KING COUNTY

Signature Report

December 11, 2012

Motion 13794

1200 King County Courthouse
516 Third Avenue
Seattle, WA 98104

King County

Proposed No. 2012-0342.1   **Sponsors** Patterson

1   A MOTION acknowledging the Report on Savings Factors

2   of Healthcare Costs, 2007-2011 in compliance with the

3   2012 Budget Ordinance, Ordinance 17232, Section 107,

4   Proviso P1.

5   WHEREAS, the 2012 Budget Ordinance, Ordinance 17232, Section 107, Proviso

6   P1, requires the executive to transmit a motion and report by August 15, 2012, and

7   WHEREAS, the proviso stipulates that the report shall provide a statistical

8   analysis of factors that led to savings in healthcare costs including but not be limited to:

9   1) the extent to which costs have been shifted to employees; 2) improvements in the

10   health of employees, dependents and covered spouses or partners; 3) changes in generic

11   and brand-name prescription drug utilization; 4) increased utilization of Group Health; 5)

12   participation in the Healthy Incentives wellness assessment and individual action plans;

13   6) changes in the percentages of employees categorized in the gold, silver or bronze

14   categories; 7) the reduction in the size of the work force; and 8) other factors leading to

15   savings in healthcare costs;

16   WHEREAS, the executive has prepared and transmitted a report that conforms to

17   the requirements of this proviso;

18   NOW, THEREFORE, BE IT MOVED by the Council of King County:

19   The Report on Savings Factors of Healthcare Costs, 2007-2011, Attachment A to

20   this motion, is hereby acknowledged.

21

        Motion 13794 was introduced on 9/10/2012 and passed by the Metropolitan King
        County Council on 12/10/2012, by the following vote:

                    Yes: 8 - Mr. Phillips, Mr. von Reichbauer, Mr. Gossett, Ms. Hague,
                    Ms. Patterson, Ms. Lambert, Mr. Dunn and Mr. McDermott
                    No: 0
                    Excused: 1 - Mr. Ferguson

                                            KING COUNTY COUNCIL
                                            KING COUNTY, WASHINGTON

                                            _____
                                            Larry Gossett, Chair

ATTEST:

_____

Anne Noris, Clerk of the Council

Attachments: A. Report on Savings Factors of Healthcare Costs 2007-2011

Report on Savings Factors of Healthcare Costs
2007-2011

Economic Analysis Section
Office of Performance, Strategy and Budget
Office of the King County Executive Dow Constantine

August 15, 2012

Executive Summary

Pursuant to a proviso in the 2012/2013 Adopted Budget, Ordinance 17232, the County Executive is to "provide a statistical analysis of factors that led to savings in healthcare costs." The cost effects of seven specific factors are requested by the proviso. From 2007 to 2011 the factors listed in the proviso decreased the County's expenditures cumulatively by $59.7 million and increased employees' out-of-pocket expenditures by $4 million.

The separate effect on costs of each factor are:

1) The extent to which costs have been shifted to employees (see Table 2, page 8 and Table 5, page 11)
   a. Since the start of Healthy Incentives^{SM} in 2007, $10.8 million ($9.47 million in medical costs and $1.37 million in prescription costs) have been shifted to County employees, with 80% of the shift occurring in the last two years.
   b. Employee out-of-pocket expenditures net of changes in utilization, health and switching enrollment to Group Health increased $4 million over this time period.

2) Improvements in the health of employees and covered spouses or partners (see Table 10, page 20)
   a. From 2007 to 2011, the County's healthcare expenditures decreased $14.6 million due to health improvements of its employees and covered spouses and partners.
   b. Employee out-of-pocket expenditures decreased $0.6 million due to health improvements over this same time period.

3) Changes in generic and brand-name prescription drug utilization (see Table 5, page 11)
   a. Changes in the KingCare^{SM} prescription drug co-payment amounts starting in 2010 decreased the County's share of prescription drug utilization by $0.5 million in 2010 and $1.9 million in 2011.
   b. Employee share of prescription drug utilization decreased $0.4 million in 2010 and $0.6 million in 2011.

4) Increased utilization of Group Health (see Tables 12 and 13, page 22)
   a. The employee enrollment switch from KingCare^{SM} to Group Health saved the County $3.6 million in 2010 and $2.9 million in 2011.
   b. The enrollment switch saved employees $1.0 million in 2010 and $1.2 million in 2011.

5) Participation in the Healthy Incentives wellness assessment and individual action plans (see Table 10, page 20)
   a. The effect on County costs was equal to the impact of health improvements or $14.6 million from 2007 to 2011.

6) Changes in the percentages of employees categorized in the gold, silver or bronze categories (see Section II, page 7)

a. The increase in the number of silver Healthy Incentives^{SM} participants in 2011 decreased County expenditures by $1 million.

7) The reduction in the size of the work force (see Table 14, page 23)
   a. Layoffs led to a decrease in County expenditures of $3.8 million in 2010 and $10.1 million in 2011.

8) Other factors leading to savings in healthcare costs (see Table 2, page 8)
   a. In addition to the cost shift to employees, utilization decreases caused by changes in deductible limits, coinsurance rates and copayment amounts saved the County $13.8 million from 2007 to 2011.

In September 2011, King County Executive Dow Constantine announced a reduction in budgetary projections of employee health insurance benefit costs totaling $61 million for 2011 and 2012. This reduction was the result of budget forecasts that were higher than actual costs in 2010 and 2011. Analysis indicates that during those years plan design changes decreased the County's expenditures by a total of $25 million. It is expected that a similar order of magnitude of savings due to plan design change will be achieved in 2012. The amount cannot be determined until data for that year is available.

I. Introduction

In September 2011, King County Executive Dow Constantine announced a reduction in budgetary projections of employee health insurance benefit costs totaling $61 million for 2011 and 2012. Subsequently, the King County Council included a proviso in the 2012 budget requiring the Office of Performance, Strategy and Budget to prepare a report that

> "shall provide a statistical analysis of factors that led to savings in healthcare costs. The report shall also include, but not be limited to: 1) the extent to which costs have been shifted to employees; 2) improvements in the health of employees, dependents and covered spouses or partners; 3) changes in generic and brand-name prescription drug utilization; 4) increased utilization of Group Health; 5) participation in the Healthy Incentives wellness assessment and individual action plans; 6) changes in the percentages of employees categorized in the gold, silver or bronze categories; 7) the reduction in the size of the work force; and 8) other factors leading to savings in healthcare costs."

