are unreliable as the coefficients are not significantly different from zero. Table 20 repeats the analysis for the choice set faced by the employees with discontinued insurance, that is Aetna Wellness, Aetna, and no insurance. The coefficients are similar in magnitude and sign.

Robustness of Results

In all of the above estimates, I estimate the contemporaneous peer effects. For new employees this is particularly appropriate since when choosing among plans, they would discuss their current

experiences with their colleagues. How would the estimates change if the peer effect was introduced with a lag? Table 21 has the estimates from the regression with lagged peer effects for new employees. The lagged peer effects are not significant for in any of the specifications, confirming that the new employees indeed rely on the current experiences of their colleagues.

Does the reliance on peer experiences change in the years after the introduction of the Wellness plan? Table 22 estimates the logit model of comparison between Aetna Wellness and Aetna, including a peer and time interaction. The first two columns present the results for the entire sample, while the last two focus on the sample of new employees. In the second and fourth columns I have estimates the marginal effects of the individual peer-year interactions on the probability of enrolling in Aetna Wellness. In the total sample, the peer effect is at 7.0 pp in 2008, the first year of introduction, and steadily declines to 2.2 pp by 2012. For the sample of new employees, a similar decline can be seen, though the large standard errors do not allow me to rely on the result. These suggest that as the Wellness plan becomes better known, the value of peer feedback or information declines.

Finally, a falsification test will allow me to rule out spurious peer effects. To check the robustness of peer effects, I have randomly assigned the peer group to the employee. The estimates of the logit model are presented in Table 23. As expected, all the coefficients are close to zero and insignificant for both total and new employee sample. This confirms that the estimates seen in the previous tables are not spurious.

Conclusions and Policy Implications

This paper studies the introduction of a wellness program as an optional part of health insurance. Many employers and insurers are turning to wellness programs as a means of slowing the rising costs of health insurance by making the patient more mindful of their health and medical services utilization. While many employers introduce these programs as a mandatory part of all insurance, I study the program in the voluntary context.

Aetna Wellness was introduced by a large self-insured employer to its health insurance options. Aetna Wellness was based on and introduced in parallel to an existing Aetna plan. Despite lower premium and deductible, employees actively chose plans other than Aetna Wellness. I look at two factors affecting the choice between Aetna Wellness and Aetna: peer choices and family health. To measure the effect of peer choices, I count the share of employee's department enrolled in each plan. To measure the family health status, I use three measures: the Charlson index of comorbidities uses medical claims to isolate the presence of 22 severe medical conditions, and rates them according to mortality; the Johns Hopkins ACG software allows me to generate two measures of medical service utilization on the basis of medical and pharmaceutical claims, by age and gender. The resource utilization bands measure the current intensity of medical utilization by individual. The predicted total cost range reflects the expected medical costs the individual.

Since Aetna Wellness and Aetna differ only on the wellness program, I ascribe the choice to preferences over it. I use two subsamples to avoid the choice bias introduced by switching costs: new employees, and employees whose health plan was discontinued in 2013. I find that a 10 pp

rise in the peer enrollment in Aetna Wellness increases own probability of enrollment between 0.9 pp to 5.9 pp. Family health status has a different effect depending on the measure used. Using the resource utilization band, which has a more even distribution across employees, I find that a 1 point rise in the index increases the probability of enrollment in Aetna Wellness up to 3 pp. When using the Charlson family index, which has a skewed distribution towards the more severe medical conditions, I find that a 1 point rise in the index reduces the probability of enrollment in Aetna Wellness up to 5 pp. For every \$1,000 increase in the predicted medical expenditure, the probability of enrollment increases by 9 pp.

The results suggest that lack of information and experience about the wellness features is a major impediment in the adoption of the program. As the program is increasingly implemented by employers, state and regional governments, the effectiveness will increase if employees are better informed about the true costs and benefits of the program, for example, the Virginia Wellness Is Now (WIN).

The results also suggest that those who join the program tend to be generally healthier, but heavy users of medical services. The resource utilization band, which has a wider distribution among all employees, suggests that Wellness members are not the non-users – they are light to medium users of medical services. However, as the Charlson index shows, those with more severe permanent medical conditions tend to avoid the Wellness program. A more effective program would reach those with more severe permanent medical conditions.

2.2 Appendix

The sample used in the dissertation tracks 13,450 employees across an average 4.2 years. Of those employees 9,632 employees enroll in one of the health insurance plans during some period of the panel. The remaining 29% of employees choose not to enroll in health insurance. These employees may be on spousal health insurance, though this cannot be ascertained due to lack of data.

During the length of the panel 4,716 employees were hired. A new employee is defined as an employee who started employment during the panel year. This implies that the new employee did not participate in the benefit selection during the open enrollment period. A new employee becomes a non-new employee on January 1 of the calendar year following the date of hire.

Of 4,716 new employees, 1,771 select one of the available health insurance plans. The remaining 2,918 (about 62.09%) do not select a plan, which is much higher than the rate of no-insurance selection among non-new employees. To better understand the sample of new employees who do not select health insurance, I look at their composition.

Among the 2,918 new employees who do not select health insurance, 787 have only one year of observation in all the years of the sample. These may have been temporary or seasonal employees. These employees are much more likely not to select health insurance or have alternative insurance. Of new employees with 2 or more years of observations, 2,141 did not select health insurance (about 57.22% of new employees with 2 or more years of employment) in the first year

of employment.

Since the data is administrative, the high rate of no insurance plan could be due to choice of employee or poor quality of data entry. To test this hypothesis, I look at the rate of health insurance choice in their second year of employment by new employees. Of 3,662 new employees in their second year of employment 2,106 select a health insurance plan (57.71%), while 1,556 (42.59%) do not select a health insurance plan.

There are 12,420 non-new employees in the sample, of which 9,565 select insurance, while 4,698 have no insurance in some year during the length of the panel. Thus, among the non-new employees, approximately 21.94% of the sample does not choose insurance. Comparing the new employees to non-new employees, in the initial year of employment, new employees are around 36 percentage points (or about 2.5 times) more likely not to enroll in health insurance. In their second year of employment, new employees are 21 percentage points (or about 2 times) more likely not to enroll in health insurance.

Thus, new employees who do not select health insurance are substantially different from those who do select health insurance. This suggests that the missing insurance information in the data is not a data entry error, since such error would yield a more randomized assignment of insurance status. The high rate of no insurance in the second year of employment further supports this conclusion, as it suggests that the choice is often consistent year after year.

Table 25 shows the summary statistics for the new employees by insurance status and employment

type. Among the long term employees, those with no insurance tend to be younger, with fewer dependents than those with insurance. This sample contains fewer females, and a larger share of academic employees, who earn a lower wage. Temporary employees display a similar trend, though a much higher share has no insurance. Uninsured and insured employees differ most in their job type. 85% of the uninsured have an academic job, while only 50% of the insured are in that job type.

Table 26 presents the estimates of a linear probability model of insurance enrollment. The dependent variable is a dummy which is 1 when the observation is enrolled in insurance. The coefficient on the dummy for new employees suggests that they are 19 percentage points less likely to enroll in health insurance. This is consistent with the comparison of raw averages in the second year of employment, and suggests that most of the difference in the insurance enrollment between new and existing employees can be explained by the characteristics of new employees.

The number of dependents affects the choice to enroll in health insurance as well. With the omitted category as no dependents, employees with 1 or more dependents are more likely to take up insurance. When interacting the number of dependents with gender, this relationship is weakened. Female employees are less likely to take up insurance if they have dependants. Thus, a female employee with one dependent is 10 percentage points less likely to enroll in insurance than a male employee with one dependent, suggesting that spousal health insurance is a major reason for lack of insurance among female employees.

While new employees appear to be much more likely to not enroll in health insurance, some of the

difference can be explained by their characteristics. This tendency not to enroll in health insurance continues in their second year of employment, suggesting that the enrollment data in the first year is not spuriously missing.

Table 2.1: Plan Comparison for a Family, All Plans 2012

	Aetna Wellness	Aetna	Third	HSA	Aetna 80/20
Premium	3515	4555	3828	3615	6133
Deductible					
<i>In Network</i>	0	500	300	2400	1100
<i>Out of Network</i>	800	900	900	4800	1100
Out of Pocket Maximum					
<i>In Network</i>	4000	4100	4100	5000	7100
<i>Out of Network</i>	7000	7100	7100	7000	7100
Coinsurance					
<i>In Network</i>	90	90	90	90	80
<i>Out of Network</i>	80	80	70	80	80
Network	Aetna	Aetna	PHCS	Aetna	Aetna
Must choose PCP	Yes	No	No	No	No
Enhanced Wellness Program	Yes	No	No	No	No

Table 2.2: Enrollment across years by numbers

	Aetna Well	Aetna	Aetna 80/20	Third	HSA
2007	.	971	269	3166	.
2008	445	1091	308	3748	16
2009	680	1004	301	3527	17
2010	959	909	257	3051	18
2011	1324	887	236	2719	22
2012	1647	859	229	2428	18
2013	2621	1017	152	.	26

Figure 2.1: Enrollment in Plans, 2007-2012

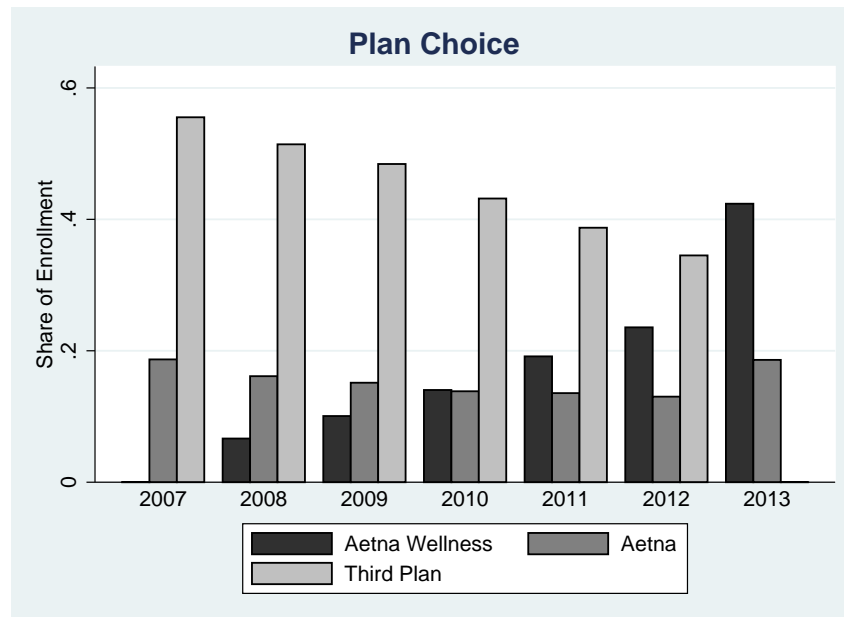


Table 2.3: Summary Statistics

	Aetna Wellness	Aetna	Third Plan	All
Age	43.52 (11.72)	47.60 (11.83)	45.29 (11.42)	46.30 (13.91)
Female	.56 (.49)	.44 (.50)	.51 (.50)	.50 (.50)
No. of dependents	1.13 (1.30)	1.25 (1.30)	1.27 (1.27)	.91 (1.09)
Salary	64166 (46992)	84224 (56193)	59126 (34056)	63201 (41901)
Past Medical Expenditure	9188 (19373)	11054 (17392)	8815 (14028)	6959 (13372)
Charlson Index	.27 (.77)	.39 (.88)	.32 (.64)	.34 (.71)
Medical Utilization Intensity	3.67 (1.70)	4.62 (2.46)	4.86 (2.56)	3.24 (2.55)
Predicted Total Medical Cost (1000's)	10.45 (9.92)	16.44 (16.94)	15.82 (15.34)	11.24 (12.67)
Gym Membership	.09 (.27)	.18 (.35)	.18 (.36)	.15 (.32)
Aetna Wellness Share in Dept.	.25 (.16)	.14 (.14)	.10 (.08)	.14 (.11)
n	3770	2374	5375	13450

Figure 2.2: Aetna v. Aetna Wellness: Cost Difference

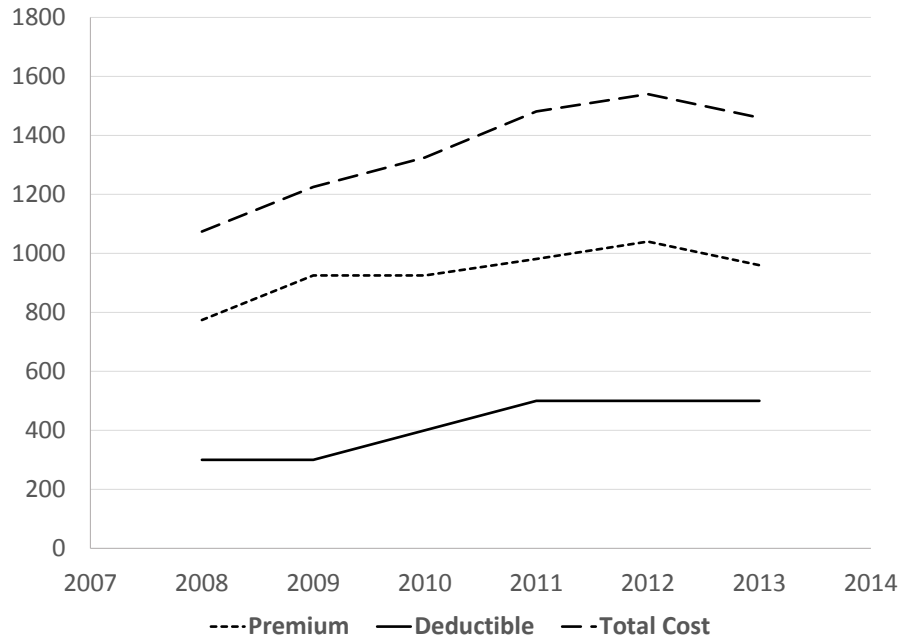


Table 2.4: Summary Statistics: New Employees

	Aetna Wellness	Aetna	No Insurance	All
Age	35.24 (9.50)	37.22 (9.66)	35.77 (9.82)	36.37 (11.18)
Female	.47 (.50)	.45 (.50)	.40 (.49)	.44 (.49)
No. of dependents	.40 (.85)	.55 (1.08)	.05 (.34)	.21 (.66)
Salary	57253 (39530)	75472 (60887)	45952 (30138)	50970 (36664)
Medical Expenditure	3443 (9689)	5846 (22697)		1419 (7736)
Charlson Index	.09 (.40)	.28 (1.04)		.14 (.62)
Medical Utilization Intensity	2.93 (2.12)	3.64 (2.82)		1.22 (2.13)
Predicted Total Medical Cost (1000's)	6.81 (8.49)	10.98 (21.56)		4.32 (8.75)
Gym Membership	.02 (.13)	.11 (.30)	.09 (.30)	.07 (.24)
Aetna Wellness Share in Dept.	.19 (.16)	.11 (.13)		.11 (.14)
n	756	284	2862	4603

Figure 2.3: Switching into Aetna Wellness

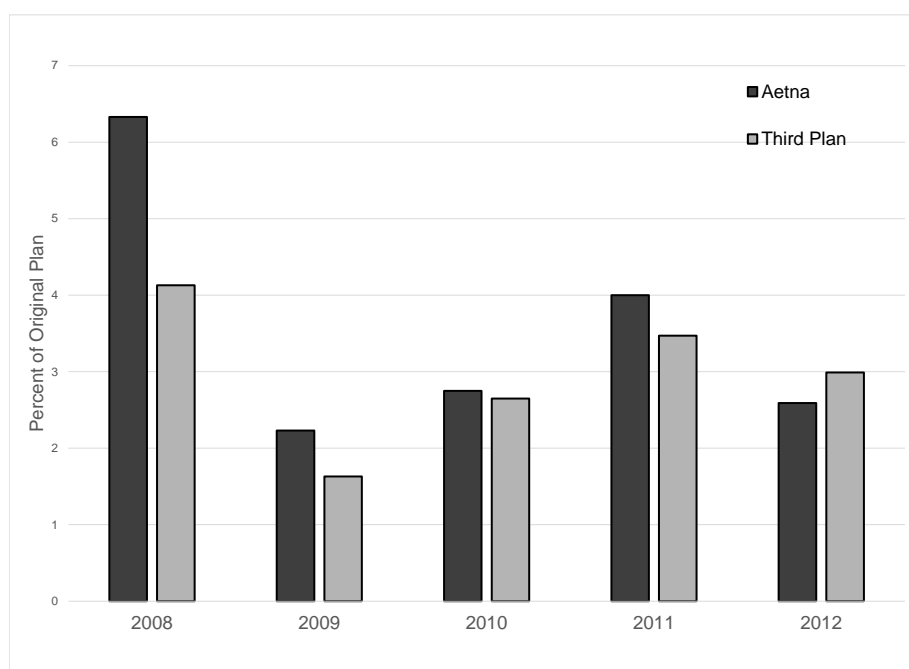


Table 2.5: Linear probability model of insurance take up.

	(1) All Employees	(2) Discontinued Plan	(3) New Employees
Age	.00*** (.00)	.00*** (.00)	-.00*** (.00)
Female	.04*** (.01)	.03*** (.01)	.08*** (.01)
No. of Dependents	.01*** (.00)	.03*** (.00)	-.06*** (.01)
Salary	.04*** (.00)	.05*** (.00)	.03* (.01)
Peer Effect Aetna Wellness	-.01 (.02)	.04 (.03)	-.03 (.06)
Peer Effect Aetna	-.05 (.02)	.01 (.05)	.08 (.07)
Peer Effect Third	.02 (.02)	-.87 (1.13)	-.05 (.04)
Medical Utilization Intensity	.05*** (.00)	-.04*** (.00)	.16*** (.00)
Const	.08* (.04)	.32*** (.04)	.01 (.13)
Year Fixed Effects	Yes	No	Yes
Dep. Var. Mean	.80	.93	.50
N	48913	2513	3169
r ²	.22	.23	.50

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 2.6: Linear probability model of choice between Aetna Wellness and Aetna for total sample.