This report responds to the budget proviso. It relies on data collected during the years 2006 through 2011 from 100,830 wellness assessments and 7,944,857 medical and prescription drug claims. The claims covered 2,185,929 health insurance plan member months and totaled $968 million in expenditures by the County and its employees. Fifty separate statistical models were estimated. While this report attempts to explain how each figure was calculated using these models, some details are quite technical and are discussed only in the technical appendix.

The reader is assumed to be familiar with the County's workplace wellness program, Healthy Incentives[SM] (HI). For those less familiar with this program, a description of it is provided in Appendix A.

The report is organized into four main sections that answer the seven questions posed by the budget proviso. Section II, Plan Design Changes, answers proviso questions 1, 3 and 6. Section III, Changes in Health, answers proviso questions 2 and 5. Section IV, Enrollment Shift to Group Health, answers proviso question 4. Section V, Layoffs, answers proviso question 7. Section VI contemplates other causes for the County's decrease in healthcare expenditures. The report is concluded in Section VII.

II. Plan Design Changes

To provide an incentive to participate in HI, several changes were made to the plan designs. These changes for KingCare[SM] medical expenditures consisted in establishing a three-tiered system in 2007 where gold members paid the lowest deductible limits and co-insurance rates, silver members paid more than gold members and bronze members paid the most. The KingCare[SM] deductible limits and co-insurance rates for all three tiers were increased in 2010. In 2007, Group Health members in the gold tier paid the lowest co-payment amount for healthcare

services and silver and bronze members paid larger co-payment amounts. There was no change in medical co-payment amounts for Group Health members in 2010.

Both KingCare^{SM} and Group Health prescription benefits required lower co-payment amounts for generic drugs and larger co-payment amounts for non-generic drugs. In 2010, the co-payment amounts for KingCare^{SM} prescription expenditures were changed. Co-payment amounts for generic drugs were decreased and co-payment amounts for non-generic drugs were increased. There was no change in prescription co-payment amounts for Group Health members in 2010.

Cost-Shifts, Utilization and Increases in Out-of-Pocket Expenditures

Besides encouraging employees to complete a wellness assessment questionnaire (WAQ) and a 10-week individual action plan, higher out-of-pocket rates (i.e. deductibles, co-insurance rates and co-payments) shift costs to employees. Cost-shifts are the increase in out-of-pocket expenditures that would be borne by the employees if the quantity of medical services and prescription drugs (i.e., utilization) did not change in response to the higher out-of-pocket rates. The fact that utilization often decreases in response to higher out-of-pocket rates means that the increase in out-of-pocket expenditures is often less than the shift in costs.

Therefore simply measuring the change in employee out-of-pocket expenditures will not answer the proviso question regarding the shifting of costs to employees. The change in utilization in response to the plan design changes must also be measured.

Estimation Steps

To deduce the shift in costs and the change in utilization, a multi-step process that relies on algebra and statistical modeling is required. The change in the County's expenditures caused by plan design changes is the sum of the shift in costs and the County's share of the change in utilization. The change in the employees' expenditures is the difference between the employees' share of the change in utilization and the shift in costs. So we have three separate cost effects to measure: the County's share of the change in utilization, the employees' share of the change in utilization and the shift in costs.

The first step is to measure the change in utilization on combined employee and County expenditures due to the change in the plan design. Changes in combined employee and County expenditures are purely utilization changes because cost shifts from the County to employees are cancelled out in the combined figure. The relationship between combined employee and County expenditures and the out-of-pocket rates are estimated via a statistical model.

In the next step, we estimate a statistical model of the relationship between County expenditures and the instruments of the plan design changes. We then calculate the change in employee expenditures by subtracting the change in County expenditures from the change in combined County and employee expenditures.

Next we estimate the shift in costs. This is done by subtracting from actual out-of-pocket expenditures the out-of-pocket expenditures employees would have paid if the deductibles, co-insurance rates and co-payments had not increased and utilization was held constant. For example, from 2009 to 2010 the deductible for individual gold members of KingCare^{SM} increased from $100 to $300. The claims records tell us the out-of-pocket expenditures that these members actually incurred in 2010 under the higher deductible. To calculate the cost shift, we subtract what their out-of-pocket expenditures would have been in 2010 if their utilization was exactly the same as observed in 2010, but their deductible was still only $100.

In the last two steps, we subtract the shift in costs from the County's change in expenditures to derive the County's share of the change in utilization and add the shift in costs to the employees' change in expenditures to derive the employees' share of the change in utilization. That leaves us with estimates of the three separate cost effects.

Medical Cost Effects of KingCare^{SM} and Group Health Plan Design Changes

Table 1 presents the deductible coefficients from the KingCare^{SM} healthcare cost regression models. These model coefficients tell us that before a KingCare^{SM} member's annual deductible limit is reached, monthly healthcare expenditures are lower than after the deductible limit is reached. For example, the County and HI participants spend $159.08 less per month for in-network healthcare for each HI participant during the months the participants are still paying their deductibles. The larger a member's annual deductible limit, the more months that member will bear the full cost of treatment. This greater burden will in turn lead to lower utilization of healthcare.

Table 1. KingCare Healthcare Cost Regression Model Deductible Coefficients

Item	Employee and County			County		
		95% Conf. Interval			95% Conf. Interval	
	Coefficient	Lower	Upper	Coefficient	Lower	Upper
In-Network						
HI Participant	-$159.08	-$174.19	-$143.96	-$199.26	-$214.25	-$184.28
Non-Participant	-$16.14	-$34.02	$1.75	-$52.07	-$69.85	-$34.29
Out-of-Network						
HI Participant	-$5.96	-$8.86	-$3.06	-$8.02	-$10.88	-$5.17
Non-Participant	-$3.34	-$5.15	-$1.53	-$4.47	-$6.24	-$2.71

In contrast, our models found no measurable utilization effect on combined County and employee KingCare^{SM} expenditures from a change in the co-insurance rate. This could be because the changes in the co-insurance rates were so small – a 5% change for gold members in 2010 – that the resulting utilization effect was too small for our statistical models to detect. It could also be because the co-insurance rates were increased ambiguously in 2010 and 2011. For

example, from 2007 to 2009 a KingCare[SM] individual member in the gold tier paid 100% of the first $100 of expenditures in a year (the deductible), 10% of the next $7,000 of expenditures (the co-insurance payments) and 0% of expenditures over $7,100. After the plan changes that took effect in 2010, that same individual member paid 100% of the first $300 of expenditures, 15% of the next $3,333 of expenditures and 0% of expenditures over $3,633. So from 2009 to 2010 the co-insurance rate increased from 10% to 15% for annual expenditure amounts between $300 and $3,633 and underlined decreased from 10% to 0% for annual expenditure amounts between $3,633 and $7,100.

Our models could find no utilization effects from the plan design changes for Group Health expenditures either. Rather than by deductibles and co-insurance rates, Group Health out-of-pocket expenditures are determined by employee co-payments, i.e., a fixed dollar amount per visit depending on gold/silver/bronze tier. Since the per visit co-payment amount was constant across time and constant across members, a cross-sectional-time-series monthly expenditure model will not be able to estimate the effect of a change in the co-payment amount. So we must assume the utilization effect for Group Health members was zero. In any event, the co-payment changes in 2007 were very small and applied only to a small minority of Group Health members. Therefore any utilization effect was likely small as well.

Table 2 (next page) presents the medical cost effects of the plan design changes from 2007 to 2011. Combined County and employee expenditures decreased $14.5 million with 95% of that being in-network. County expenditures decreased $21 million and employee expenditures increased $6.5 million. The shift in cost from the County to employees over this time period was $9.5 million. The change in expenditures was much greater in 2010 and 2011 than in the previous three years.

One of the reasons for the greater cost reductions in 2011 is that 4,790 gold tier members in 2010 became silver tier members in 2011. Starting in 2010 the WAQ and the ten-week action plan were administered by WebMD. The action plan requirements were revised by the County that same year to channel a significant number of members who had previously been able to achieve the gold tier through telephone coaching calls to now use the computer to choose and to track their action plan online. Some participants were confused by the rule change and found WebMD's website difficult to understand. This led to a reduction in the number of participants able to qualify for gold status. It is estimated that $475,119 of the $3.6 million cost shift in 2011 was due to the decrease in the number of gold tier members. The net increase in employee expenditures was $324,587 and the County's expenditures decreased $960,730.

Table 2. Changes in Medical Expenditures Due to Plan Design Changes, 2007- 2011

Category	Incurred Year					Total
	2007	2008	2009	2010	2011	
County and Employees						
Utilization	-$1,185,940	-$984,736	-$700,845	-$6,168,200	-$5,477,059	-$14,516,780
In-Network	-$1,126,846	-$929,224	-$657,422	-$5,879,265	-$5,218,755	-$13,811,513
Out-of-Network	-$59,094	-$55,512	-$43,423	-$288,934	-$258,304	-$705,267
County	-$1,775,632	-$1,559,712	-$1,177,768	-$8,665,015	-$7,795,480	-$20,973,606
Utilization	-$973,373	-$661,263	-$288,482	-$5,403,778	-$4,181,005	-$11,507,902
In-Network	-$927,565	-$627,941	-$273,202	-$5,158,368	-$3,990,376	-$10,977,453
Out-of-Network	-$45,808	-$33,322	-$15,280	-$245,409	-$190,629	-$530,449
Cost Shift	-$802,258	-$898,448	-$889,285	-$3,261,237	-$3,614,475	-$9,465,704
In-Network	-$680,406	-$776,992	-$769,095	-$3,005,429	-$3,277,563	-$8,509,485
Out-of-Network	-$33,602	-$41,231	-$43,016	-$142,983	-$156,577	-$417,409
Group Health	-$88,250	-$80,225	-$77,175	-$112,825	-$180,335	-$538,810
Employees	$589,692	$574,976	$476,922	$2,496,815	$2,318,421	$6,456,826
Utilization	-$212,567	-$323,472	-$412,363	-$764,422	-$1,296,054	-$3,008,878
In-Network	-$199,281	-$301,283	-$384,220	-$720,897	-$1,228,380	-$2,834,060
Out-of-Network	-$13,286	-$22,189	-$28,143	-$43,525	-$67,675	-$174,818
Cost Shift	$802,258	$898,448	$889,285	$3,261,237	$3,614,475	$9,465,704
In-Network	$680,406	$776,992	$769,095	$3,005,429	$3,277,563	$8,509,485
Out-of-Network	$33,602	$41,231	$43,016	$142,983	$156,577	$417,409
Group Health	$88,250	$80,225	$77,175	$112,825	$180,335	$538,810

Prescription Cost Effects of KingCare^{SM} Plan Design Changes

There are three classifications of prescription drugs (i.e. generic, preferred and non-preferred) and two modes of delivery (i.e. 30-day retail and 90-day mail-order). There is substantial clinical evidence that generic drugs often treat illnesses as well or better than non-generic drugs and always at a much lower cost. Yet since physicians do not bear the cost of the drugs they prescribe and their insured patients bear only a small fraction of the cost, over-use of very expensive non-generic drugs is pervasive nationally.

To alleviate this situation for KingCare^{SM} members, the County and its labor unions collectively bargained a change in the co-payment amounts for prescription drugs starting in 2010. Table 3 shows the schedule of KingCare^{SM} employee co-payment amounts from 2003 to 2012. Notice that the co-payment amounts for generic 30-day retail and 90-day mail-order prescriptions decreased 30% in 2010 while the co-payment amounts for preferred prescriptions increased approximately 50% and the co-payment amounts for non-preferred prescriptions approximately doubled.