	(1)	(2)	(3)	(4)	(5)	(6)
Peer Effect Aetna	-.29*** (.05)	-.14** (.05)	-.30*** (.05)	-.14** (.05)	-.25*** (.05)	-.13* (.06)
Peer Effect Aetna Wellness	.81*** (.03)	.22*** (.04)	.82*** (.03)	.23*** (.04)	.84*** (.03)	.24*** (.04)
Medical Utilization Intensity	-.02*** (.00)	.01** (.00)				
Predicted Total Cost			-.00*** (.00)	-.00 (.00)		
Charlson Index					-.04*** (.01)	-.02* (.01)
Past Med Exp						.02*** (.00)
ln(Cost)		-.25*** (.01)		-.25*** (.01)		-.24*** (.01)
Age		-.01*** (.00)		-.01*** (.00)		-.00*** (.00)
Female		.07*** (.01)		.07*** (.01)		.09*** (.02)
No. of Dependents		.12*** (.01)		.12*** (.01)		.11*** (.01)
Salary		-.03*** (.01)		-.03*** (.01)		-.03** (.01)
Const	.47*** (.02)	2.60*** (.11)	.44*** (.01)	2.60*** (.11)	.40*** (.01)	2.24*** (.12)
Year Fixed Effects	No	Yes	No	Yes	No	Yes
Dep. Var. Mean	.53	.58	.53	.58	.53	.55
N	15551	13815	15551	13815	13909	11901
r^2	.11	.24	.11	.24	.11	.24

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 2.7: Linear probability model of choice between Aetna Wellness and Aetna for subsample of employees with discontinued insurance.

	(1)	(2)	(3)
Peer Effect Aetna	-.09 (.12)	-.08 (.12)	-.08 (.12)
Peer Effect Aetna Wellness	.17* (.08)	.17* (.08)	.17* (.08)
Medical Utilization Intensity	.01 (.01)		
Predicted Total Cost		.00 (.00)	
Charlson Index			-.01 (.01)
ln(Cost)	-.21*** (.02)	-.21*** (.02)	-.21*** (.02)
Age	.00 (.00)	.00 (.00)	.00 (.00)
Female	.09*** (.02)	.09*** (.02)	.09*** (.02)
No. of Dependents	.12*** (.01)	.12*** (.01)	.12*** (.01)
Salary	-.00 (.01)	-.00 (.01)	-.00 (.01)
Const	1.98*** (.17)	2.00*** (.17)	1.99*** (.17)
Year Fixed Effects	No	No	No
Dep. Var. Mean	.71	.71	.71
N	1542	1542	1542
r^2	.09	.09	.09

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.
Standard errors clustered at individual level.

Table 2.8: Linear probability model of choice between Aetna Wellness and Aetna for new employees.

	(1)	(2)	(3)
Peer Effect Aetna	-.02 (.12)	-.02 (.12)	-.00 (.12)
Peer Effect Aetna Wellness	.10 (.09)	.10 (.09)	.11 (.09)
Medical Utilization Intensity	.00 (.01)		
Predicted Total Cost		-.00 (.00)	
Charlson Index			-.04 (.03)
ln(Cost)	-.34*** (.03)	-.33*** (.03)	-.34*** (.03)
Age	-.00 (.00)	-.00 (.00)	-.00 (.00)
Female	-.04 (.03)	-.04 (.03)	-.04 (.03)
No. of Dependents	.25*** (.03)	.25*** (.02)	.25*** (.02)
Salary	-.13*** (.03)	-.13*** (.03)	-.13*** (.03)
Const	4.22*** (.31)	4.20*** (.31)	4.18*** (.31)
Year Fixed Effects	Yes	Yes	Yes
Dep. Var. Mean	.80	.80	.80
N	881	881	871
r^2	.21	.21	.22

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.
Standard errors clustered at individual level.

Table 2.9: Logit marginal effect on choice between Aetna Wellness and Aetna with total sample.

	(1)		(2)		(3)	
	Coeff.	Marg.	Coeff.	Marg.	Coeff.	Marg.
Peer Effect Aetna	-.74** (.28)	-.14** (.05)	-.72** (.28)	-.13** (.05)	-.68* (.29)	-.13* (.05)
Peer Effect Aetna Wellness	1.32*** (.22)	.24*** (.04)	1.34*** (.22)	.25*** (.04)	1.39*** (.23)	.26*** (.04)
Medical Utilization Intensity	.04** (.01)	.01** (.00)				
Predicted Total Cost			-.00 (.00)	-.00 (.00)		
Charlson Index					-.09* (.04)	-.02* (.01)
Past Medical Exp.					.09*** (.02)	.02*** (.00)
ln(Cost)	-1.30*** (.06)	-.24*** (.01)	-1.28*** (.06)	-.24*** (.01)	-1.23*** (.06)	-.23*** (.01)
Age	-.03*** (.00)	-.01*** (.00)	-.03*** (.00)	-.01*** (.00)	-.02*** (.00)	-.00*** (.00)
Female	.36*** (.08)	.07*** (.01)	.37*** (.08)	.07*** (.01)	.45*** (.08)	.08*** (.01)
No. of Dependents	.59*** (.05)	.11*** (.01)	.63*** (.05)	.12*** (.01)	.56*** (.05)	.11*** (.01)
Salary	-.19*** (.05)	-.04*** (.01)	-.19*** (.05)	-.04*** (.01)	-.15** (.05)	-.03** (.01)
Const	11.01*** (.66)		10.95*** (.66)		9.08*** (.69)	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Dep. Var. Mean		.58		.58		.55
N	13815	13815	13815	13815	11901	11901

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 2.10: Logit marginal effect on choice between Aetna Wellness and Aetna for employees with discontinued insurance.

	(1)		(2)		(3)	
	Coeff.	Marg.	Coeff.	Marg.	Coeff.	Marg.
Peer Effect Aetna	-.50 (.63)	-.09 (.12)	-.48 (.63)	-.09 (.12)	-.50 (.64)	-.09 (.12)
Peer Effect Aetna Wellness	.97* (.43)	.18* (.08)	1.00* (.43)	.19* (.08)	1.03* (.43)	.19* (.08)
Medical Utilization Intensity	.06 (.07)	.01 (.01)				
Predicted Total Cost			.01 (.01)	.00 (.00)		
Charlson Index					-.10 (.07)	-.02 (.01)
Past Medical Exp.					.14** (.05)	.03** (.01)
ln(Cost)	-1.09*** (.10)	-.20*** (.02)	-1.09*** (.10)	-.20*** (.02)	-1.11*** (.11)	-.21*** (.02)
Age	.00 (.01)	.00 (.00)	.00 (.01)	.00 (.00)	.00 (.01)	.00 (.00)
Female	.46*** (.12)	.08*** (.02)	.46*** (.12)	.09*** (.02)	.45*** (.12)	.08*** (.02)
No. of Dependents	.68*** (.08)	.13*** (.01)	.67*** (.08)	.12*** (.01)	.64*** (.08)	.12*** (.01)
Salary	-.02 (.06)	-.00 (.01)	-.02 (.06)	-.00 (.01)	-.02 (.06)	-.00 (.01)
Const	7.67*** (.93)		7.79*** (.93)		6.92*** (.97)	
Year Fixed Effects	No	No	No	No	No	No
mean		.71		.71		.71
N	1542	1542	1542	1542	1537	1537

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 2.11: Logit marginal effect on choice between Aetna Wellness and Aetna for new employees.

	(1)		(2)		(3)	
	Coeff.	Marg.	Coeff.	Marg.	Coeff.	Marg.
Peer Effect Aetna	-.35 (.90)	-.04 (.11)	-.35 (.90)	-.04 (.11)	-.24 (.92)	-.03 (.11)
Peer Effect Aetna Wellness	.81 (.82)	.10 (.10)	.82 (.82)	.10 (.10)	.77 (.83)	.09 (.10)
Medical Utilization Intensity	.01 (.05)	.00 (.01)				
Predicted Total Cost			-.00 (.01)	-.00 (.00)		
Charlson Index					-.33 (.17)	-.04* (.02)
Med. Expenditure					.15* (.07)	.02* (.01)
ln(Cost)	-2.26*** (.23)	-.28*** (.02)	-2.26*** (.23)	-.28*** (.02)	-2.30*** (.23)	-.28*** (.02)
Age	.00 (.01)	.00 (.00)	.00 (.01)	.00 (.00)	.00 (.01)	.00 (.00)
Female	-.29 (.20)	-.04 (.02)	-.29 (.20)	-.04 (.02)	-.29 (.20)	-.04 (.02)
No. of Dependents	1.94*** (.27)	.24*** (.03)	1.95*** (.27)	.24*** (.03)	1.92*** (.27)	.24*** (.03)
Salary	-1.04*** (.21)	-.13*** (.02)	-1.04*** (.21)	-.13*** (.02)	-1.03*** (.21)	-.13*** (.02)
Const	26.49*** (2.76)		26.41*** (2.77)		25.61*** (2.79)	
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Dep. Var. Mean		.80		.80		.80
N	881	881	881	881	870	870

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 2.12: Linear probability model of choice between Aetna Wellness and Third Plan for all employees.

	(1)	(2)	(3)
Peer Effect Third Plan	-.30*** (.03)	-.30*** (.03)	-.25*** (.03)
Peer Effect Aetna Wellness	.23*** (.03)	.23*** (.03)	.25*** (.03)
Medical Utilization Intensity	.00 (.00)		
Predicted Total Cost		.00 (.00)	
Charlson Index			-.01* (.00)
Past Med Exp			.01*** (.00)
ln(Cost)	-.10*** (.01)	-.10*** (.01)	-.08*** (.01)
Age	-.00*** (.00)	-.00*** (.00)	-.00*** (.00)
Female	.03*** (.01)	.03*** (.01)	.05*** (.01)
No. of Dependents	.02*** (.01)	.02*** (.00)	.02*** (.00)
Salary	.06*** (.01)	.06*** (.01)	.07*** (.01)
Const	.43*** (.09)	.43*** (.09)	.10 (.09)
Year Fixed Effects	Yes	Yes	Yes
Dep. Var. Mean	.33	.33	.31
N	23942	23942	21441
r^2	.34	.34	.37

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 2.13: Linear probability model of choice between Aetna Wellness and Third Plan for new employees.

	(1)	(2)	(3)
Peer Effect Third Plan	-.15 (.08)	-.15 (.08)	-.18* (.08)
Peer Effect Aetna Wellness	.18 (.10)	.18 (.10)	.17 (.10)
Medical Utilization Intensity	-.01* (.01)		
Predicted Total Cost		-.00 (.00)	
Charlson Index			-.01 (.03)
ln(Cost)	-.13*** (.03)	-.13*** (.03)	-.13*** (.03)
Age	-.00 (.00)	-.00 (.00)	-.00 (.00)
Female	-.05* (.03)	-.05* (.03)	-.04 (.03)
No. of Dependents	.07** (.03)	.06* (.03)	.05* (.03)
Salary	.11*** (.03)	.11*** (.03)	.11*** (.03)
Const	.24 (.34)	.20 (.34)	.19 (.35)
Year Fixed Effects	Yes	Yes	Yes
Dep. Var. Mean	.71	.71	.71
N	986	986	975
r^2	.27	.27	.27

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.
Standard errors clustered at individual level.

Table 2.14: Logit marginal effect of choice between Aetna Wellness and Third Plan for all employees.

	(1)		(2)		(3)	
	Coeff.	Marg.	Coeff.	Marg.	Coeff.	Marg.
Peer Effect Third	-1.72*** (.18)	-.27*** (.03)	-1.71*** (.18)	-.27*** (.03)	-1.53*** (.20)	-.22*** (.03)
Peer Effect Aetna Wellness	1.22*** (.22)	.19*** (.03)	1.22*** (.22)	.19*** (.03)	1.44*** (.24)	.21*** (.03)
Medical Utilization Intensity	.01 (.01)	.00 (.00)				
Predicted Total Cost			.00 (.00)	.00 (.00)		
Charlson Index					-.09* (.04)	-.01* (.01)
Past Medical Exp.					.07** (.02)	.01** (.00)
ln(Cost)	-.72*** (.06)	-.11*** (.01)	-.71*** (.05)	-.11*** (.01)	-.65*** (.06)	-.10*** (.01)
Age	-.04*** (.00)	-.01*** (.00)	-.04*** (.00)	-.01*** (.00)	-.03*** (.00)	-.00*** (.00)
Female	.27*** (.06)	.04*** (.01)	.27*** (.06)	.04*** (.01)	.40*** (.07)	.06*** (.01)
No. of Dependents	.17*** (.04)	.03*** (.01)	.18*** (.04)	.03*** (.01)	.19*** (.04)	.03*** (.01)
Salary	.64*** (.07)	.10*** (.01)	.64*** (.07)	.10*** (.01)	.72*** (.07)	.11*** (.01)
Const	-2.04* (.81)		-2.05* (.81)		-4.72*** (.89)	
Fixed Year Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	21537	21537	21537	21537	19136	19136

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 2.15: Logit marginal effect of choice between Aetna Wellness and Third Plan for new employees.

	(1)		(2)		(3)	
	Coeff.	Marg.	Coeff.	Marg.	Coeff.	Marg.
Peer Effect Third	-.92 (.51)	-.14 (.08)	-.94 (.51)	-.14 (.08)	-1.13* (.51)	-.17* (.08)
Peer Effect Aetna Wellness	1.89* (.88)	.28* (.13)	1.84* (.88)	.28* (.13)	1.75* (.88)	.26* (.13)
Medical Utilization Intensity	-.08* (.04)	-.01* (.01)				
Predicted Total Cost			-.01 (.01)	-.00 (.00)		
Charlson Index					-.13 (.22)	-.02 (.03)
Medical Expenditure					.04 (.06)	.01 (.01)
ln(Cost)	-.82*** (.19)	-.12*** (.03)	-.78*** (.18)	-.12*** (.03)	-.79*** (.19)	-.12*** (.03)
Age	-.01 (.01)	-.00 (.00)	-.01 (.01)	-.00 (.00)	-.01 (.01)	-.00 (.00)
Female	-.37* (.17)	-.06* (.03)	-.34* (.17)	-.05* (.03)	-.30 (.17)	-.04 (.03)
No. of Dependents	.42* (.18)	.06* (.03)	.34 (.18)	.05 (.03)	.27 (.18)	.04 (.03)
Salary	.85*** (.20)	.13*** (.03)	.84*** (.20)	.13*** (.03)	.87*** (.20)	.13*** (.03)
Const	-3.26 (2.39)		-3.58 (2.40)		-4.02 (2.45)	
Fixed Year Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	965	965	965	965	952	952

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 2.16: Multinomial logit comparing Aetna Wellness to Aetna, Aetna 80/20, and Third Plan for all employees.

	Medical Utilization Intensity		Predicted Total Cost		Charlson Index	
	Coeff.	Marg.	Coeff.	Marg.	Coeff.	Marg.
Pr(Aetna Wellness) (base category)						
Peer Effect Aetna	.00 (.)	-.05 (.04)	.00 (.)	-.05 (.04)	.00 (.)	-.04 (.04)
Peer Effect Aetna Wellness	.00 (.)	.17*** (.03)	.00 (.)	.17*** (.03)	.00 (.)	.18*** (.03)
Peer Effect Third	.00 (.)	-.20*** (.02)	.00 (.)	-.20*** (.02)	.00 (.)	-.18*** (.02)
Health Measure	.00 (.)	.00*** (.00)	.00 (.)	.00 (.00)	.00 (.)	-.00 (.00)
Pr(Aetna)						
Peer Effect Aetna	.87* (.34)		.86* (.34)		.87* (.36)	
Peer Effect Aetna Wellness	-1.16*** (.28)		-1.18*** (.28)		-1.27*** (.30)	
Peer Effect Third	.58* (.24)		.56* (.24)		.49 (.25)	
Health Measure	-.06*** (.01)		-.00 (.00)		.05 (.04)	
Pr(Aetna 80/20)						
Peer Effect Aetna	.59 (.64)		.57 (.63)		.39 (.66)	
Peer Effect Aetna Wellness	-1.36 (.74)		-1.45* (.72)		-1.47* (.73)	
Peer Effect Third	.84 (.46)		.78 (.46)		.72 (.47)	
Health Measure	-.30*** (.04)		-.01* (.00)		.01 (.07)	
Pr(Third)						
Peer Effect Aetna	.24 (.27)		.24 (.27)		.12 (.28)	
Peer Effect Aetna Wellness	-1.24*** (.22)		-1.25*** (.22)		-1.43*** (.24)	
Peer Effect Third	1.74*** (.18)		1.74*** (.18)		1.61*** (.20)	
Health Measure	-.01 (.01)		-.00 (.00)		.02 (.04)	
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	27432	27432	27432	27432	25505	25505

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.
Standard errors clustered at individual level.

Demographic variables include age, gender, number of dependents, salary. All specifications also control for log of sum of premium and deductible. Each pair of columns represents a specification using a different measure of health. The first pair of columns use medical utilization intensity, the second pair of columns use predicted total cost, and the last pair of columns use the Charlson index.

Table 2.17: Multinomial logit comparing Aetna Wellness to Aetna and Third Plan, and no plan for all employees

	Medical Utilization Intensity		Predicted Total Cost		Charlson Index	
	Coeff.	Marg.	Coeff.	Marg.	Coeff.	Marg.
Pr(Aetna Wellness) (base category)						
Peer Effect Aetna	.00 (.)	-.05 (.03)	.00 (.)	-.04 (.03)	.00 (.)	-.03 (.04)
Peer Effect Aetna Wellness	.00 (.)	.16*** (.02)	.00 (.)	.16*** (.03)	.00 (.)	.21*** (.03)
Peer Effect Third	.00 (.)	-.15*** (.02)	.00 (.)	-.14*** (.02)	.00 (.)	-.15*** (.02)
Health Measure	.00 (.)	.02*** (.00)	.00 (.)	.01*** (.00)	.00 (.)	-.01* (.01)
Pr(Aetna)						
Peer Effect Aetna	.75* (.33)		.73* (.34)		.70* (.35)	
Peer Effect Aetna Wellness	-1.40*** (.28)		-1.42*** (.28)		-1.53*** (.29)	
Peer Effect Third	.41 (.23)		.39 (.23)		.32 (.24)	
Health Measure	.00 (.01)		.00 (.00)		.12** (.04)	
Pr(Third Plan)						
Peer Effect Aetna	.20 (.27)		.17 (.27)		.04 (.29)	
Peer Effect Aetna Wellness	-1.38*** (.23)		-1.41*** (.23)		-1.58*** (.24)	
Peer Effect Third	1.66*** (.18)		1.63*** (.18)		1.53*** (.20)	
Health Measure	.02* (.01)		.00 (.00)		.06 (.04)	
Pr(No plan)						
Peer Effect Aetna	.65* (.28)		.42 (.29)		.31 (.33)	
Peer Effect Aetna Wellness	-.69** (.23)		-.92*** (.24)		-1.67*** (.29)	
Peer Effect Third	.76*** (.19)		.62** (.20)		-.05 (.24)	
Health Measure	-1.01*** (.02)		-.20*** (.01)		.03 (.06)	
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	33269	33269	33269	33269	26423	26423

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.
Standard errors clustered at individual level.

Demographic variables include age, gender, number of dependents, salary. All specifications also control for log of sum of premium and deductible. Each pair of columns represents a specification using a different measure of health. The first pair of columns use medical utilization intensity, the second pair of columns use predicted total cost, and the last pair of columns use the Charlson index.

Table 2.18: Multinomial logit comparing Aetna Wellness to Aetna, Third Plan, and no plan for new employees.

	Medical Utilization Intensity		Predicted Total Cost		Charlson Index	
	Coeff.	Marg.	Coeff.	Marg.	Coeff.	Marg.
Pr(Aetna Wellness) (base category)						
Peer Effect Aetna	.00 (.)	-.03 (.07)	.00 (.)	-.01 (.09)	.00 (.)	-.01 (1.99)
Peer Effect Aetna Wellness	.00 (.)	.13* (.06)	.00 (.)	.08 (.08)	.00 (.)	.25 (.77)
Peer Effect Third	.00 (.)	-.03 (.05)	.00 (.)	-.07 (.06)	.00 (.)	-.07 (.79)
Health Measure	.00 (.)	-.00 (.01)	.00 (.)	.10*** (.00)	.00 (.)	-.04 (1.18)
Pr(Aetna)						
Peer Effect Aetna	-.44 (.90)		-.38 (.89)		-.53 (.90)	
Peer Effect Aetna Wellness	-.93 (.79)		-.94 (.78)		-.96 (.79)	
Peer Effect Third	-.75 (.62)		-.76 (.61)		-.73 (.62)	
Health Measure	-.01 (.04)		.01 (.01)		.29 (.16)	
Pr(Third Plan)						
Peer Effect Aetna	.84 (.84)		.84 (.81)		.67 (.85)	
Peer Effect Aetna Wellness	-1.59 (.87)		-1.79* (.86)		-1.54 (.87)	
Peer Effect Third	1.08* (.54)		.77 (.52)		1.20* (.54)	
Health Measure	.07* (.04)		.02* (.01)		.10 (.19)	
Pr(No plan)						
Peer Effect Aetna	-40.77 (15473.06)		-.09 (.68)		-345.13 (49777.49)	
Peer Effect Aetna Wellness	113.29 (19099.74)		.23 (.55)		88.38 (16943.74)	
Peer Effect Third	173.04 (18723.81)		.69 (.41)		121.32 (17557.45)	
Health Measure	-237.17 (12587.96)		-1.11*** (.06)		33.09 (28521.09)	
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	2305	2305	2305	2305	1129	1129

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.
Standard errors clustered at individual level.

Demographic variables include age, gender, number of dependents, salary. All specifications also control for log of sum of premium and deductible. Each pair of columns represents a specification using a different measure of health. The first pair of columns use medical utilization intensity, the second pair of columns use predicted total cost, and the last pair of columns use the Charlson index.

Table 2.19: Alternative specific conditional logit comparing Aetna Wellness, Aetna, Third Plan, and no plan.

	Total Sample		New Employees	
	Coeff.	Marg.	Coeff.	Marg.
Peer effect Aetna Wellness	1.61*** (.06)	.18 (.08)	2.82*** (.25)	.44 (.27)
Medical Utilization Intensity	-.03*** (.01)	.02 (.01)	-.06 (.04)	.05 (.03)
Peer effect Aetna Wellness	1.57*** (.06)	.18 (.07)	1.61*** (.17)	.28 (.11)
Predicted Total Cost	-.00* (.00)	-.00 (.00)	.02* (.01)	.01 (.00)
Peer effect Aetna Wellness	1.61*** (.08)	.22 (.08)	2.92*** (.25)	.59 (.15)
Family health	-.15** (.05)	.07 (.02)	-.31* (.15)	.23 (.06)
Demographics	Yes	Yes	Yes	Yes
Year Fixed Effects	No	No	No	No

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Demographic variables include age, gender, number of dependents, salary. All specifications also control for log of sum of premium and deductible.

Table 2.20: Alternative specific conditional logit comparing Aetna Wellness, Aetna, and no plan, 2013 choice set.

	Total Sample		Discontinued Plan	
	Coeff.	Marg.	Coeff.	Marg.
Peer effect Aetna Wellness	.37*	.07	.50*	.11
	(.14)	(.02)	(.25)	(.01)
Medical Utilization Intensity	-.01	.01	-.01	.02
	(.03)	(.00)	(.05)	(.00)
Peer effect Aetna Wellness	.28*	.06	.49*	.11
	(.13)	(.01)	(.25)	(.01)
Predicted Total Cost	-.00	.00	.01	.00
	(.00)	(.00)	(.01)	(.00)
Peer effect Aetna Wellness	.80***	.16	.83**	.18
	(.19)	(.02)	(.28)	(.02)
Family Health	-.04	.07	-.07	.07
	(.03)	(.01)	(.05)	(.01)
Demographics	Yes	Yes	Yes	Yes
Year Fixed Effects	No	No	No	No

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Demographic variables include age, gender, number of dependents, salary. All specifications also control for log of sum of premium and deductible.

Table 2.21: Logit marginal effect of choice between Aetna Wellness and Aetna with lagged peer effects for new employees.

	(1)		(2)		(3)	
	Coeff.	Marg.	Coeff.	Marg.	Coeff.	Marg.
Peer Effect Aetna	-.83 (.57)	-.10 (.07)	-.84 (.57)	-.10 (.07)	-.77 (.56)	-.09 (.07)
Peer Effect Aetna Wellness	-.47 (.63)	-.06 (.08)	-.47 (.63)	-.06 (.08)	-.59 (.64)	-.07 (.08)
Medical Utilization Intensity	.01 (.05)	.00 (.01)				
Predicted Total Cost			-.00 (.01)	-.00 (.00)		
Charlson Index					-.33 (.19)	-.04 (.02)
Med. Expenditure					.17* (.07)	.02* (.01)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Year Effects	Yes	Yes	Yes	Yes	Yes	Yes
Dep. Var. Mean		.80		.80		.80
N	849	849	849	849	838	838

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Demographic variables include age, gender, number of dependents, salary. All specifications also control for log of sum of premium and deductible.

Table 2.22: Logit marginal effects of choice between Aetna Wellness and Aetna, with year and peer effect interactions.

	Total Sample		New Employees	
	Coeff.	Marg.	Coeff.	Marg.
Peer Effects Aetna	-.74**		-.28	
	(.28)		(.91)	
Peer Effect Aetna Wellness	3.70***		3.97	
	(.64)		(2.73)	
Medical Utilization Intensity	.04**		.01	
	(.01)		(.05)	
<i>Peer Effect Aetna Wellness * Year</i>				
2008	.00	.70***	.00	.62
	(.)	(.12)	(.)	(.36)
2009	-2.10***	.32**	.25	.52
	(.60)	(.10)	(5.28)	(.48)
2010	-2.46***	.25**	-4.36	-.05
	(.69)	(.08)	(3.25)	(.24)
2011	-2.31***	.27***	-3.77	.02
	(.67)	(.07)	(3.06)	(.14)
2012	-2.51***	.22***	-3.03	.09
	(.68)	(.06)	(3.01)	(.14)
Fixed Year Effects	Yes		Yes	
Dep. Var. Mean		.58		.80
N	13815	13815	881	881

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.
Standard errors clustered at individual level.

Table 2.23: Logit marginal effects of choice between Aetna Wellness and Aetna, random peer assignment.

	All Employees		New Employees	
	Coeff.	Marg.	Coeff.	Marg.
Peer Effects Aetna	-.03 (.09)	-.01 (.02)	.60 (.50)	.08 (.06)
Peer Effect Aetna Wellness	.16* (.07)	.03* (.01)	-.00 (.32)	-.00 (.04)
Medical Utilization Intensity	.04*** (.01)	.01*** (.00)	.00 (.05)	.00 (.01)
Demographics	Yes	Yes	Yes	Yes
Fixed Year Effects	Yes	Yes	Yes	Yes
Dep. Var. Mean		.58		.79
N	12405	12405	792	792

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 2.24: Summary Statistics: New Employees

	Longer Term Employees		Temporary Employees	
	No Insurance Mean / Std. Dev.	Insurance Mean / Std. Dev.	No Insurance Mean / Std. Dev..	Insurance Mean / Std. Dev.
Age	35.89 (10.01)	37.45 (12.89)	35.43 (9.31)	36.61 (13.68)
Female	.42 (.49)	.50 (.50)	.37 (.48)	.44 (.49)
Dependents	.06 (.35)	.46 (.93)	.04 (.32)	.42 (.96)
Wage	45095 (29554)	56924 (41889)	48492 (31668)	47708 (35274)
Job Type: Academic	.66 (.47)	.42 (.49)	.85 (.35)	.50 (.50)
Job Type: Admin	.15 (.36)	.38 (.48)	.05 (.22)	.23 (.42)
Job Type: Union	.12 (.32)	.11 (.32)	.06 (.24)	.15 (.36)
N	2075	1584	787	187

Table 2.25: Linear probability model of insurance take up: all employees.

	All Employees	
	Marg.	Robust Std. Err.
Age	.00***	(.00)
Female	.07***	(.01)
<i>Dependents</i>		
1	.06***	(.01)
2	.13***	(.01)
3	.07***	(.01)
4+	-.01	(.01)
<i>Female*Dependents</i>		
1	-.10***	(.02)
2	-.06***	(.01)
3	-.06***	(.01)
4+	-.03	(.01)
Ln(Salary)	.04***	(.00)
New	-.19***	(.01)
Academic	-.02**	(.01)
Temporary Employee	-.08***	(.01)
Peer Effect Aetna Wellness	-.02	(.02)
Peer Effect Aetna	-.05*	(.02)
Peer Effect Third	.00	(.01)
Medical Utilization Intensity	.05***	(.00)
Const	.09*	(.03)
Year Fixed Effects	Yes	
mean	.80	
N	47603	
r^2	.35	

*** Significant at 0.1 percent level.

** Significant at 1 percent level.

* Significant at 5 percent level.

CHAPTER 3

MEDICAL EXPENDITURES UNDER A WELLNESS PLAN

3.1 Introduction

The Centers for Disease Control and Prevention (CDC) has identified four behaviors - inactivity, poor nutrition, tobacco use, and frequent alcohol consumption - as the primary causes of chronic disease in US (Mattke et al. 2013). These behaviors result in increased prevalence of diabetes, heart disease, and chronic pulmonary conditions, and lead to a decreased quality of life, premature death, and disability. While these diseases were once associated with old age, the early onset of these diseases mean that a large portion of the health cost of these diseases is born by employers, through absence from work, reduced performance, and increased health insurance costs. According to a report released by the Milken Institute the cumulative health care costs associated with chronic disease totaled around \$277 billion (Mattke et al. 2013).

According to the 2013 Rand Survey of Employers, more than 50% of US employers offer workplace wellness programs to employees. A workplace wellness program can include on-site gym or discounts on gym membership, an on-site nutrition and health counseling as well as health checks or a partnership with local physicians to increase use of preventive care services. Some wellness programs include group programs with incentives toward weight loss, smoking cessation, stress management, or other measures of healthy living. While some of these programs are offered independently, over 30% of employers tie wellness programs with health insurance benefits. These

programs have many aims. For employees, the program is intended to provide resources and emphasize healthy living. Many such programs aim directly to identify and treat early risks to health. If a chronic health condition is present, such as diabetes or high blood pressure, the program is intended to facilitate regular checks and maintenance of the conditions to reduce the incidence of complications. The benefit to employers is two-fold. The wellness programs aim to improve the maintenance of chronic conditions, reducing the lost productivity from absenteeism and presenteeism. The wellness program also allows the employer to direct the medical care received by the employee and family, to some extent. As the *New York Times* article described, employers are using wellness programs to slow the growth of costs associated with health insurance in advance of the excise tax imposed by the Affordable Care Act in 2018 (Abelson, 2013). In Chapter 1 of this dissertation, I discuss the simple economics of wellness programs.

The savings in health insurance costs would stem from both a change in a pattern of utilization as well as the improvements in health. Many of the wellness programs, particularly those integrated with a health insurance plan encourage or require the completion of a risk assessment questionnaire as well as a health check with a primary care physician. The primary care physician is intended to identify health risks and develop a set of goals for the member to follow during the year to reduce the risks. This also offers the primary care physician an opportunity to increase the outpatient care for existing medical conditions, reducing the incidence of emergency room use and hospitalization. Combined, members should see a decrease in more expensive emergency room and inpatient hospital use, and an increase in outpatient and ambulatory care.

This paper evaluates the health services utilization by members of a wellness plan integrated into health insurance. I first look at the combined impact of changes in patterns of utilization and

improved health. Based on medical claims files, I analyze the effect of wellness plan enrollment on total medical expenditure. Next, I focus specifically on the patterns of utilization by repeating the analysis of medical expenditure by type of care, separating inpatient and outpatient, as well as emergency and preventive care. To analyze the change in the pattern of utilization, I look at utilization in terms of visits. In this context, I can furthermore differentiate by type of preventive visits, such as nutritional counseling, smoking-cessation, as well as mammogram.

A major contribution of this analysis is the length of the panel, which allows results to extend to the longer term effects of wellness programs. To study the changing effect of wellness programs on medical expenditure, I start the analysis by conducting an event study. The event study compares the medical expenditure of those who eventually enroll in the wellness program, to those who never enroll, in the years leading to the enrollment and in the years that follow. The event study, therefore, shows how the utilization of the wellness program evolves over time. This is an important component of the development of the wellness program, as the preventive care utilization should have an immediate effect on the medical expenditure, but the overall gains in health are likely to show only after years of preventive care.

The event study is followed by a descriptive multivariate analysis of how medical utilization differs for those enrolled in the health insurance with wellness program. To account for possible selection bias on observables, I extend the analysis and use propensity score matching. In the conclusion I discuss the challenges of extending the analysis further to address selection into the wellness program on unobservables.

The data used in the analysis comes from a large self-insured university employer. The employer introduced a wellness program in 2008 integrated with a health insurance plan, Aetna Wellness, in parallel to an already existing identical plan Aetna. Aetna Wellness provided substantial financial incentive for enrollment, with a lower deductible and a lower premium. It provided a set of features aimed to improve healthy living, and required only the completion of a risk assessment questionnaire. Despite the substantial incentives to enroll in Aetna Wellness, many employees instead enrolled in the Aetna plan which lacked the wellness features. Chapter 2 of this dissertation reports empirical analyses that explore in detail possible explanations for this puzzle. In the next section, I discuss the features of the Aetna Wellness plan, as well as some of the factors in choosing Aetna Wellness, contributing towards the challenges to estimation of effect of wellness features on medical utilization.

The analysis conducted here finds that those who switch into Aetna Wellness do change the composition of medical services they use. Aetna Wellness members use 0.5 more preventive visits compared to the average 2.05 visits by non-members. They also use more outpatient services. The increases in utilization are not well matched by declines in other areas. The intensity of emergency room utilization does not change significantly, but Aetna Wellness members are 3 percentage points less likely to use the emergency room during the year. The use of inpatient acute hospitalizations also decline by 0.06 visits on an average of 0.37 visits per year for non-members.

In terms of the expenditure, however, these changes in medical utilization do not translate into significant savings. The overall medical expenditure per wellness plan participant per year increases by an average between \$50 to \$198 per year. Inpatient acute care expenditure declines by \$453 on an average of \$1580 per year, while emergency room expenditure declines by a modest \$19 on

an average of \$480. However, pharmacy expenditure increases by \$212, and all other care, which includes outpatient expenditure increases by \$224.