Table 3. KingCare^{SM} Co-payment Amounts, 2003-2012

Years	Plan	Generic	Preferred		Non-Preferred	
			Regular	DAW*	Regular	DAW*
2003-2009	Retail	$10	$20	$15	$30	$25
2003-2009	Mail-Order	$20	$40	$30	$60	$50
2010-2012	Retail	$7	$30	$22	$60	$45
2010-2012	Mail-Order	$14	$60	$44	$120	$90

*Dispense As Written

As with the case of the increase in the deductible for KingCare^{SM} medical claims, the change in the employees' out-of-pocket cost caused both a change in utilization and a shift of costs; however, since the changes in the co-payment amounts occurred at the start of 2010 and have continued since, it is impossible for a statistical model to distinguish the change in expenditures due to the co-payment change from the change in expenditures due to a time trend. Therefore an alternative method of estimating the change in expenditures is necessary.

Table 4 shows that the percentage of KingCare^{SM} prescription drug claims shifted towards generic drugs and away from non-generic drugs over the 2009-2011 time span. If we assume this shift is entirely due to the co-payment changes in 2010 and 2011, then the change in expenditures would equal the difference between actual expenditures and the amount of expenditures that would have occurred if the percentage of claims by type had not shifted towards generic drugs.

Table 4. Percentage of KingCare[SM] Prescription Drug
Claims, 2009-2011

Type	Year		
	2009	2010	2011
Generic Retail	52.2%	57.3%	59.9%
Preferred Retail	26.4%	22.9%	22.1%
Non-Pref. Retail	9.1%	5.2%	3.9%
Generic Mail-Order	6.1%	8.3%	8.5%
Preferred Mail-Order	4.9%	5.4%	5.0%
Non-Pref. Mail-Order	1.2%	0.9%	0.5%

The shift in claims was calculated by taking the number of claims by type – assuming the proportion of claims didn't change from 2009 – and multiplying by the change in the co-payment amount.

Table 5 presents the estimated change in KingCare[SM] prescription expenditures in 2010 and 2011. The two-year total decrease in employee and County expenditures was $3.3 million with 75% occurring in 2011. The County's expenditures decreased $3.7 million and the employee's expenditures increased $0.4 million. The cost shift from the County to employees was $1.4 million.

Table 5. Cost Effects of KingCare[SM] Prescription Co-payment Changes, 2010-2011

Category	Incurred Year		
	2010	2011	Total
County and Employees	-$860,852	-$2,423,856	-$3,284,708
Generic Retail	$159,358	$254,355	$413,713
Preferred Retail	-$720,917	-$1,119,197	-$1,840,114
Non-Pref. Retail	-$850,146	-$1,463,594	-$2,313,740
Generic Mail-Order	$197,216	$252,656	$449,872
Preferred Mail-Order	$504,502	$91,782	$596,284
Non-Pref. Mail-Order	-$150,864	-$439,859	-$590,724
County	-$1,171,954	-$2,532,423	-$3,704,377
Utilization	-$484,093	-$1,852,277	-$2,336,370
Generic Retail	$112,356	$183,816	$296,172
Preferred Retail	-$582,320	-$952,191	-$1,534,510
Non-Pref. Retail	-$536,034	-$1,051,816	-$1,587,850
Generic Mail-Order	$156,622	$207,884	$364,506
Preferred Mail-Order	$463,934	$85,091	$549,025
Non-Pref. Mail-Order	-$98,651	-$325,062	-$423,713
Cost Shift	-$687,861	-$680,146	-$1,368,007
Generic Retail	$208,195	$205,860	$414,056
Preferred Retail	-$350,409	-$346,479	-$696,888
Non-Pref. Retail	-$364,386	-$360,299	-$724,685
Generic Mail-Order	$48,363	$47,820	$96,183
Preferred Mail-Order	-$130,857	-$129,390	-$260,247
Non-Pref. Mail-Order	-$98,766	-$97,659	-$196,425
Employees	$311,102	$108,566	$419,668
Utilization	-$376,759	-$571,579	-$948,339
Generic Retail	$47,002	$70,539	$117,540
Preferred Retail	-$138,598	-$167,006	-$305,604
Non-Pref. Retail	-$314,112	-$411,778	-$725,890
Generic Mail-Order	$40,594	$44,772	$85,366
Preferred Mail-Order	$40,568	$6,691	$47,259
Non-Pref. Mail-Order	-$52,213	-$114,797	-$167,010
Cost Shift	$687,861	$680,146	$1,368,007
Generic Retail	-$208,195	-$205,860	-$414,056
Preferred Retail	$350,409	$346,479	$696,888
Non-Pref. Retail	$364,386	$360,299	$724,685
Generic Mail-Order	-$48,363	-$47,820	-$96,183
Preferred Mail-Order	$130,857	$129,390	$260,247
Non-Pref. Mail-Order	$98,766	$97,659	$196,425

III. Changes in Health

For the purposes of this study we used the answer to the general health question in the WAQ as the measure of individual health. This question asks each participant to rank their general health by one of five descriptions: excellent, very good, good, fair and poor. First we estimated what each participant's general health status would have been had HI not been implemented. Then we estimated the relationship between general health and expenditures on healthcare and prescription drugs. Finally we used those two sets of results together to estimate what the medical and prescription costs would have been if the participants' health status had not changed. A concise and accurate measure of one's health is difficult to find since it is a multi-faceted concept, both subjective and objective at the same time.

The evidence that the health of HI participants improved over time and relative to a national control group is quite strong. From Table 6 we see that 6.7% more HI participants reported an improvement in general health than reported a decline during the first year of the program. This compares to a 1.7% net reduction in those who reported an improvement during a year's time in a matched national control group of people who have health insurance from their employer or their spouse's employer. The improvement in the general health of HI participants relative to the control group is 8.5% with a 95% confidence interval from 6.9% to 10.0%.

Table 6. First-year Changes in Health Status
Healthy Incentives[SM] vs. Control Group
2006-2011

Health Status	Healthy Incentives[SM] (1)	Control Group (2)	Difference (1) - (2)
Improved	23.0%	23.3%	-0.3%
Declined	16.2%	25.0%	-8.8%
Net Improved	6.7%	-1.7%	8.5%

Two major objectives of Healthy Incentives[SM] were weight management and smoking cessation. According to the responses to the WAQ, there was considerable success on both scores. Figure 1 shows that the average Body Mass Index (BMI) of HI participants declined significantly relative to a national control group[1] from 2006 to 2011.