The remainder of this chapter will proceed as follows: Section 2 will present Aetna Wellness and discuss the features of the plan. It will also describe the uptake of the plan by employees and in doing so, it will refer to Chapter 2 about the sources of selection into the plan. Section 3 will review the literature in wellness plan evaluation, while Section 4 will discuss the challenges to estimation. Section 5 will discuss the data and present some summary statistics. Section 6 will discuss the estimation strategy. Section 7 presents the estimation results. Section 8 concludes.

3.2 Aetna Wellness

In 2008, in cooperation with the local area physicians, the employer introduced Aetna Wellness to the health insurance menu on offer to its employees. Aetna Wellness was derived from and offered simultaneously with the Aetna PPO plan. The aim of the Aetna Wellness plan was to include the primary physician more actively in the preventive health care for the member, to identify and treat health risks before they evolve into costly hospitalizations. The plan was also designed to encourage healthier lifestyle by offering discounts to the gym, counseling for obesity, smoking cessation, and stress management. To achieve these goals, the enrollees were required to choose a primary care physician (PCP) and complete a health risk assessment questionnaire. On the basis of the questionnaire, the PCP would conduct an annual physical examination. Beyond the initial examination, the PCP did not act as a gatekeeper for the health plan as the member could use any

specialist services without referrals.

The employer designed the financial characteristics of Aetna Wellness to be comparable with and more appealing than existing plans. Table 1 presents a side-by-side comparison of all health insurance choices for a family in 2012. Compared to the Aetna plan, Aetna Wellness had the same coinsurance rate, the same network of physicians, hospitals, and pharmacies, and no referrals were necessary for specialist visits. Aetna Wellness was better than Aetna because it had a lower premium, deductible, and annual out of pocket maximum across the years, and it offered health services such as discounted gym membership. However, upon enrollment in Aetna Wellness, the employee was required to select a primary care physician (PCP), and complete a health risk assessment questionnaire. These features constitute the additional non-monetary cost of Aetna Wellness.

The brochure that introduced of Aetna Wellness, as well as subsequent issues, specifies that the employee would be responsible only for selecting a PCP and completing a health risk assessment. The brochure also urged employees to also encourage dependents to engage in same healthy lifestyle. The brochure does not specify any penalties for failure to complete the health risk assessment questionnaire or having an annual physical. Thus, if the employee chooses to sign up for Aetna Wellness exclusively for plan savings, without completion of any of the requirements, there are no financial or other penalties imposed.

The aim of the Aetna Wellness plan was to include the primary physician more actively in the preventive health care for the member, to identify and treat health risks before they evolve into

costly hospitalizations. The plan was also designed to encourage healthier lifestyle by offering discounts to the gym, counseling for obesity, smoking cessation, and stress management. To achieve these goals, the enrollees were required to choose a primary care physician (PCP) and complete a health risk assessment questionnaire. On the basis of the questionnaire, the PCP would conduct an annual physical examination. Beyond the initial examination, the PCP did not act as a gatekeeper for the health plan as the member could use any specialist services without referrals. The assessment questionnaire and the visit with the primary care physician incurred no copay or coinsurance. Similarly, the counseling sessions were offered at a copay of \$10 to \$20.

While Aetna plan offers the closest comparison to Aetna Wellness in terms of choice and utilization, the analysis will include individuals who switched into Aetna Wellness from both Aetna and the Third Plan. Table 1 presents a side-by-side comparison of plans available to employees between 2008 and 2012. For an employee with a family in 2012, there were 5 plans to choose from starting in 2008. Of these plans, the first three had the overwhelmingly largest enrollment among active employees. In this analysis, I disregard employees enrolled in Aetna 80/20 and the Aetna Health Savings Account (HSA). The Aetna 80/20 was a plan designed and used overwhelmingly by retired employees. It offers a higher coinsurance rate of 20%. It is not a suitable comparison to the Aetna Wellness program because of both substantial difference in the type of population, as well as the difference in the structure of benefits. Similarly, the Aetna HSA account does not offer a good comparison of benefit structure. Furthermore, the enrollment in the HSA account did not exceed 30 employees per year.

Looking across the columns of Table 1, Aetna Wellness is sufficiently similar to Aetna and the Third plan to allow for a reasonable comparison. All three plans have the same in-network coinsur-

ance rate, and only the Third plan differs on the out of network coinsurance rate. To circumvent the difference in the in-network and out-of-network rates, I will use the insurance allowed amounts for medical services as the basis of comparison. All the plans have the same co-pay for office visits, making them comparable across plans. Furthermore, the Third plan differs from Aetna Wellness in the network of physicians and hospitals. However, a comparison of in-network physicians in the primary zip code of the employer from the insurer website showed a similar number of providers. Given the geographically concentrated locality of the employer, this suggests that the networks overlap substantially.

Chapter 2 of this dissertation studies two factors in the choice of Aetna Wellness. In particular, the paper addresses the puzzle of low enrollment in the presence of financial incentives of up to \$1500, through the effect of peer choices and family health. The results show that peer enrollment in Aetna Wellness increases own probability of enrollment. However, family health has an ambiguous effect on choice of Aetna Wellness. When using a metric of severe, often chronic, medical conditions, the employee is moderately less likely to enroll in Aetna Wellness. However, when measuring health in terms of intensity of medical services utilization, there is evidence of modest increase in probability of enrollment.

These results suggest that selection may be present in the choice of Aetna Wellness. The early joiners into Aetna Wellness may be predisposed towards wellness activities and preventive care, biasing the effect on preventive care upwards. As Aetna Wellness becomes more prevalent, the later joiners may be responding more to the difference in prices, and therefore preferences over wellness are likely to generate less selection and less bias. The comparison of utilization between Aetna Wellness and those who never enrolled in the plan will have to account for the selection

occurring in plan selection. The estimation method used in this chapter, though controlling for the selection on observables, will not control for the selection on unobservable characteristics, which is left as an extension to present work.

The next section will discuss the program evaluation literature for wellness plans. It will then shift focus towards propensity score matching literature which will be the preferred estimation method for this analysis.

3.3 Literature Review

Wellness programs have been evaluated across many dimensions. Osilla et al (2012) conduct a systematic review of evaluations of worksite wellness programs. The evaluations reviewed by them include different outcomes: exercise, diet, physiological markers, smoking, alcohol use, absenteeism, mental health, and healthcare costs. Healthcare costs were studied generally either through randomized control trial (Milani and Lavie 2009), nonrandom comparison group (Henke et al. 2011, Merrill et al. 2011, Naydeck et al. 2008), or descriptive studies (Aldana et al. 2005, Stave et al. 2003, Yen et al. 2010). All of these studies differed on the type of wellness program, the duration of the observation period, as well as methodology, however they all looked at the effect on total medical expenditure without any investigation into compositional changes.

One of the studies found no difference in total medical costs between the treated and control

groups (Aldana et al. 2005). The other studies found cost savings ranging from \$176 (Naydeck et al. 2008) to \$613 (Stave et al. 2003), and the randomized control trial found a decline of 48% in annual claim costs (Milani and Lavie 2009). I will review the non-random comparison studies and the randomized control trial in greater detail; the descriptive studies are not comparable in methodology to the one used in this chapter.

Henke et al. (2011) use propensity score matching to evaluate the effect of Johnson & Johnson's health and wellness program on employee health risks and medical costs. The treatment group was defined as employees who completed a risk assessment questionnaire. As a control group, Johnson & Johnson anonymously selected comparison companies which it deemed similar in industry (manufacturing) and size (large, self-insured). Four of the 16 comparison companies had fully operation wellness programs, while a sizable proportion did not have any current wellness programs. All companies contributed at least two years of medical claims data. Medical care costs were calculated as a total of all payments (inpatient, outpatient, and pharmaceutical), including both employer and employee share of the costs. They followed a coarsened exact matching approach in estimation, matching parsimoniously on basic demographic variables. Their results suggest that Johnson & Johnson had 3.7% lower average annual growth in medical costs compared to the comparison group, and an annual savings in medical costs of about \$535 per employee.

Naydeck et al. (2008) conduct a similar study for Highmark Inc. employees. The sample consists employees who chose to participate in the wellness program offered by the employer and who had the biometric screening done. The control group consisted of Highmark employees who did not participate in the wellness program and selected client accounts in similar industries as Highmark. The method of comparison is matching on gender, age, net payments for healthcare expenditures,

and comorbidities, with a sample of 1890 participants. They find \$176 per person lower medical expenses for participants, and \$182 per person per year savings in inpatient expenses.

Milani and Lavie (2009) present the results of a randomized control trial (RCT) where participants were recruited from two geographically disparate work sites of an employer. One site acted as the treatment group, while the other was the control. Health risk evaluations were obtained at baseline and 6 months after intervention for all participants. Of 339 participants, 185 were in the treatment group. Though the treatment and control groups were randomly assigned, the control group was older with a slightly larger share of smokers. Medical expenditure was taken from health insurance files for 12 months prior to intervention and 12 months after the intervention. The results suggested that while medical expenditure declined for both groups, for those in the treatment group it declined by \$941 more than the control group. The authors do not provide any other measure of medical utilization.

The present study improves on the abovementioned studies in both methodology and data. The randomized trial presents the gold standard in policy evaluation. Randomized trials, however, are limited in the size and scope of the experiment, which is apparent in both the sample size and the duration of the after-period in Milani and Lavie (2012). While the methodology of the present study will be similar to Henke et al. (2011) and Naydeck et al. (2008), it will improve on these studies in two important ways. First, when applying the propensity matching mechanism, manual balancing will be applied to provide evidence on the quality of the match. Second, the analysis will be conducted on multiple measures of utilization in addition to overall medical expenditure, providing a fuller picture of the compositional changes in utilization. The next section discusses the estimation method used in this study.

3.4 Methods

In an ideal experimental set-up, employees would be assigned randomly to the Aetna Wellness plan. Since the assignment would be random, the sample of employees in Aetna Wellness would be comparable to employees not in the wellness plan. The observed utilization, therefore, would reflect the effect of the Wellness plan. Let Y_{i1} represent the utilization when employee i is enrolled in the Wellness plan (treatment), and let Y_{i0} be the utilization of individual i in the other plans (control). Only one of the outcomes can be observed for individual i , and we must appeal to randomized assignment to estimate the average effect of the treatment. Randomization provides us with the assumption that

$$Y_{i1}, Y_{i0} \perp\!\!\!\perp T_i$$

conditional independence, which allows us to estimate the average effect treatment as:

$$\tau = E(Y_{i1}|T_i = 1) - E(Y_{i0}|T_i = 0) = E(Y_i|T_i = 1) - E(Y_i|T_i = 0)$$

where T_i is the treatment status. That is, if the treatment is randomly assigned, then the difference in the observed outcome between the treatment and control groups is a consistent estimate of the treatment effect.

In an observational data, such as the one used here, the treatment and control groups are not randomly assigned. The failure of the conditional independence assumption precludes a simple comparison of outcomes. The treatment effect on the treated becomes:

$$\tau|_{T=1} = E(Y_{i1}|T_i = 1) - E(Y_{i0}|T_i = 1)$$

That is, in the absence of random assignment, the treatment effect is the difference between the observed treatment outcome, and the counterfactual outcome for the same group had they not

received treatment. Since the counterfactual cannot be observed, however, Rosenbaum and Rubin (1983) propose that conditional on observables for individual i , X_i , there should not be a systematic pre-treatment difference between the groups assigned to treatment and control. However, as the number of covariates in X_i increases, the dimension of comparison increases as well. Rosenbaum and Rubin (1983) propose the propensity score as the means by which to match the treatment with a control group. Let $p(X_i)$ be the probability of individual i enrolling in treatment, defined as $p(X_i) = Pr(T_i = 1|X_i) = E(T_i|X_i)$, and $0 < p(X_i) < 1$. If $\{(Y_{i1}, Y_{i0}) \perp\!\!\!\perp T_i\}|X_i$, then the treatment effect can be defined as:

$$\tau|_{T=1} = E\{E(Y_i|T_i = 1, p(X_i)) - E(Y_i|T_i = 0, p(X_i))|T_i = 1\}$$

where the outer expectation is over the distribution of $p(X_i)|T_i = 1$. That is, conditional on the propensity score as function of observable characteristics, the treatment effect is the difference in observed outcomes between the treated and control. Rosenbaum and Rubin (1984) addresses the choice of covariates X_i in the estimation of the propensity score, and propose a stratification method adding higher order terms and interactions until there is no significant difference between the two groups.

Non-experimental program evaluations came under scrutiny in LaLonde (1986). He estimated the impact of a labor training program on post-intervention income levels. He used data from a randomized evaluation of the program, and examined to the extent which non-experimental estimators could replicated the treatment impact from the experimental estimate. Comparing regression, fixed-effect, and latent variable selection models, LaLonde concluded that these estimators are either inaccurate with respect to the experimental results, or are sensitive to specification used. To counter the LaLonde critique, Dehejia and Wahba (1999) used the same data to estimate the treatment effect using propensity score matching. They found that when the range of estimated

propensity scores of the treatment and control groups overlap, the propensity score methods can estimate the treatment impact for the treatment group, and are not sensitive to specification.

As Dehejia and Wahba (1999) emphasize, the key to success in matching is the successful overlap in the propensity score between the treatment and control groups. This study will follow the methodology laid out in Imbens and Rubin (forthcoming) for balancing and stratification of the control group to improve the matching on the propensity score.

Before proceeding with the model and estimation, however, it is important to address the timing component of enrollment in these programs. While Aetna Wellness was introduced in 2008, in every year since employees have faced the choice of enrolling or not enrolling. Thus, contrary to programs which have a single enrollment opportunity, there is no clear set up of treatment and control. Figure 1 depicts the timing of the enrollment for the sample. Thus, in 2008, of the total sample N , N_{08} are the treatment. In the analysis that follows, the control group will be defined in two ways. First I compare those who switched at any time during the panel, $N_{08} + N_{09} + N_{10} + N_{11} + N_{12} + N_{13}$, to those who never switched. This analysis, therefore, will not differentiate between pre- and post-switching behavior of those who switched into Aetna Wellness. It will serve to compare the utilization of ever switchers to non-switchers, identifying the difference in utilization patterns between the two groups. If the selection into treatment is biased, therefore, these estimates are likely to reflect the greatest share of that bias. I label this comparison of ever-switchers to never-switchers.

Then, I repeat the analysis comparing those who switched after the switch to the control group

consisting of those who never switched and the switchers prior to switching. This comparison will be closer to the experimental setting: it will compare employees enrolled in Aetna Wellness to employees not enrolled in Aetna Wellness, and compare the changes in utilization. Because the control group will consist of both never-switchers as well as switchers prior to switching, when matched, a switcher may act as its own control group in the propensity score matching analysis. This type of comparison should alleviate some of the bias due to nonrandom selection. I label this comparison Aetna Wellness members to non-members. The analysis will focus on medical expenditure by type, as well as utilization as defined by types of visits.

One of the main criticisms of propensity matching is that it matches on the basis of observable characteristics only. Indeed the central assumption of the propensity matching technique is that controlling for observed characteristics, the assignment to treatment and control are random. Future extensions to this project will address the selection on unobservables.

3.5 Data

The data consists of health insurance plan selection and claims data from a large self-insured university, spanning the period of 2007 to 2013. The sample consists of the universe of eligible employees for that employer, which includes both hourly and salaried, administrative and faculty, and other types of employees. From the sample I drop employees with missing department, as well as non-active employees – this includes employees who are retired, on leave, on suspension, or on other form of paid or unpaid leave. The remaining sample consists of 13,080 employees tracked

over an average 4.2 years. Focusing only on employees who are members only of Aetna Wellness, Aetna, or Third Plan, the sample is further reduced to 5,852 employees, to a total of 33,729 person years. The analysis focuses on employees and their dependents, and therefore, while the unit of analysis is the employee, all figures include or are adjusted for number of dependents. The employees are tracked for an average of 5.25 years. Among the employees in the sample, 2,277 switched into Aetna Wellness at some point during the span of the panel. The remaining 3,575 remain as the control group as non-switchers.

Table 2 presents the summary statistics of those who switched into Aetna Wellness to those who never switched. The statistics for the those who switched are the average for both before and after switching. The statistics suggest that switchers and non-switchers are overall different. Switchers tend to have more dependents and earn somewhat less than non-switchers. Utilization is different among the two groups as well. Overall, switchers appear to use medical services more intensively, and have a higher total expenditure. However, while their inpatient expenses are lower, the pharmaceutical expenditure is substantially higher.

Table 3 compares the medical expenditure of switchers before and after switching. The simple comparison of statistics suggest that those who switch into Aetna Wellness tend to use medical services more intensely after switching. This is also reflected in the medical expenditure. Emergency room expenditure declines after switching, but inpatient expenditure increases slightly. Pharmacy expenditure does not change significantly.

An important covariate in the estimation is past family health. I use two metrics of family health

in this study, by making use of the claims data. The first, the Charlson Comorbidity Index, is an index which predicts the 10 year mortality of a patient who may have a range of comorbid conditions from a total of 22. Each condition is assigned a score 1, 2, 3 or 6 depending on the risk of dying associated with each one. For example, a score of 1 is assigned to myocardial infarction, congestive heart failure, peripheral vascular disease, dementia, cerebrovascular disease, chronic lung disease, connective tissue disease, ulcer, chronic liver disease. A score of 2 is assigned to hemiplegia, moderate or severe kidney disease, diabetes, diabetes with complication, tumor, leukemia, lymphoma. The maximum score is 16, and a higher score is associated with greater mortality. The score is assigned on the basis of medical claims. The family health index is the sum of the Charlson index for the employee and dependents. In this sample 79% of families have a Charlson score of 0. Since the index is heavily skewed, it reflects the presence of severe medical conditions in the expenditure and utilization decision of the household. To capture the middle of the health distribution, I use software developed at the Johns Hopkins University School of Public Health.