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[1] See Scoggins JF, Sakumoto KN, Schaefer KS, Bascom B, Robbins DJ, Whalen CL. Short-term and Long-term Weight Management Results of a Large Employer-Sponsored Wellness Program. Journal of Occupational and Environmental Medicine, 2011 Nov;53(11):1215-20.

Figure 1. Average BMI, Healthy Incentives vs. National Control Group, 2006-2011
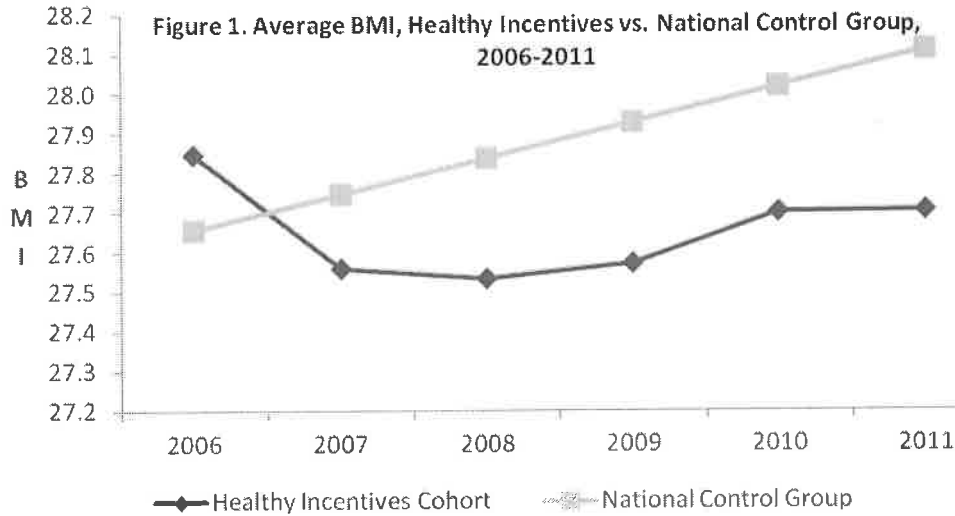
Additionally, the percentage of participants who smoke declined from 11.3% to 6.2% over this same time period. See Figure 2.

Fig. 2 Percent of Healthy Incentives Participants Who Smoke vs. National Control Group
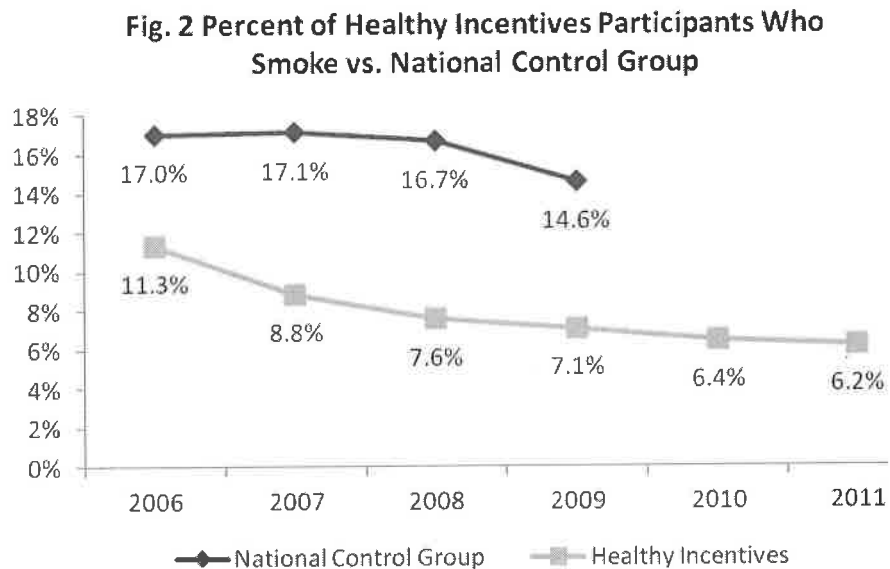
To estimate what the health status of each participant would have been without HI, we fitted the health status responses from the first year of the program, 2006, to a statistical model that estimates the probabilities that the participant experienced the five different levels of health. We used this model to estimate what each participant's health status would have been as they aged during the years 2006 through 2011. The details of this model are explained in the technical appendix.

Figure 3 displays the percentage of HI participants who reported either excellent or very good general health versus the estimated percentage that would have been reported had HI not been

implemented. In the first year of the program, the percentage increased approximately five points and has declined slightly since.

Figure 3. Percentage of Participants Reporting Either Excellent or Very Good General Health
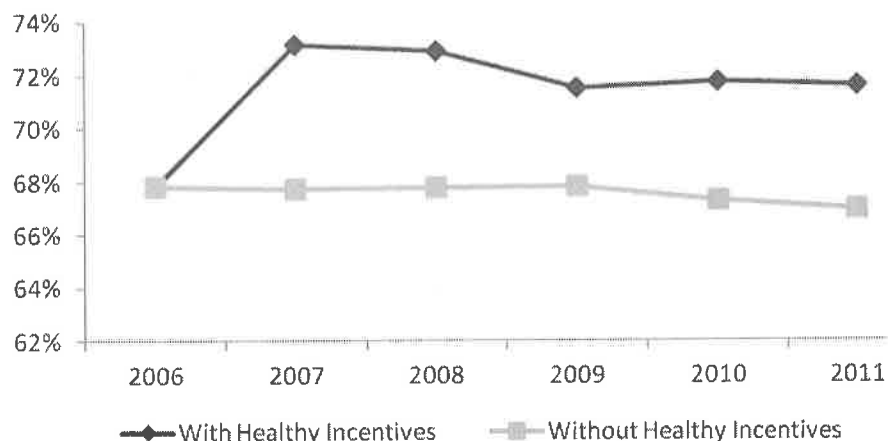
Since our general health, BMI and smoking status measures are self-reported, we tested how well the general health measure agreed with medical conditions not reported by the participants but by their professional caregivers. We found 38 different medical conditions that are correlated with the self-reported general health responses at a 5% level of statistical significance or better. Table 7 lists these medical conditions by ICD-9 diagnostic code. Please see the technical appendix for more details.

Table 7. Provider-Reported Medical Conditions Correlated with Patient-Reported Health Status

ICD-9 Diagnostic Code	Description
139	Late effects of other infectious and parasitic diseases
174	Malignant neoplasm of female breast
183	Malignant neoplasm of ovary and other uterine adnexa
185	Malignant neoplasm of prostate
189	Malignant neoplasm of kidney and other and unspecified urinary organs
195	Malignant neoplasm of other and ill-defined sites
197	Secondary malignant neoplasm of respiratory and digestive systems
205	Myeloid leukemia
250	Diabetes mellitus
274	Gout
296	Episodic mood disorders
298	Other nonorganic psychoses
307	Special symptoms or syndromes, not elsewhere classified
338	Pain, not elsewhere classified
347	Cataplexy and narcolepsy
401	Essential hypertension
412	Old myocardial infarction
414	Other forms of chronic ischemic heart disease
492	Emphysema
496	Chronic airway obstruction, not elsewhere classified
571	Chronic liver disease and cirrhosis
577	Diseases of pancreas
596	Other disorders of bladder
601	Inflammatory diseases of prostate
680	Carbuncle and furuncle
693	Dermatitis due to substances taken internally
695	Erythematous conditions
710	Diffuse diseases of connective tissue
714	Rheumatoid arthritis and other inflammatory polyarthropathies
729	Other disorders of soft tissues
754	Certain congenital musculoskeletal deformities
786	Symptoms involving respiratory system and other chest symptoms
892	Open wound of foot except toe(s) alone
908	Late effects of other and unspecified injuries
932	Foreign body in nose
944	Burn of wrist(s) and hand(s)
V58	Encounter for other and unspecified procedures and aftercare
V79	Special screening for mental disorders and developmental handicaps

To estimate the healthcare and prescription costs associated with the five different levels of health, we fitted the claims data to a series of statistical models. For this study overall, we estimated 50 separate statistical models. Twenty of these models were used to estimate the effect of health changes on healthcare and prescription costs. Figure 4 shows the monthly per member in-network medical cost differences between excellent health status and the other four levels of self-reported health for KingCare[SM] and Group Health members who completed a WAQ. For example, after controlling for age, race/ethnicity, sex and plan design, KingCare[SM] members reporting poor health had $1,299 greater medical expenditures per month than members reporting excellent health. In general, as health status declines cost increases significantly. Tables 8 and 9 give the results of the health status coefficients for all 20 statistical models. Complete model results are presented in the technical appendix.

Figure 4. PMPM In-Network Medical Cost Differences from Excellent Health Status, 2006-2011
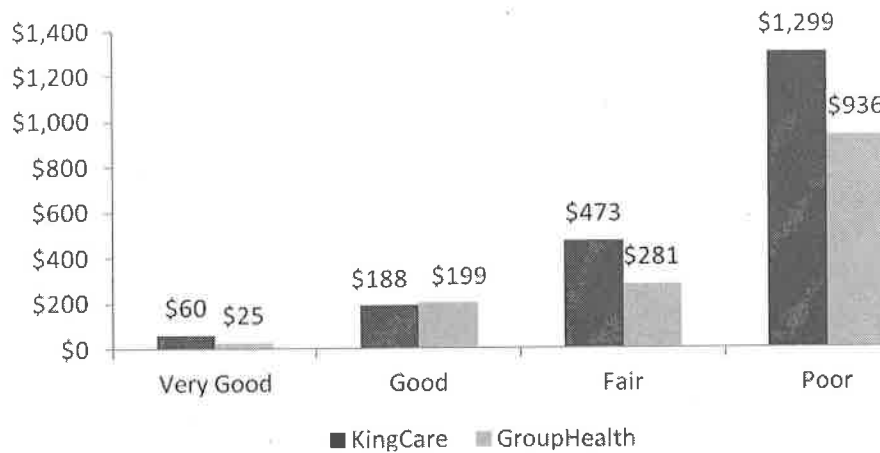
Table 8. Health Coefficients of the Healthcare Cost Regression Models

Plan/Health Status	County and Employee			County		
		95% Conf. Interval			95% Conf. Interval	
	Coefficient	Lower	Upper	Coefficient	Lower	Upper
PPO In-Network						
Very Good	$60.35	$33.90	$86.79	$56.40	$30.17	$82.64
Good	$187.92	$156.09	$219.75	$178.79	$147.22	$210.36
Fair	$472.58	$413.14	$532.01	$456.68	$397.72	$515.64
Poor	$1,299.05	$1,145.06	$1,453.04	$1,277.83	$1,125.08	$1,430.59
PPO Out-of-Network						
Very Good	$2.05	-$3.56	$7.66	$1.95	-$3.58	$7.49
Good	$5.66	-$1.18	$12.50	$5.24	-$1.51	$11.99
Fair	$47.69	$35.02	$60.37	$44.23	$31.71	$56.74
Poor	$24.94	-$7.71	$57.58	$18.89	-$13.35	$51.13
Group Health						
Very Good	$25.34	-$16.71	$67.40	$24.61	-$17.09	$66.32
Good	$198.93	$149.93	$247.93	$194.24	$145.67	$242.81
Fair	$280.79	$191.59	$369.99	$272.81	$184.37	$361.25
Poor	$936.32	$690.37	$1,182.28	$922.86	$679.04	$1,166.68