The Johns Hopkins ACG[®] software uses diagnostic codes from claims and case-mix methodology to describe and predict population past or future health care utilization and costs. The Adjusted Clinical Groups (ACG) are a series of mutually exclusive health status categories defined by morbidity, age, and sex. They are based on the premise that the level of resources necessary for delivering appropriate healthcare to a population is correlated with the illness burden of that population. Thus, individual diseases or conditions are placed into diagnostic groups based on five clinical dimensions: duration of condition, severity of condition, diagnostic certainty, etiology of the condition (infectious, injury, other), and specialty care involvement. The software allows me to generate medical utilization intensity index which categorizes the individual according to health services utilization:

- 0 - No diagnoses available
- 1 - Healthy Users
- 2 - Low Users
- 3 - Moderate Users
- 4 - High Users
- 5 - Very High Users

For the family, the individual medical utilization intensity indices are summed. In the result, only 25% of the employees have a family score of 0, and the scores are well distributed in the healthy to low user range. In the analysis that follows, both metrics will be used in estimation.

3.6 Estimation Strategy

Before proceeding with the propensity score matching, I estimate a naive specification:

$$Y_{it} = \alpha + \beta_1 T_i + \beta_2 Health_{it-1} + \gamma X_{it} + \epsilon_{1,it} \quad (3.1)$$

where Y_{it} is the outcome of interest for individual i in year t , T_i is an indicator of whether the individual has ever joined Aetna Wellness, $Health_{it-1}$ is a measure of individual's health in the previous period, and X_{it} is a vector of individual characteristics. Here, β_1 is the coefficient of interest, estimating the difference in outcome variable between the ever joiners and never joiners of Aetna Wellness.

Next, I conduct an event study to see the change in medical expenditure for Aetna Wellness members compared to non-joiners over time. To do so, I estimate:

$$Y_{it} = \alpha + \sum_{j=T_{min}}^{T_{max}} \beta_{1j} T_i \cdot Time_{ij} + \beta_2 Health_{it-1} + \gamma X_{it} + \epsilon_{2,it} \quad (3.2)$$

Here, T_i is the indicator for ever-joiner, and $Time_{ij}$ is a dummy variable for each year of data before and after joining. The timing of this variable is important, as it tracks the years before and after joining for each individual: T_{min} corresponds to the largest number of panel years prior to switching, and T_{max} is the largest number of years after switching. The resulting vector of β_1 estimates the difference in outcome variable between the ever joiners and never joiners in each year prior and post joining.

If the wellness program indeed changes the composition of medical care utilization, one might expect the effect to become more pronounced over time. While in the initial year of enrollment, the member is likely to take advantage of the preventive and wellness features, over years, as the member becomes better acquainted with the features, their utilization should increase. At the same time, if the preventive care does reduce emergency and inpatient care, the decline should become greater over time as the health gains materialize. Therefore, the event study should show an initial decline in emergency and inpatient care, followed by a continued but steady decline over years of enrollment in Aetna Wellness.

To evaluate the distributional effects of medical expenditure, I will estimate a two part conditional model. In the first part, I will estimate a binary specification of any medical expenditure:

$$Pr(M_{it}) = f(Health_{it-1}, X_{it}, \epsilon_{3,it}) \quad (3.3)$$

where M_{it} is an indicator variable for any medical expenditure, and $Health_{it-1}$ and X_{it} are health

and a vector of individual characteristics, as before. In the second part, I re-estimate the linear specification in equation (1) conditional on non-zero medical expenditure. The two-part model is used frequently in health economics to account for the share of zero medical expenditures. Jones (2000) in the *Handbook of Health Economics* reviews the justification for using a two-part model (2PM) compared to a generalized Tobit or a sample selection specification (SSM). The two-part model was adopted for the RAND Health Insurance Experiment (Newhouse et al. 1980, Leibowitz et al. 1985, Manning, Newhouse et al. 1987) because of the unreliable statistical performance of the SSM. While the debate between the two methods continues, Duan et al. (1984) showed that in some contexts, the multi-part and sample selection models give similar results.

Angrist and Pischke (2009) compare Tobit specification to the two-part model. They note that the Tobit model does not fit the features of the health expenditure specification since it was designed for data with censored observations, and while health expenditure assumes only positive values and has a mass point at zero, it is a not censored limited dependent variable. Instead, health insurance data can be subject to two separate processes determining the zero and non-zero values. Comparing the marginal effect estimates of the Tobit and two-part models, they find similar estimates for the effect of childbearing on mothers' labor supply. With this, they conclude that while the non-linear models may provide a better fit, when it comes to the marginal effect, however, the linear model is sufficiently close.

In all of these specifications, however, the coefficient estimates may be biased by potential for selection occurring when the employee chooses Aetna Wellness. For example, the switchers may be healthier employees who are more likely to take advantage of gym discounts, and biasing the effect of Aetna Wellness on medical expenditure downward. On the other hand, Aetna Wellness

may attract more health conscious employees, who are more active in preventive care, resulting in a positive bias on medical expenditure. Since the enrollment in the plan is not randomly assigned, the conditional independence assumption (CIA), $Y_{i1}, Y_{i0} \perp\!\!\!\perp T_i$, necessary for a causal interpretation of the coefficient may not hold. Here, CIA fails because the Aetna Wellness employees are compared to a pool of employees who are systematically different from them.

To generate a quasi-experimental setting for the estimation, I use propensity score matching to trim the control group. Following Rosenbaum and Rubin (1983), I will estimate the treatment effect using

$$\tau|_{T=1} = E\{E(Y_i|T_i = 1, p(X_i)) - E(Y_i|T_i = 0, p(X_i))|T_i = 1\} \quad (3.4)$$

where $p(X_i)$ is the propensity score, and T_i is the treatment status. The propensity score matching will yield unbiased estimated if two conditions are satisfied. The first, the conditional independence assumption, is now conditional on the vector of covariates: $\{(Y_{i1}, Y_{i0}) \perp\!\!\!\perp T_i\}|X_i$. And second, the propensity score of the treated and control must overlap: $0 < p(X_i) < 1$.

The estimation is a two step process. In the first step, the propensity score is estimated using a logit specification:

$$Pr(T_{it}) = f(Health_{it-1}, X_{it}, t, \epsilon_{4,it}) \quad (3.5)$$

where T_{it} is a treatment selection indicator, X_{it} is a vector of covariates, t are year fixed effects, and $\epsilon_{4,it}$ is individual specific error.

In the second step, observations from the treated group are matched to observations from the control group. The matching is performed with the nearest neighbor method, where the treated observations are matched to control observations according to the absolute value of the difference in the propensity score. The outcome variables, Y_{i1} and Y_{i0} are compared using these matched samples to generate the estimate of the treatment effect.

As an initial estimate, I use the Stata[®] *tseffects* command. It uses a logit specification to estimate the propensity score for selection into treatment. Then, observations are matched by nearest neighbor matching on the basis of the propensity score. The logit specification, however, does not guarantee that the conditional independence assumption is satisfied. To explore this further, I re-estimate the model using the method described by Imbens and Rubin (forthcoming) which differs from the Stata in the more thorough balancing and stratification methods used to estimate the propensity score. In addition to a iterative selection of the covariates, Imbens and Rubin suggest a careful assessment of the balancing of data. To that effect, they recommend gradual splitting of comparison groups by blocks of propensity score to ensure that the treated and control groups in each block are balanced in covariates. This balancing and stratification process ensures that the observations are matched not only on the propensity score, but that the underlying covariates are also comparable. Once the propensity score is estimated using the balancing and stratification method, the matching will use the same nearest neighbor method to estimate the average treatment effect.

In the next section, I first discuss the results of the baseline estimation. Then, I proceed to present the results of the two stage estimates of effect of switching conditional on any expenditure. Finally, I introduce the propensity matching results. The section will be divided according to the

comparison group used.

3.7 Results

The outcome variables of interest focus both on expenditure and on utilization. The data provides several categories by type of medical expenditure: total, emergency, pharmacy, and inpatient acute. I define the category of other expenditure as the difference between the total and the other categories. All expenditure variables are defined as allowed amounts; these correspond to the insurance negotiated price for procedure, and include both the patient and insurance share of the cost.

Utilization is also analyzed as visits by category on both the intensive as well as extensive margin: emergency, preventive, inpatient, outpatient, smoking cessation counseling, alcohol counseling, nutrition counseling, and mammogram. To generate the visits information, I parsed through claims data to catalog them by type. To define the emergency, inpatient, and outpatient visits, I used the place of service as the indicator of visit type. Thus, the place of service for emergency visit is a hospital emergency room, while for inpatient it is an inpatient hospital. An outpatient visit can take place in a number of locations, including outpatient hospital, ambulatory surgical center, or doctor's office.

To define the preventive service category, I relied on an Aetna Benefit Guidance Statement, which listed all ICD-9 diagnostic codes which are covered as preventive. Aside from wellness exams,

these include developmental testing; screening for depression, hearing, vision, cancer, osteoporosis, anemia, sexually transmitted diseases, cholesterol, diabetes, sickle cell, hepatitis B and C, HIV, and many others; immunizations; electrocardiograms; obesity preventive counseling; healthy diet counseling; alcohol/drug counseling; tobacco counseling; sexually transmitted infections counseling; and genetic counseling. Using the categories provided by the diagnostic codes, I define the types of preventive visits.

The results will be presented according to the definition of the comparison groups. The first section will contain the results from the analysis comparing ever switchers to never switchers. The analysis will then be repeated in the following section for Aetna Wellness members to non-members.

3.7.1 Ever-switchers vs. never-switchers

Table 4 consists of estimation of specifications (1) and (2). The first column presents the results for the linear specification using the lagged Charlson Index to control for health. The second column repeats the linear specification but controls for health using lagged medical utilization intensity. The dependent variable is total allowed medical expenditure in dollars. The coefficient of interest is an indicator variable denoting membership in Aetna Wellness, and columns 1 and 2 show that controlling for covariates, those who switch to Aetna Wellness spend on average \$4 to \$466 more in total than those who never switch, though the results are not statistically significantly different from zero at conventional levels.

The third column presents the coefficient estimates specification (2). The event study presented in that column compares switchers and never-switchers in the years leading up to, and following, switching. The estimates of this specification are plotted in Figure 2 with the 95% interval for four expenditure categories: total, emergency, pharmacy, and inpatient acute. Each of the coefficients in the third column represent the difference in dollars of total medical expenditure between never switchers and switchers in the years leading up to, and following, switching. Thus, for employees who switched, six years prior to switching they spent \$394 more than never switchers. By the time the employees switched, they were still spending \$981 more than never switchers. Thus, because the panel consists of 7 years, this affords a 6 year look back, and a 5 year forward look. The year zero corresponds to the year the employee switched to Aetna Wellness, which differs for every employee.

Figure 2 represents the analysis graphically. The horizontal axis corresponds to the years before and years after switching, spanning from 6 years prior to 5 years forward. The vertical axis plots the coefficient values from the regression estimates, which are in effect the average difference in expenditure between switchers and non-switchers. The bars provide the 95% confidence interval. Each panel depicts a different category of expenditure. While the large standard errors do not make these estimates reliable, there is a trend apparent in emergency and pharmacy expenditure. In both categories, expenditure appears to decline around the switching time. Though, pharmacy expenditures seem to trend lower in the years before switching.

Tables 5, 6, and 7 depict the results of the baseline estimates for expenditure and utilization categories. All of these tables are split into two panels. The top panel has the estimates of the baseline specification using the Charlson Index to control for past family health. The bottom panel

has the estimates using the medical utilization intensity metric for family health. All estimates that follow control for family demographics and year fixed effects. All reported standard errors are clustered at individual level.

The first column of Table 5 repeats the estimates of the first and second columns of Table 4. The estimates suggest that those who switch to Aetna Wellness spend on average \$4 to \$466 more in total. When breaking this down into categories, however, an interesting pattern emerges. Those who switch spend between \$328 to \$426 more on prescriptions in column 3, but about \$393 to \$505 less on acute care in column 4. The estimate on acute care is statistically significant and robust across the two specifications, and represents a 24% difference between switchers and non-switchers. Emergency room expenditure is not very different between the groups as seen by the estimates in column 2.

Table 6 looks at utilization of medical services by type on the intensive margin. I defined the category of utilization either using the place of service or insurance coding for the conditions. Thus, emergency, inpatient, and outpatient visits were defined by the place of service. The preventive visits were defined according to a comprehensive list of visits considered preventive by Aetna. Because of this specification, preventive and outpatient visits are not mutually exclusive. Across the four categories, the statistically significant differences are in use of preventive services (column 2), and outpatient services (column 4). Switchers tend to have between .21 to .25 more preventive visits per year, which corresponds to a 15% of the mean. Similarly, switchers have between 2.19 to 2.93 more outpatient visits compared to non-switchers, on a base of 16.8 visits a year. However, the estimate on the emergency and inpatient visits are small and statistically insignificant. Comparing to the expenditure this suggests that those who switch to Aetna Wellness do not have fewer

inpatient visits, but do incur less acute care costs during their visits. Given that these estimates control for both age and past health, the duality suggests that Aetna Wellness is indeed shifting more of the care to outpatient setting, resulting in less severe hospitalizations.

Do those who enroll in Aetna Wellness use the features provided by the program? Table 7 looks specifically at certain types of visits, available to employees, but provided at a discounted copay rate to Aetna Wellness employees. The dependent variable here is a dummy for whether the employee or dependent ever had these visits during the year. Switchers are 2 percentage points less likely to visit the emergency room, though in the previous sections we saw no difference in the expenditure or intensity of visits. They are also 3 to 4 percentage points more likely to have a preventive visit. However, the preventive visits do not appear to take advantage of the features of the wellness plan. Switchers are 2 to 3 percentage points less likely to have a smoking cessation, alcohol counseling, or nutrition counseling visit compared to non-switchers. Switchers are also 5 to 7 percentage points more likely to take advantage of mammography services.

The two-part specification described by equation (3) is estimated in Table 8. In each of the four expenditure categories, the first column presents the estimates from the first part of any expenditure. The second part which estimates specification (1) conditional on non-zero expenditure. The results of the second part are presented in the second column in each category. In total and pharmacy expenditure, Aetna Wellness members are more likely to have positive expenditure. Conditional on non-zero expenditure, however, Aetna Wellness members do not differ significantly from non-members in level of expenditure. The notable expenditure is acute care expenditure, where switchers spend on average \$4388 less than never-switchers. The results are very similar when using the medical utilization intensity to control for past health.

Proceeding to propensity score matching, Table 9 presents the results from the baseline estimate side-by-side with the matched estimates. Each of the numbers in this table, is the coefficient on "Wellness Member" from a regression with a different dependent variable. The dependent variables are listed in the left-most column. The first column repeats the baseline estimates from Tables 5, 6, 7. The second column has the estimates of the Stata matched comparison of treatment and control groups.

The estimates change quantitatively, but qualitatively the effect is unchanged. The total medical expenditure increases by \$268 for those who switched, driven primarily by pharmacy expenses which increased by \$276, and other expenses (which includes outpatient care) \$392. Inpatient care declined by \$484. The number of visits support the trend in expenditure. Switchers have .25 more preventive visits compared to non-switchers, and about 2.89 more outpatient visits. They also tend to have .08 fewer inpatient visits, and .02 fewer emergency visits. Looking at the extensive margin of medical service use, the baseline results hold essentially unchanged. Switchers tend to use preventive services and mammograms, but not the counseling such as smoking cessation, alcohol, and nutrition counseling. Table 10 repeats the analysis using the medical utilization intensity as a measure of health. The results are quantitatively and qualitatively similar to those in Table 9.

To evaluate the quality of the match generated by Stata, Figure 3 plots the density of the propensity score according to treatment status. The solid line corresponds to the never-switchers, while the dashed line represents the switchers. While the bulk of the distribution overlaps successfully, there is substantial difference in the tails of both distributions. The non-switchers have a heavier left tail, while the switchers have a heavier right tail. In the next step, the manual balancing will trim the tails to make the distributions more comparable.

Table 11 compares the mean and standard deviations of the treated and control groups after balancing for the covariates used in matching. The first four columns present the means and standard deviations of covariates by treatment status. The fifth column shows the normalized difference of the means. The sixth column, labeled as $\pi^{0.05}$ Control, represents the share of treated observations falling outside the 5% range of the control group. Similarly, the seventh column lists the percentage of control observations falling outside the 5% range of the treated group. Inspecting the balance of covariates, gender appears to be the least balanced. The normalized difference remains substantial, though it is reasonable that the ranges overlap perfectly. The same can be concluded about the faculty status of the employee, with a large normalized difference but perfectly overlapping ranges. This is due to the binary nature of the variables. In other categories, however, the normalized difference is small, and the overlap very good. Age has 7% of treated observations falling outside the 95% sample of the control group, and wage has 2% of treated falling outside that range.

Figure 4 presents the histograms of covariate distribution by treatment status. The teal colored bars are the treated group, while the white bars are the control group. The histograms confirm the balancing of covariates seen in Table 12. Among the four covariates in the first four panels, all covariates overlap nicely between the treated and control groups. In the first plot, the age of the treated appears to be a little less spread than for the control, however, the overall fit is excellent. The last panel in the figure plots the linear propensity score distribution by treatment status. Here, we see a marked shift between the treated and control. However, as Imbens and Rubin (forthcoming) discuss, since the focus of the balancing exercise is to compare on the covariates, the propensity score which is an amalgamation of these often reflects the complexity of the dimensionality of the matching.