Table 9. Health Coefficients of the Prescription Cost Regression Models

Plan/Health Status	County and Employee			County		
		95% Conf. Interval			95% Conf. Interval	
	Coefficient	Lower	Upper	Coefficient	Lower	Upper
ESI Generic Retail						
Very Good	$1.15	$0.69	$1.60	$0.70	$0.28	$1.12
Good	$2.97	$2.41	$3.54	$1.96	$1.44	$2.47
Fair	$6.66	$5.61	$7.70	$4.25	$3.31	$5.20
Poor	$19.60	$16.93	$22.26	$16.25	$13.83	$18.68
ESI Generic Mail-Order						
Very Good	$0.61	$0.25	$0.96	$0.55	$0.22	$0.89
Good	$1.66	$1.23	$2.10	$1.51	$1.10	$1.92
Fair	$5.35	$4.54	$6.16	$4.76	$4.00	$5.52
Poor	$6.25	$4.16	$8.33	$5.50	$3.55	$7.45
ESI Preferred Retail						
Very Good	$3.96	-$0.27	$8.19	$3.64	-$0.54	$7.81
Good	$13.02	$7.77	$18.26	$11.73	$6.55	$16.91
Fair	$34.14	$24.55	$43.73	$31.13	$21.64	$40.61
Poor	$62.60	$37.87	$87.32	$57.58	$33.13	$82.02
ESI Preferred Mail-Order						
Very Good	$0.25	-$3.33	$3.84	$0.12	-$3.45	$3.69
Good	$6.90	$2.49	$11.31	$6.63	$2.25	$11.02
Fair	$18.66	$10.53	$26.80	$17.82	$9.73	$25.92
Poor	-$5.93	-$26.80	$14.95	-$6.36	-$27.14	$14.42
ESI Non-Pref. Retail						
Very Good	$0.62	-$0.01	$1.25	$0.52	-$0.06	$1.11
Good	$1.72	$0.95	$2.49	$1.54	$0.82	$2.25
Fair	$2.43	$1.00	$3.85	$1.84	$0.51	$3.16
Poor	$12.27	$8.61	$15.93	$11.14	$7.73	$14.55
ESI Non-Pref. Mail-Order						
Very Good	$0.61	$0.26	$0.97	$0.54	$0.23	$0.86
Good	$0.91	$0.48	$1.33	$0.81	$0.43	$1.20
Fair	$2.63	$1.83	$3.42	$2.27	$1.56	$2.99
Poor	$0.84	-$1.21	$2.89	$0.85	-$0.98	$2.69
Group Health						
Very Good	$2.25	-$2.35	$6.85	$1.87	-$2.61	$6.35
Good	$10.62	$4.91	$16.33	$8.73	$3.17	$14.29
Fair	$26.76	$16.67	$36.85	$22.60	$12.78	$32.42
Poor	$54.41	$25.75	$83.07	$47.12	$19.22	$75.01

Table 10 presents the cost change estimates due to health status changes of the 26,937 HI participants from 2007 to 2011. Decreases in allowed expenditures, i.e., combined employer and employee expenditures, averaged $3 million per year for a five-year total of $15.2 million. The decrease in employee out-of-pocket expenditures was approximately $650 thousand or less than 5% of the five-year total. Since a majority of employees are KingCare[SM] members and KingCare[SM] expenditures per member are generally more sensitive to differences in health status than those for Group Health members, over 87% of the cost savings are from KingCare[SM].

Table 10. Changes in Expenditures Due to Health Status, 2007-2011

Category	Incurred Year					Total
	2007	2008	2009	2010	2011	
Combined	-$3,646,838	-$2,998,714	-$2,737,205	-$2,865,118	-$2,967,963	-$15,215,839
KingCare	-$3,223,823	-$2,686,255	-$2,581,936	-$2,385,826	-$2,432,143	-$13,309,983
Medical	-$2,871,769	-$2,385,299	-$2,305,895	-$2,115,298	-$2,158,082	-$11,836,344
Prescription	-$352,054	-$300,956	-$276,041	-$270,528	-$274,061	-$1,473,639
Group Health	-$423,015	-$312,459	-$155,269	-$479,292	-$535,820	-$1,905,855
Medical	-$394,780	-$292,117	-$142,770	-$447,801	-$501,039	-$1,778,508
Prescription	-$28,235	-$20,342	-$12,499	-$31,491	-$34,781	-$127,347
County	-$3,496,311	-$2,869,619	-$2,621,474	-$2,741,217	-$2,841,038	-$14,569,658
KingCare	-$3,088,268	-$2,568,323	-$2,472,273	-$2,278,617	-$2,323,344	-$12,730,825
Medical	-$2,773,602	-$2,299,530	-$2,226,015	-$2,037,003	-$2,078,614	-$11,414,764
Prescription	-$314,666	-$268,793	-$246,258	-$241,614	-$244,731	-$1,316,062
Group Health	-$408,043	-$301,296	-$149,201	-$462,600	-$517,694	-$1,838,833
Medical	-$384,488	-$284,386	-$138,704	-$436,312	-$488,594	-$1,732,486
Prescription	-$23,555	-$16,909	-$10,497	-$26,288	-$29,099	-$106,347
Employees	-$150,527	-$129,096	-$115,731	-$123,901	-$126,926	-$646,180
KingCare	-$135,555	-$117,932	-$109,663	-$107,209	-$108,799	-$579,158
Medical	-$98,167	-$85,769	-$79,880	-$78,295	-$79,469	-$421,580
Prescription	-$37,388	-$32,163	-$29,783	-$28,914	-$29,330	-$157,578
Group Health	-$14,972	-$11,164	-$6,068	-$16,692	-$18,127	-$67,022
Medical	-$10,292	-$7,731	-$4,066	-$11,489	-$12,445	-$46,022
Prescription	-$4,680	-$3,433	-$2,002	-$5,203	-$5,682	-$21,000

IV. Enrollment Shift to Group Health

The increase in KingCare^{SM} deductibles and co-insurance rates in 2010 was intended to encourage greater enrollment in Group Health. This strategy met with success, because after several years of almost no migration between the two plans, 1,885 members switched their membership from KingCare^{SM} to Group Health in 2010 and an additional 389 members switched in 2011.

We compared the actual expenditures of the switching members in 2010 and 2011 to what their estimated expenditures would have been had they not switched their enrollment from KingCare^{SM}. The hypothetical KingCare^{SM} expenditures were estimated using statistical models that are explained in the technical appendix.

Tables 11, 12 and 13 show the estimated savings from the enrollment switch to Group Health. Including administration fees, combined County and employee expenditures decreased $8.7 million during the two-year period. County expenditures decreased $6.5 million or 74% of the total. Employee expenditures decreased $2.2 million or 26% of the total.