The estimates from the manually balanced propensity score matching are in the third column of Table 12. The first two columns in that table repeat the estimates in Table 10 for ease of comparison. Qualitatively, the estimates from the balanced match paint the same picture. Switchers tend to have lower expenditures in inpatient acute care (-\$429), and emergency room care (-\$14), but higher expenditures in prescriptions (\$265). They also have a greater number of preventive (.21) and outpatient visits (2.24), and fewer number of inpatient visits (-.06). On the extensive margin, however, Aetna Wellness members tend to be less likely to use the emergency room (3 percentage points), but more likely to have preventive visits (4 percentage points) including mammogram (2 percentage points), without taking advantage of the wellness counseling such as smoking (-2 percentage points), alcohol (-2 percentage points), and nutrition (-2 percentage points).

3.7.2 Switchers: Before and After

Next, I change the comparison group to evaluate the before and after changes for those who switched to Aetna Wellness. Table 13, 14, 15 present the estimates for utilization after enrollment for Aetna Wellness members. The indicator variable "After Switching" becomes 1 for switchers once they are enrolled in Aetna Wellness. It remains 0 for switchers before they are enrolled, as well as never-switchers. In Table 13, Aetna Wellness members experienced between \$95 and \$107 decline in their emergency room expenditure after switching, but the expenditure in other category, which includes outpatient visits, increased between \$810 and \$960. Total expenditure increased between \$464 to \$760, however the estimate is too noisy and is not significant.

Utilization is analyzed in Table 14, on the intensive margin. Compared to before, the change in utilization has greater magnitude, as emergency visits decline by .13 visits on an average of .51 after switching. However preventive and outpatient visits increase significantly, with preventive visits increasing by .21 on an average of 1.63, which is a more than 12% increase in the number of visits. Table 15 estimates utilization on the extensive margin after enrollment. Aetna Wellness members have a 8 to 11 percentage point decline in emergency room use, but a parallel 3 percentage point increase in preventive care visits. The use of counseling services provided by Aetna Wellness is, once again, weak, with a 4 to 6 percentage point decline in smoking cessation counseling, 3 to 6 percentage point decline in alcohol counseling, 2 to 5 percentage point decrease in nutrition counseling, and a 3 to 5 percentage point increase in mammograms.

The two part estimation results are in Table 16, with the first column presenting the estimates for probability of any expenditure, and the second column presenting the estimates of specification (1) conditional on non-zero expenditure. Aetna Wellness members are 14 to 21 percentage point more likely to have any expenditure and 4 to 6 percentage point more likely to have pharmacy expenditure, though 7 percentage point less likely to have emergency expenditure. Conditional on any expenditure, however, their utilization does not differ significantly from their prior utilization and from non-switchers.

Table 18 includes the estimates from the baseline specification in the first column, as well as the propensity score matching estimates in columns 2 and 3. The second column contains the estimates from Stata matched comparison of treated and control. The third column presents the manually balanced treated and control group comparison.

Before interpreting the coefficients, however, Figure 5 plots the distribution of covariates after the manual balancing. The balancing here has a lower quality, particularly in the wage, as the treated group has a large concentration in the left tail. The linearized propensity score reflects the lower quality of the match, with a substantial shift between the density of the treated and control groups. As an extension to this analysis, a trimming procedure would help balance the covariates better to improve the comparison.

The second and third columns of Table 18 paint a qualitatively similar picture. After enrollment, Aetna Wellness members appear to have fewer emergency room expenditures, by \$70 less, and a \$394 decline in inpatient acute expenditure. This estimate shows a modest rise in total medical and a decline in pharmacy expenditure, though the large standard errors render these estimates not statistically different from zero.

Utilization also changes for Aetna Wellness members. On the intensive margin then have .17 fewer emergency room visits, .12 fewer inpatient visits. On the other hand, they use .08 more preventive visits, and 4.25 more outpatient visits. This is also reflected in the extensive margin, as switchers are 9 percentage points less likely to use the emergency room use, and 2 percentage points more likely to have preventive visits. And, as before, switchers are less likely to use the features of the wellness program, with a 3 percentage points lower probability of using smoking cessation counseling, 2 percentage points lower probability of using alcohol counseling, and 2 percentage points lower probability of using nutritional counseling.

3.8 Discussion

3.8.1 Discussion of Results

The results suggest that Aetna Wellness member did not have a lower overall medical expenditure. Comparing those who switched into Aetna Wellness anytime during the panel to those who never switched, switchers have overall higher expenditure, buoyed by higher expenditure in outpatient care. The composition of expenditure is different, as switchers tend to have lower emergency and acute expenditure, but higher pharmacy expenditure. This pattern is also supported by evidence in utilization. Switchers are both less likely to use the emergency room, and tend to have fewer visits. They they are more intensive users of preventive care, both on the intensive and extensive margin. Since the comparison made here is between switchers and never-switchers, this pattern of utilization can be attributed to selection into Aetna Wellness: switchers tend to be more focused on preventive care and are particularly attracted to the features of the wellness plan. However, looking at the use of the counseling services offered with Aetna Wellness, the switchers are not users of these services, though they make greater use of mammograms.

After joining Aetna Wellness, switchers do not significantly change their overall medical expenditure, though the composition of their expenditure continues to be different. After switching, Aetna Wellness members tend to spend less in the emergency room, resulting from both fewer emergency room visits, and a smaller proportion of members going to the emergency room. Expenditure on outpatient and preventive services increases, from both a greater number of visits and a greater

share of members going for preventive visits. Despite the increase in the frequency of preventive visits, however, Aetna Wellness members do not take advantage of the enhanced wellness features, as they are less likely to attend the smoking, nutrition, and alcohol counseling session.

The different comparison groups suggest that the switchers may have increased the preventive visits and healthier lifestyle before enrolling in Aetna Wellness. Figure 2 shows modest evidence in a declining pre-trend, especially in pharmacy expenditures. This suggests that the perception of wellness is an important component of the switching behavior.

The event study suggests that the effect lasts over time. While the large standard errors do not allow statistical significance of results, the estimates suggest that emergency expenditure for Aetna Wellness members declines sharply in the first year of enrollment, and remains low in the subsequent years. Pharmacy expenditure also declines upon switching, but the decline is less pronounced over time. This time trend suggests that the wellness program has the intended effect on the pattern of medical utilization. A more detailed analysis of the time component is warranted in future studies, to see if the utilization pattern persists and whether the gains from reduced inpatient care eventually outweigh the costs of additional preventive care.

While a result presented here show a slight increase in total medical expenditure, the literature discussed in the previous sections shows total medical expenditure unchanged or declining. The difference in results can be attributed to multiple factors. The results presented here are limited to one employer in the education industry. The conclusions, therefore, are not readily generalizable to other industries. Hanke et al. (2011) analyze utilization at Johnson & Johnson and other large self-

insured employers in the manufacturing industry. Naydeck et al. (2008) use a sample of Highmark Inc. employees, and compares participants to non-participants and clients in similar industries.

Another source of the difference could be the design of the wellness program. The wellness program studied by Milani and Lavie (2009) not only offers the risk assessment and counseling, but it also offers workplace medical care by nurses. In the results here, the decline in hospital and emergency room is offset by increases in preventive care expenditure. If the workplace medical care replaces the preventive care, it would not be reflected in the health insurance utilization files and, therefore, underestimate the cost of preventive care.

Finally, the present analysis uses a longer period to evaluate the medical expenditure and utilization resulting from a wellness plan. Milani and Lavie (2009), by design compare medical expenditure 12 months prior and 12 months following the introduction of wellness plan. Henke et al. (2011) track 2 years of medical utilization data, which incorporates both the pre- and the post-period. Wellness programs may reduce utilization in the initial year, but utilization may return to pre-wellness levels in the following years.

3.8.2 Limitations and Extensions

The propensity score matching relies on the matching of treated and control on the basis of observable characteristics. If selection into treatment occurs based on the unobservables, the propensity

score matching does not account for these differences. The selection on unobservables is a major limitation of this matching method. To account for the unobservable heterogeneity in the data, I intend to extend the analysis using the panel nature of the data. Smith and Todd (2005), building on Heckman, Ichimura, and Todd (1997, 1998), propose a difference-in-differences propensity matching method to take advantage of the available pre- and post-treatment data. Smith and Todd (2005) use the LaLonde (1986) and Dehejia and Wahba (1999) experimental labor training data to evaluate the performance of various propensity score matching estimators. They find that difference-in-differences performs best, which they attribute to the elimination of remaining unobservable bias. To set up a difference-in-differences propensity score matching estimator, the treatment group will have to be compared contemporaneously to the control group. That is, looking at Figure 1, for example the 2010 treatment group will be N_{10} , while the control group will be $N - N_{08} - N_{09} - N_{10}$. The process of manual balancing can be used with this specification.

The results of this study rely on the success of the propensity matching method. This presents the another limitation of this study, as the bias of the estimate depends on the quality of the matching mechanism. The similarity of the results across methods suggests that despite the manual balancing, the treatment and control groups remain substantially different. The next step in this direction is to explore further trimming and matching techniques to identify how the estimates depend on the method and specification.

Finally, the effectiveness of the two-part model can be tested using the non-nested hypothesis testing framework proposed by Silva et al. (2014). The test, designed on the basis of the P and C tests of Davidson and MacKinnon (1981), allows the comparison between the two-part model and, among others, the exponential conditional expectation model. The test they propose checks

whether the errors of the two-part model under the null hypothesis have zero expectations when the weight given to each observation depends on the difference between the conditional expectations of the two models.

3.9 Conclusion

The Aetna Wellness program was introduced in 2008 in order to improve the health maintenance, risk identification and prevention for employees and families by a large self-insured employer. While the features of the program are designed to help the employee, the increased emphasis on preventive care is intended to be reflected in the lower hospitalization and emergency room use. This study looks at the medical utilization of employees enrolled in the Aetna Wellness program, comparing their use to non-participants in the program.

To avoid the problem of selection into a health plan, I use propensity score matching to match the observations in the treated sample with observations in the control groups. Manual balancing allows for a better comparison on the basis of observed covariates. I first present the baseline naive specification results, and compare them to the non-balanced Stata propensity score match estimates as well as the manually-balanced propensity score match estimates. The similarity of the results suggest that there is room to improve in the matching mechanism, which is an extension of the present study.

The results suggest that there is no significant change in the overall medical expenditure. However, there is substantial compositional change in both expenditure and utilization by Aetna Wellness members. While switchers tend to be more intensive users of medical services, particularly in pharmacy and outpatient, they tend to use fewer inpatient acute and emergency room services. After joining, Aetna Wellness members experience a decline in pharmacy and inpatient expenditures and services, but this decline is more than offset by a rise in preventive care services.

Table 3.1: Plan Comparison for a Family, All Plans 2012

	Aetna Wellness	Aetna	Third	HSA	Aetna 80/20
Premium	3515	4555	3828	3615	6133
Deductible					
<i>In Network</i>	0	500	300	2400	1100
<i>Out of Network</i>	800	900	900	4800	1100
Out of Pocket Maximum					
<i>In Network</i>	4000	4100	4100	5000	7100
<i>Out of Network</i>	7000	7100	7100	7000	7100
Coinsurance					
<i>In Network</i>	90	90	90	90	80
<i>Out of Network</i>	80	80	70	80	80
Network	Aetna	Aetna	PHCS	Aetna	Aetna
Must choose PCP	Yes	No	No	No	No
Enhanced Wellness Program	Yes	No	No	No	No

Table 3.2: Summary Statistics: Switchers v. Non-Switchers

	Non Switchers	Switchers
	Mean / Std. Dev.	Mean / Std. Dev.
Age	46.14 (11.48)	46.36 (10.16)
Female	.45 (.49)	.58*** (.49)
Dependents	1.15 (1.34)	1.38*** (1.41)
Employee Wage	66590 (47263)	65188** (44533)
Medical Utilization Intensity	2.07 (1.21)	2.20*** (1.14)
Medical Expenses per person	4472 (11663)	4935** (12404)
Emergency Expenses per person	210 (736)	209 (717)
Inpatient Acute Expenses per person	812 (6747)	664* (5090)
Pharmacy Expenses per person	975 (2615)	1261*** (7661)
N	20597	14457
n	3914	2213

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 3.3: Summary Statistics: Switchers Before v. Switchers After

	Before	After
	Mean / Std. Dev.	Mean / Std. Dev.
Medical Utilization Intensity	2.28 (1.13)	2.04*** (1.13)
Medical Expenses per person	4581 (11380)	5689*** (14311)
Emergency Expenses per person	216 (715)	192 (721)
Inpatient Acute Expenses per person	605 (4088)	790* (6741)
Pharmacy Expenses per person	1263 (8081)	1255 (6682)
N	9830	4627
n	2213	2213

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 3.4: Baseline specification.

	(1)	(2)	(3)
	Coeff./se	Coeff./se	Coeff./se
<i>Dep. Var.: Total Allowed Medical Expenditure</i>			
Aetna Wellness	466 (398)	4.12 (379)	
Age	145*** (15)	167*** (14)	167*** (14)
Female	244 (399)	323 (373)	330 (370)
No. of Dependents	2044*** (142)	280 (161)	279 (162)
Salary	730** (227)	719** (220)	729** (227)
Medical Utilization Intensity		1425*** (136)	1426*** (72)
Charlson Index	4600*** (420)		
<i>Wellness Member * Year</i>			
Switch year - 6			394 (597)
Switch year - 5			-204 (543)
Switch year - 4			-401 (564)
Switch year - 3			60 (475)
Switch year - 2			117 (656)
Switch year - 1			-376 (456)
Switch year			981 (580)
Switch year + 1			-1679*** (447)
Switch year +2			281 (788)
Switch year +3			985 (1350)
Switch year +4			-1038 (996)
Switch year + 5			-271 (1572)
Const	-11211*** (2555)	-13981*** (2470)	-14123*** (2580)
Year FE	122	Yes	Yes
Mean Dep. Var.		9820	9358
N		31342	34476
r^2		.06	.06

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Table 3.5: Baseline estimates for comparison of treatment and control by expenditure type.

<i>Dep. Var.: Medical Expenditure</i>	Total	ED	RX	IP Acute	Other
Wellness Member	466.17 (398.87)	-2.30 (24.42)	426.84 (227.25)	-393.51* (180.21)	435.13* (184.68)
Dep. Var. Mean	9820.83	487.02	2181.32	1610.97	5541.51
Charlson Index	Yes	Yes	Yes	Yes	Yes
Medical Utilization Intensity	No	No	No	No	No
Demographic Var.	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	31342	31342	31342	31342	31342
r^2	.07	.04	.03	.01	.08
Wellness Member	4.13 (379.79)	-20.43 (22.79)	328.56 (215.25)	-505.55** (161.51)	201.55 (181.00)
Dep. Var. Mean	9358.73	469.21	2075.33	1537.91	5276.29
Charlson Index	No	No	No	No	No
Medical Utilization Intensity	Yes	Yes	Yes	Yes	Yes
Demographic Var.	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	34476	34476	34476	34476	34476
r^2	.06	.05	.03	.01	.07

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

The dependent variables are: Total - total allowed amount by insurance; ED - total allowed expenditure where emergency department is place of service; RX - total allowed pharmacy expenditure; IP Acute - total allowed inpatient acute medical expenditure; Other - all other medical expenditure.

Standard errors clustered at individual level.

Table 3.6: Baseline estimates for comparison of treatment and control in utilization by type (intensive margin).

<i>Dep. Var.: Number of Visits</i>	Emergency	Preventive	Inpatient	Outpatient
Wellness Member	-.02 (.02)	.25*** (.03)	-.05 (.04)	2.93*** (.29)
Dep. Var. Mean	.51	1.63	.38	16.87
Charlson Index	Yes	Yes	Yes	Yes
Medical Utilization Intensity	No	No	No	No
Demographic Var.	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	30319	30319	30319	30319
r^2	.08	.21	.01	.22
Wellness Member	-.04* (.02)	.21*** (.03)	-.09* (.03)	2.19*** (.26)
Dep. Var. Mean	.50	1.60	.38	16.51
Charlson Index	No	No	No	No
Medical Utilization Intensity	Yes	Yes	Yes	Yes
Demographic Var.	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	32633	32633	32633	32633
r^2	.10	.24	.01	.29

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

The dependent variables are: Emergency - number of visits where emergency department is the place of service; Preventive - number of preventive visits; Inpatient - number of inpatient visits; Outpatient - number of outpatient visits. Standard errors clustered at individual level.

Table 3.7: Baseline estimates for comparison of treatment and control in utilization by type (extensive margin).

<i>Dep. Var.: Ever Visit</i>	(1)	(2)	(3)	(4)	(5)	(6)
	ED	Prev.	Smoke	Alc.	Nutr.	Mamm.
Wellness Member	-.02*** (.01)	.04*** (.01)	-.03*** (.00)	-.02*** (.00)	-.02* (.01)	.07*** (.01)
Mean Dep. Var.	.32	.67	.03	.04	.17	.43
Charlson Index	Yes	Yes	Yes	Yes	Yes	Yes
Medical Utilization Intensity	No	No	No	No	No	No
Demographic Var.	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	31342	31342	31342	31342	31342	15830
r^2	.06	.14	.05	.04	.06	.14
Wellness Member	-.04*** (.01)	.03*** (.01)	-.04*** (.00)	-.03*** (.00)	-.03*** (.01)	.05*** (.01)
Mean Dep. Var.	.33	.67	.05	.06	.19	.43
Charlson Index	No	No	No	No	No	No
Medical Utilization Intensity	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Var.	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	34476	34476	34476	34476	34476	17384
r^2	.05	.14	.07	.06	.02	.13

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

In each column, the dependent variable is a count of visits by category. The categories are as follows: (1) Emergency visits; (2) Preventive visits; (3) Smoking counseling; (4) Alcohol counseling; (5) Nutritional counseling; (6) Mammography visits.

Standard errors clustered at individual level.

Table 3.8: Two part estimation of Aetna Wellness effect conditional on any expenditure

<i>Dep. Var.: Med. Expenditure</i>	Total		ED		Acute		RX	
	P(Exp>0)	Exp Exp>0	P(Exp>0)	Exp Exp>0	P(Exp>0)	Exp Exp>0	P(Exp>0)	Exp Exp>0
Wellness Member	.03*** (.00)	291.94 (407.88)	.01 (.01)	-34.01 (64.13)	.00 (.00)	-4388.05* (1701.99)	.04*** (.00)	398.01 (246.08)
Mean Dep. Var.	.97	10164.67	.32	1510.35	.10	16882.85	.90	2434.40
Charlson Index	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Medical Utilization Intensity	No	No	No	No	No	No	No	No
Demographic Var.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	31342	30283	31342	10110	31342	2995	31342	28084
r^2		.06		.03		.02		.03
Wellness Member	.04*** (.00)	-316.30 (395.09)	.00 (.01)	-75.57 (61.47)	-.00 (.00)	-4927.47** (1573.52)	.05*** (.01)	270.20 (238.25)
Mean Dep. Var.	.95	9900.10	.31	1498.31	.09	16649.76	.87	2382.06
Charlson Index	No	No	No	No	No	No	No	No
Medical Utilization Intensity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Var.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	34476	32592	34476	10800	34476	3189	34476	30037
r^2		.06		.04		.02		.02

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Each pair of columns represent a type of medical expenditure. For each type of medical expenditure, the first stage is a logit where the dependent is a binary variable for any expenditure. The second stage is a OLS with dependent variable of expenditure, conditional on non-zero level of expenditure. The types of medical expenditure are Total - total medical expenditure; ED - expenditure in emergency room; Acute - inpatient hospital acute expenditure; RX - pharmacy expenditure.

Standard errors clustered at individual level.

Table 3.9: Coefficient estimate on propensity matching of treatment and control by expenditure type.

	Baseline	Matched: ATE
<i>Dependent Variable</i>		
Total Medical Expense	466.17 (398.87)	268.66 (150.70)
Emergency Expense	-2.30 (24.42)	-6.76 (10.12)
Pharmacy Expense	426.84 (227.25)	276.38*** (76.34)
Inpatient Acute	-393.51* (180.21)	-484.91* (199.18)
Other	435.13* (184.68)	392.44** (138.05)
Emergency (number of visits)	-.02 (.02)	-.02 (.01)
Preventive (number of visits)	.25*** (.03)	.25*** (.02)
Inpatient (number of visits)	-.05 (.04)	-.08* (.03)
Outpatient (number of visits)	2.93*** (.29)	2.89*** (.19)
Emergency (ever)	-.02*** (.01)	-.02** (.01)
Preventive (ever)	.04*** (.01)	.04*** (.01)
Smoking cessation	-.03*** (.00)	-.03*** (.00)
Alcohol counseling	-.02*** (.00)	-.02*** (.00)
Nutrition	-.02*** (.01)	-.02** (.01)
Mammograms	.07*** (.01)	.03*** (.01)
Charlson Index	Yes	Yes
Medical Utilization Intensity	No	No
Demographic Var.	Yes	Yes
Year Fixed Effects	Yes	Yes

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.
Standard errors clustered at individual level.

Table 3.10: Coefficient estimate on propensity matching of treatment and control by expenditure type.

	Baseline	Matched: ATE
<i>Dependent Variable</i>		
Total Medical Expense	4.13 (379.79)	316.61 (171.27)
Emergency Expense	-20.43 (22.79)	-6.21 (9.05)
Pharmacy Expense	328.56 (2215.25)	298.62** (101.33)
Inpatient Acute	-505.55** (161.51)	-386.84** (145.69)
Other	201.55 (181.00)	182.04 (141.88)
Emergency (number of visits)	-.04* (.02)	-.03* (.01)
Preventive (number of visits)	.21*** (.03)	.21*** (.02)
Inpatient (number of visits)	-.09* (.03)	-.07** (.03)
Outpatient (number of visits)	2.19*** (.26)	2.32*** (.17)
Emergency (ever)	-.04*** (.01)	-.03*** (.01)
Preventive (ever)	.03*** (.01)	.03*** (.01)
Smoking cessation	-.04*** (.00)	-.03*** (.00)
Alcohol counseling	-.03*** (.00)	-.03*** (.00)
Nutrition	-.03*** (.01)	-.03*** (.01)
Mammograms	.05*** (.01)	.01 (.01)
Charlson Index	No	No
Medical Utilization Intensity	Yes	Yes
Demographic Var.	Yes	Yes
Year Fixed Effects	Yes	Yes

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

Table 3.11: Covariate characteristics after manual balancing by treatment status.

Variable	Control		Treated		Norm. Diff.	$\pi^{0.05}$	
	Mean	Std. Dev.	Mean	Std. Dev.		Control	Treated
Age	46.69	11.39	46.64	10.12	-.0052	.0705	.0242
Female	.4460	.4970	.5837	.4929	.2783	0	0
Dependents	1.22	1.35	1.41	1.41	.1377	.0159	.0195
Ln(Salary)	10.88	.8025	10.89	.6633	.0143	.0595	.0445
Medical Utilization	4.49	2.93	4.85	3.07	.1215	.0188	.0369
Family Health	.3582	.9126	.3240	.7950	-.0399	.0251	.0068

Normalized difference defined as $ND = \frac{Mean_T - Mean_C}{\sqrt{(Var_T + Var_C)}/2}$

$\pi_{Control}^{0.05}$ is the percentage of treated sample in the 5% outlier range of the control group. $\pi_{Treated}^{0.05}$ is the percentage of control sample in the 5% outlier range of the treated group.

Table 3.12: Coefficient on switching dummy by expenditure type comparing baseline to matched and manually balanced matched.

<i>Dependent Variable</i>	Baseline	Matched: ATE	
	Coeff./ Robust Std. Err.	Stata Balanced Coeff./ Robust Std. Err.	Manually Balanced Coeff./ Robust Std. Err.
Total Medical Expense	50.46 (373.92)	198.45 * (154.74)	179.08 (159.94)
Emergency Expense	-17.42 (23.77)	-18.41 (10.13)	-14.57 (8.66)
Pharmacy Expense	284.24 (205.41)	291.89*** (82.67)	265.07** (86.12)
Inpatient Acute	-436.41** (161.91)	-331.20* (159.32)	-429.38** (164.55)
Other	361.25 (195.80)	456.96** (163.50)	191.84 (134.79)
Emergency (number of visits)	-.02 (.02)	-.03* (.01)	-.03* (.01)
Preventive (number of visits)	.49*** (.03)	.45*** (.02)	.21*** (.02)
Inpatient (number of visits)	-.06 (.04)	-.07* (.03)	-.06* (.02)
Outpatient (number of visits)	2.44*** (.29)	2.14*** (.18)	2.24*** (.15)
Emergency (ever)	-.03*** (.01)	-.03*** (.01)	-.03*** (.01)
Preventive (ever)	.05*** (.01)	.06*** (.01)	.04*** (.01)
Smoking cessation	-.03*** (.00)	-.03*** (.00)	-.02*** (.00)
Alcohol counseling	-.03*** (.00)	-.03*** (.00)	-.02*** (.00)
Nutrition	-.03*** (.01)	-.03*** (.01)	-.02*** (.00)
Mammograms	.04*** (.01)	.02** (.01)	.02*** (.01)
Demographic Var.	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.
Standard errors clustered at individual level.

Stata Balanced: uses Stata *teffects* command with nearest neighbor matching and robust standard errors, does not adjust for covariate balancing by strata. *Manually Balanced:* uses Imbens and Rubin (forthcoming) suggested method for covariate balancing by strata, followed by Stata *teffects* command with nearest neighbor matching.

Table 3.13: Baseline estimates for comparison of treatment and control after switching to Aetna Wellness.

<i>Dep. Var.: Expenditure</i>	Total	ED	RX	IP Acute	Other
After Switching	760.81 (427.68)	-94.48*** (24.98)	52.11 (110.50)	-157.70 (255.07)	960.88*** (256.48)
Mean Dep. Var.	9820.83	487.02	2181.32	1610.97	5541.51
Charlson Index	Yes	Yes	Yes	Yes	Yes
Medical Utilization Intensity	No	No	No	No	No
Demographic Var.	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	31342	31342	31342	31342	31342
r^2	.07	.04	.03	.01	.08
After Switching	464.00 (427.03)	-107.90*** (24.41)	14.12 (112.14)	-252.63 (245.97)	810.40** (259.28)
Mean Dep. Var.	9358.73	469.21	2075.33	1537.91	5276.29
Charlson Index	No	No	No	No	No
Medical Utilization Intensity	Yes	Yes	Yes	Yes	Yes
Demographic Var.	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	34476	34476	34476	34476	34476
r^2	.06	.05	.03	.01	.07

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

The dependent variables are: Total - total allowed amount by insurance; ED - total allowed expenditure where emergency department is place of service; RX - total allowed pharmacy expenditure; IP Acute - total allowed inpatient acute medical expenditure; Other - all other medical expenditure.

Standard errors clustered at individual level.

Table 3.14: Baseline estimates for comparison of treatment and control in utilization after switching to Aetna Wellness (intensive margin).

<i>Dep. Var.: Number of Visits</i>	Emergency	Preventive	Inpatient	Outpatient
After Switching	-.13*** (.02)	.21*** (.04)	-.05 (.04)	4.61*** (.38)
Mean Dep. Var.	.51	1.63	.38	16.87
Charlson Index	Yes	Yes	Yes	Yes
Medical Utilization Intensity	No	No	No	No
Demographic Var.	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	30319	30319	30319	30319
r^2	.08	.21	.01	.22
After Switching	-.16*** (.02)	.18*** (.04)	-.09* (.04)	4.05*** (.36)
Mean Dep. Var.	.50	1.60	.38	16.51
Charlson Index	No	No	No	No
Medical Utilization Intensity	Yes	Yes	Yes	Yes
Demographic Var.	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	32633	32633	32633	32633
r^2	.10	.24	.01	.29

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

The dependent variables are: Emergency - number of visits where emergency department is the place of service; Preventive - number of preventive visits; Inpatient - number of inpatient visits; Outpatient - number of outpatient visits.

Standard errors clustered at individual level.

Table 3.15: Baseline estimates for comparison of treatment and control in utilization after switching to Aetna Wellness (extensive margin).

<i>Dep. Var.: Ever Visit</i>	(1)	(2)	(3)	(4)	(5)	(6)
	ED	Prev.	Smoke	Alc.	Nutr.	Mamm.
After Switching	−.08*** (.01)	.03** (.01)	−.04*** (.00)	−.03*** (.00)	−.02* (.01)	.05*** (.01)
Mean Dep. Var.	.32	.67	.03	.04	.17	.43
Charlson Index	Yes	Yes	Yes	Yes	Yes	Yes
Medical Utilization Intensity	No	No	No	No	No	No
Demographic Var.	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	31342	31342	31342	31342	31342	15830
r^2	.07	.14	.05	.04	.06	.13
After Switching	−.11*** (.01)	.01 (.01)	−.06*** (.00)	−.06*** (.00)	−.05*** (.01)	.03* (.01)
Mean Dep. Var.	.33	.67	.05	.06	.19	.43
Charlson Index	No	No	No	No	No	No
Medical Utilization Intensity	Yes	Yes	Yes	Yes	Yes	
Demographic Var.	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	34476	34476	34476	34476	34476	17384
r^2	.06	.14	.07	.06	.02	.13

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

In each column, the dependent variable is a count of visits by category. The categories are as follows: (1) Emergency visits; (2) Preventive visits; (3) Smoking counseling; (4) Alcohol counseling; (5) Nutritional counseling; (6) Mammography visits.

Standard errors clustered at individual level.

Table 3.16: Two part estimation of Aetna Wellness effect after switching conditional on any expenditure

<i>Dep. Var.: Med. Expenditure</i>	Total		ED		Acute		RX	
	P(Exp>0)	Exp Exp>0	P(Exp>0)	Exp Exp>0	P(Exp>0)	Exp Exp>0	P(Exp>0)	Exp Exp>0
After Switching	.14*** (.02)	468.90 (432.72)	-.06*** (.01)	-8.13 (77.44)	.00 (.01)	-2057.06 (2739.47)	.04*** (.01)	-8.30 (119.04)
Mean Dep. Var.	.97	10164.67	.32	1510.35	.10	16882.85	.90	2434.40
Charlson Index	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Medical Utilization Intensity	No	No	No	No	No	No	No	No
Demographic Var.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	31342	30283	31342	10110	31342	2995	31342	28084
r ²		.06		.03		.02		.03
After Switching	.21*** (.03)	-133.39 (413.83)	-.07*** (.01)	-56.97 (80.34)	-.01 (.01)	-214.53 (2606.67)	.06*** (.01)	-223.73 (118.74)
Mean Dep. Var.	.95	9674.83	.31	1491.20	.09	16570.42	.87	2352.96
Charlson Index	No	No	No	No	No	No	No	No
Medical Utilization Intensity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Var.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	32756	31049	32756	10150	32756	2960	32756	28653
r ²		.04		.03		.01		.02

*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Each pair of columns represent a type of medical expenditure. For each type of medical expenditure, the first stage is a logit where the dependent is a binary variable for any expenditure. The second stage is a OLS with dependent variable of expenditure, conditional on non-zero level of expenditure. The types of medical expenditure are Total - total medical expenditure; ED - expenditure in emergency room; Acute - inpatient hospital acute expenditure; RX - pharmacy expenditure.

Standard errors clustered at individual level.

Table 3.17: Covariate characteristics after manual balancing by treatment status.

Variable	Control		Treated		Norm. Diff.	$\pi^{0.05}$	
	Mean	Std. Dev.	Mean	Std. Dev.		Control	Treated
Age	46.75	10.97	48.23	10.12	.1403	.0657	.0311
Female	.5049	.4999	.6148	.4866	.2228	0	0
Dependents	1.26	1.37	1.39	1.41	.0922	.0165	.0206
Ln(Salary)	10.89	.7262	10.86	.8595	-.0417	.0286	.1544
Faculty	-2.08	14.99	-3.64	19.23	-.0901	0	.0390
Medical Utilization	2.56	.8851	2.69	.8263	.1480	.0166	.0136
Family Health	.2077	.6594	.2074	.6069	-.0004	.0091	.0086

Normalized difference defined as $ND = \frac{Mean_T - Mean_C}{\sqrt{(Var_T + Var_C)}/2}$

$\pi_{Control}^{0.05}$ is the percentage of treated sample in the 5% outlier range of the control group. $\pi_{Treated}^{0.05}$ is the percentage of control sample in the 5% outlier range of the treated group.

Table 3.18: Coefficient estimate on propensity matching of treatment and control by expenditure type after switching to Aetna Wellness.

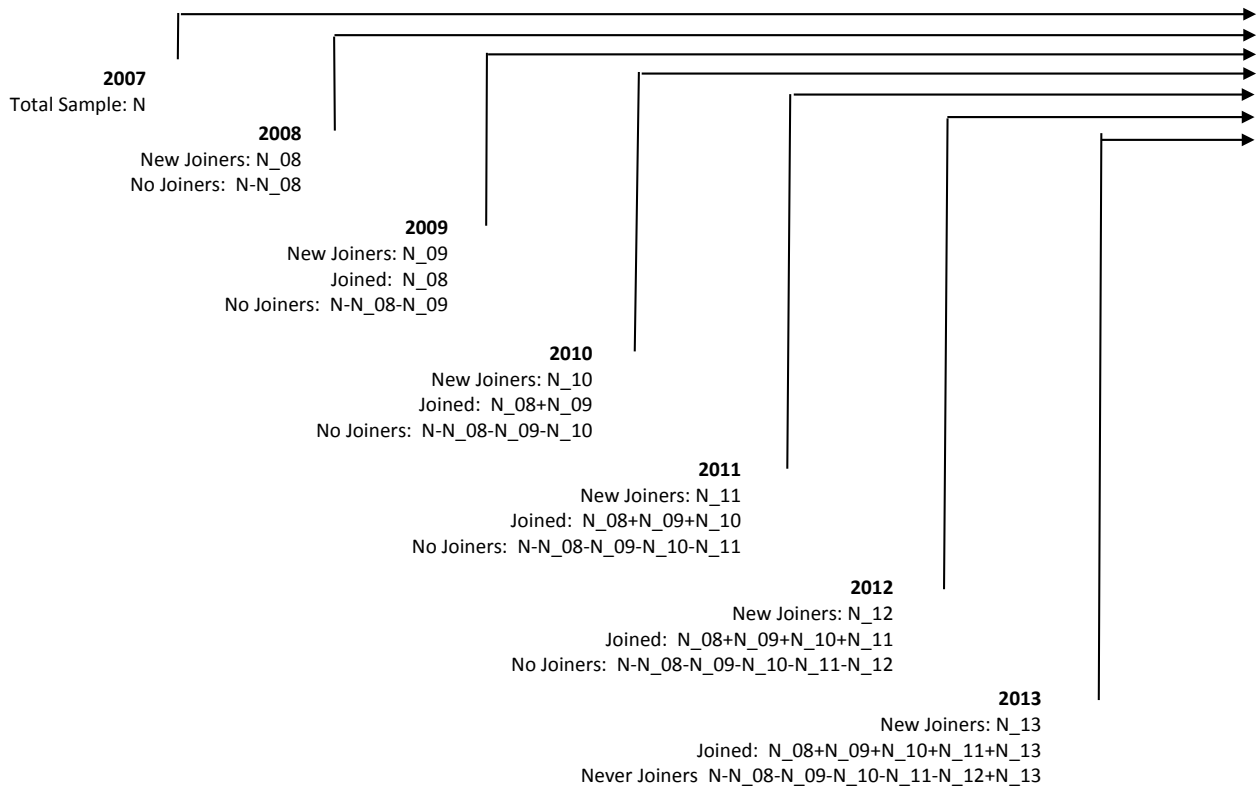
<i>Dependent Variable</i>	Baseline	Matched: ATE	
		Stata Balanced	Manually Balanced
Total Medical Expense	133.65 (562.99)	242.15 (189.67)	56.10 (185.35)
Emergency Expense	-166.67*** (34.25)	-69.04*** (11.08)	-70.57*** (10.86)
Pharmacy Expense	-531.99* (271.22)	-72.18 (55.59)	-72.44 (73.84)
Inpatient Acute	123.53 (294.72)	-328.96 (213.93)	-394.52* (194.09)
Other	776.52** (252.97)	435.83* (187.71)	556.02** (197.24)
Emergency (number of visits)	-.19*** (.02)	-.19*** (.02)	-.17*** (.02)
Preventive (number of visits)	.99*** (.05)	1.02*** (.05)	.08* (.04)
Inpatient (number of visits)	-.05 (.04)	-.11* (.05)	-.12*** (.04)
Outpatient (number of visits)	4.05*** (.46)	4.23*** (.34)	4.25*** (.33)
Emergency (ever)	-.10*** (.01)	-.10*** (.01)	-.09*** (.01)
Preventive (ever)	.08*** (.01)	.11*** (.01)	.02 (.01)
Smoking cessation	-.02*** (.00)	-.03*** (.00)	-.03*** (.00)
Alcohol counseling	-.01* (.00)	-.02*** (.00)	-.02*** (.00)
Nutrition	-.01 (.01)	-.02 (.01)	-.01 (.01)
Mammograms	.01 (.01)	.02* (.01)	.03*** (.01)
Demographic Var.	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

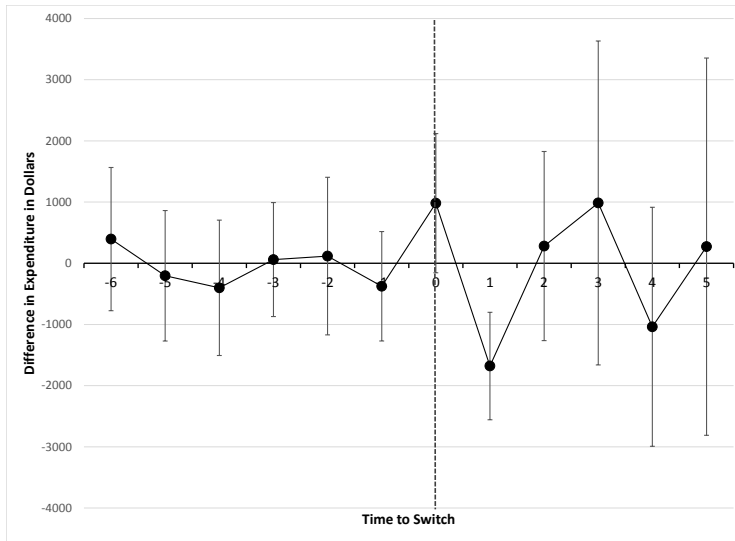
*** Significant at 0.1 percent level. ** Significant at 1 percent level. * Significant at 5 percent level.

Standard errors clustered at individual level.

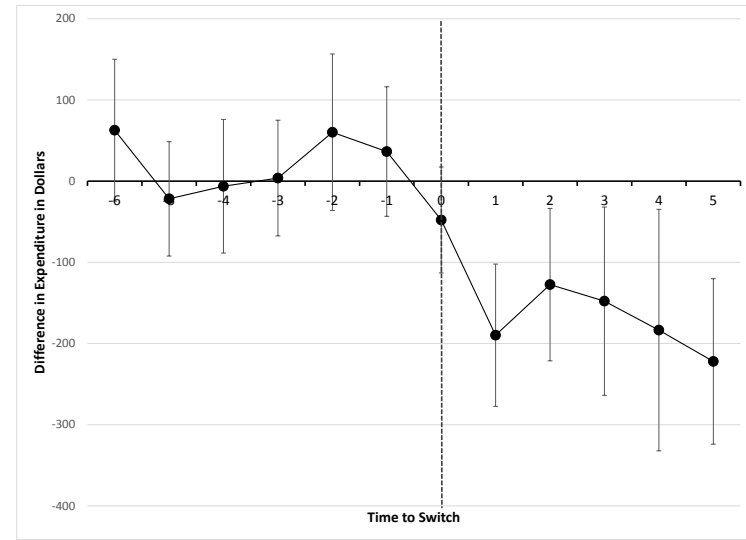
Stata Balanced: uses Stata *teffects* command with nearest neighbor matching and robust standard errors, does not adjust for covariate balancing by strata. *Manually Balanced:* uses Imbens and Rubin (forthcoming) suggested method for covariate balancing by strata, followed by Stata *teffects* command with nearest neighbor matching.

Figure 3.1: Treatment v. Control: Time of joining Aetna Wellness.

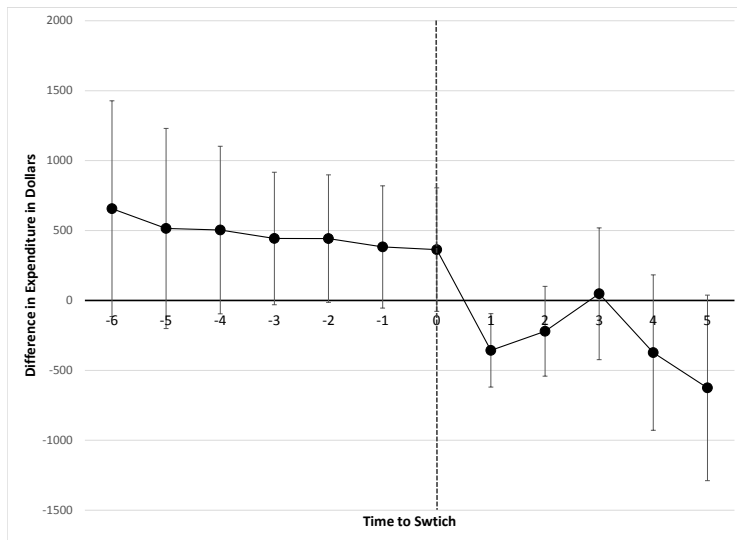




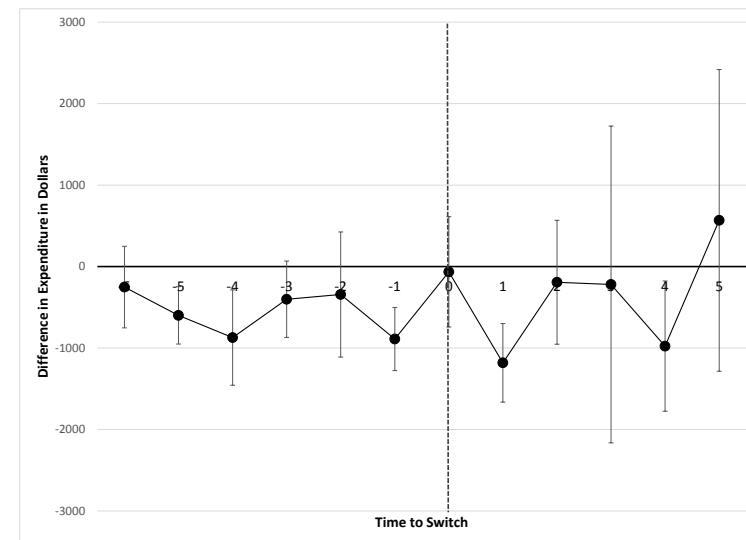
(a) Total Expenditure



(b) Emergency Expenditure



(c) Pharmacy Expenditure



(d) Inpatient Acute Expenditure

Figure 3.2: Event Study by Expenditure Type

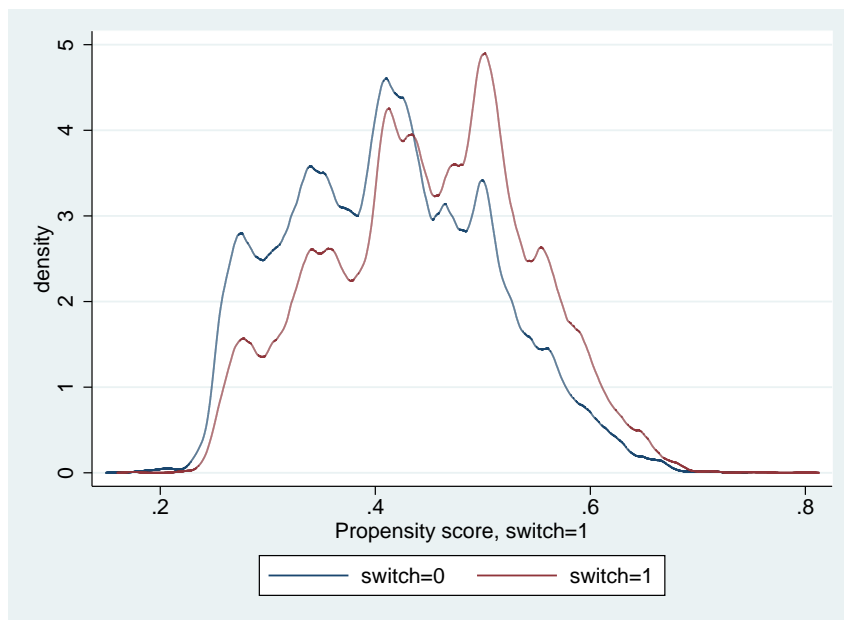


Figure 3.3: Propensity score by treatment category.

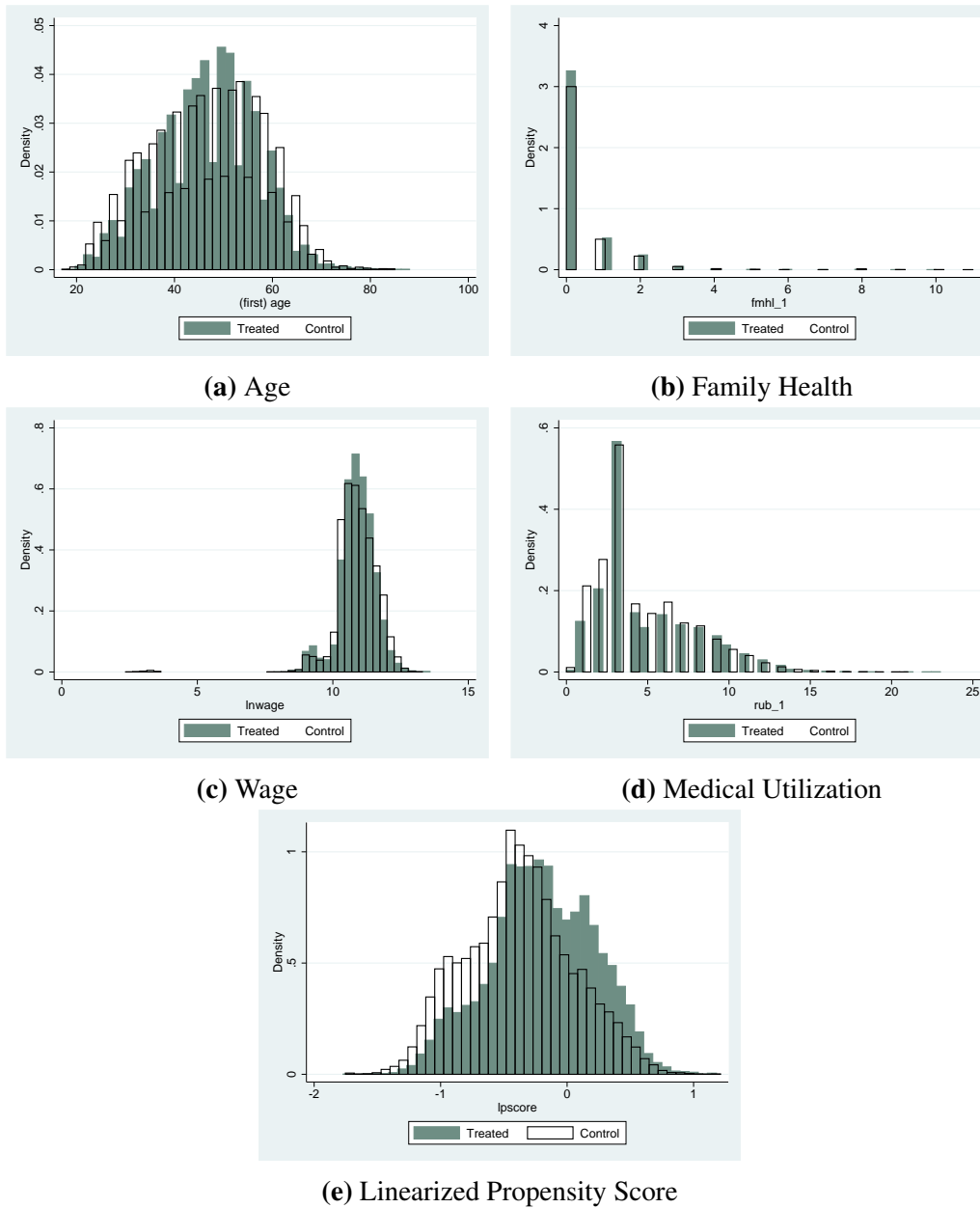


Figure 3.4: Covariate by treatment status after manual balancing.

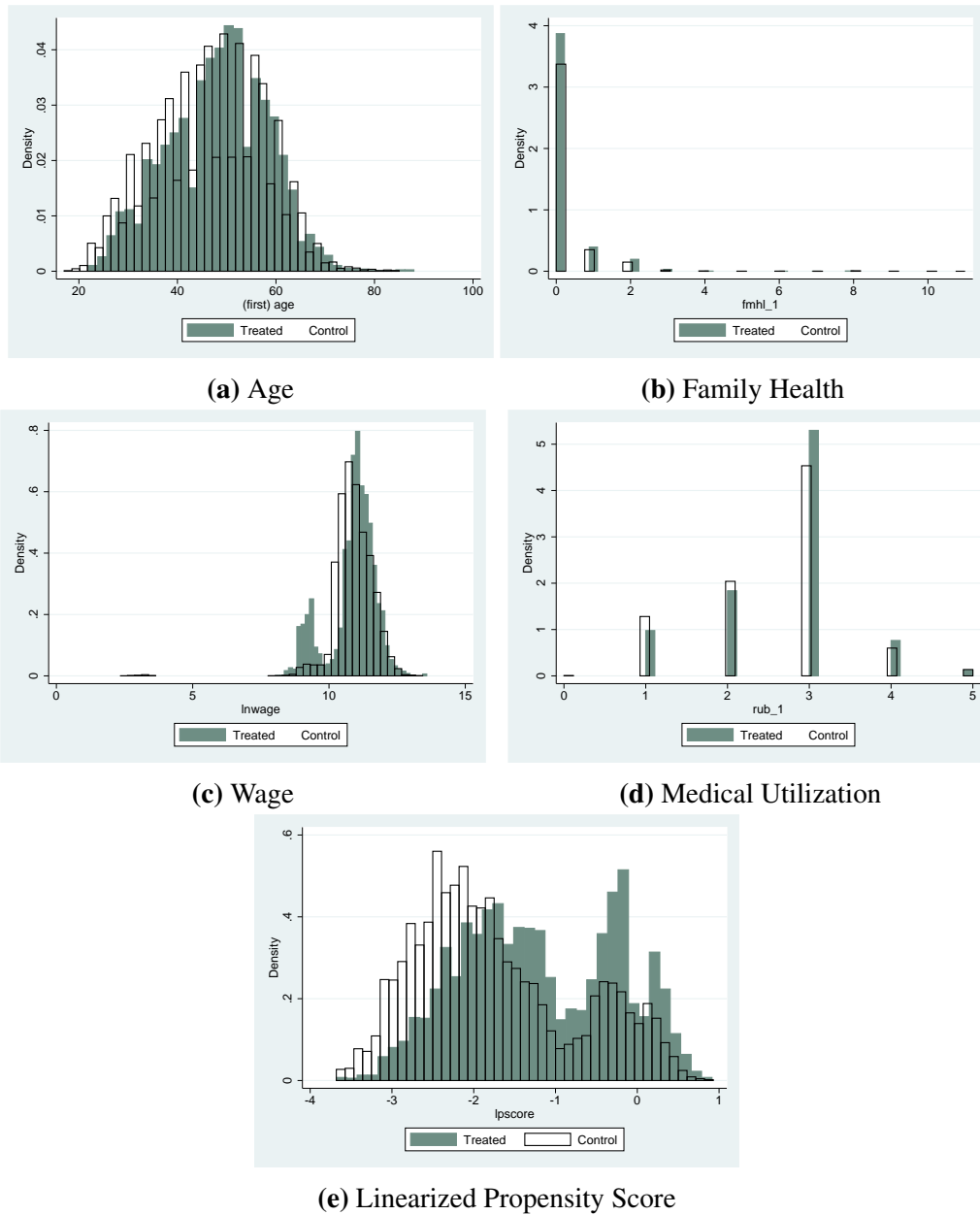


Figure 3.5: Covariate by treatment status after manual balancing (after switching).

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