Table 11. County and Employee Expenditure Changes from Switch to Group Health Enrollment, 2010-2011

Category	2010	2011	Total
Total	-$4,621,197	-$4,124,223	-$8,745,420
KingCare^{SM}	-$9,716,365	-$11,755,722	-$21,472,086
Medical	-$7,775,668	-$9,312,611	-$17,088,279
In-Network	-$7,416,654	-$8,847,907	-$16,264,561
Out-of-Network	-$359,014	-$464,704	-$823,718
Prescription	-$1,548,152	-$1,980,115	-$3,528,267
Generic Retail	-$279,405	-$390,550	-$669,955
Preferred Retail	-$587,887	-$756,268	-$1,344,155
Non-Pref. Retail	-$91,722	-$104,731	-$196,453
Generic Mail-Order	-$78,892	-$120,260	-$199,151
Preferred Mail-Order	-$484,974	-$586,389	-$1,071,363
Non-Pref. Mail-Order	-$25,273	-$21,918	-$47,190
Administration Fees	-$392,544	-$462,996	-$855,540
Group Health	$5,095,167	$7,631,499	$12,726,666
Medical	$3,862,005	$6,053,742	$9,915,747
Prescription	$622,539	$857,541	$1,480,080
Administration Fees	$610,624	$720,216	$1,330,840

Table 12. County Expenditure Changes from Switch to Group Health Enrollment, 2010-2011

Category	2010	2011	Total
County	-$3,597,005	-$2,903,122	-$6,500,127
KingCare[SM]	-$8,376,782	-$10,126,763	-$18,503,545
Medical	-$6,881,272	-$8,228,269	-$15,109,541
In-Network	-$6,602,490	-$7,865,322	-$14,467,812
Out-of-Network	-$278,782	-$362,947	-$641,728
Prescription	-$1,102,966	-$1,435,498	-$2,538,464
Generic Retail	-$162,270	-$236,927	-$399,197
Preferred Retail	-$433,627	-$566,829	-$1,000,456
Non-Pref. Retail	-$50,671	-$59,748	-$110,419
Generic Mail-Order	-$57,230	-$91,098	-$148,328
Preferred Mail-Order	-$383,510	-$464,633	-$848,143
Non-Pref. Mail-Order	-$15,657	-$16,263	-$31,920
Administration Fees	-$392,544	-$462,996	-$855,540
Group Health	$4,779,777	$7,223,641	$12,003,418
Medical	$3,688,664	$5,822,264	$9,510,928
Prescription	$480,489	$681,161	$1,161,650
Administration Fees	$610,624	$720,216	$1,330,840

Table 13. Employee Expenditure Changes from Switch to Group Health Enrollment, 2010-2011

Category	2010	2011	Total
Employees	-$1,024,192	-$1,221,100	-$2,245,292
KingCare[SM]	-$1,339,583	-$1,628,958	-$2,968,541
Medical	-$894,397	-$1,084,341	-$1,978,738
In-Network	-$814,164	-$982,584	-$1,796,748
Out-of-Network	-$80,233	-$101,757	-$181,990
Prescription	-$445,186	-$544,617	-$989,803
Generic Retail	-$117,135	-$153,622	-$270,757
Preferred Retail	-$154,259	-$189,439	-$343,698
Non-Pref. Retail	-$41,051	-$44,983	-$86,035
Generic Mail-Order	-$21,661	-$29,162	-$50,823
Preferred Mail-Order	-$101,464	-$121,756	-$223,220
Non-Pref. Mail-Order	-$9,615	-$5,655	-$15,270
Group Health	$315,391	$407,858	$723,249
Medical	$173,341	$231,478	$404,819
Prescription	$142,050	$176,380	$318,430

V. Layoffs

There were substantial layoffs in the King County workforce during 2010 and 2011. After peaking in 2009, combined membership in the health plans declined in 2010 and 2011. Table 14 shows that the reductions in the County's medical and prescription expenditures in 2010 and 2011 due to layoffs were $3.8 million and $10.1 million, respectively.

Table 14. Cost Reductions Due to Layoffs, 2010-2011

	Year		
Item	2009	2010	2011
Member Months			
KingCare^{SM}	314,752	282,556	265,919
Group Health	67,728	90,715	91,363
Combined	382,480	373,271	357,282
% Difference from 2009		-2.41%	-6.59%
County Expenditures		× $158,531,494	× $153,365,435
Change in Expenditures		-$3,816,975	-$10,103,802

VI. Other Factors

Table 15 summarizes the estimated cost effects of the factors cited in the budget proviso. The County's expenditures decreased $59.7 million from 2007 to 2011. The employees' out-of-pocket expenditures increased $4 million. Combined expenditures decreased $55.7 million from 2007 to 2011 with $43.4 million of that occurring in the last two years. Figure 5 illustrates the County's cost reductions in a pie chart.

As large as these dollar figures might seem, it is likely that the factors specified in the budget proviso do not account for all of the cost reductions experienced by the County over recent years. Figure 6 shows the County's actual growth rates in healthcare expenditures and the County's growth rates after the estimated $59.7 million in cost reductions are added to actual expenditures.

A primary motivating factor in creating HI in 2005 was the double-digit growth rate in healthcare expenditures the County had been experiencing. Figure 6 shows that before 2009 the growth rate – had Healthy Incentives not been implemented – would have been near the 10% level or higher. In 2009 the Sheriff's Deputies union joined HI with a different benefits plan and caused the annual growth to greatly exceed 10% in that year. After 2009, however, the estimated

growth rate would have been only 3.2% to 3.3% even if Healthy Incentives[SM] and the layoffs had not happened.

Table 15. Cost Changes by Incurred Year

Item	Year					Total
	2007	2008	2009	2010	2011	
Combined	-$4,832,778	-$3,983,450	-$3,438,050	-$18,332,341	-$25,096,904	-$55,683,524
Utilization Change	-$1,185,940	-$984,736	-$700,845	-$7,029,052	-$7,900,916	-$17,801,488
Health Improvements	-$3,646,838	-$2,998,714	-$2,737,205	-$2,865,118	-$2,967,963	-$15,215,839
Switch to Group Health				-$4,621,197	-$4,124,223	-$8,745,420
Layoffs				-$3,816,975	-$10,103,802	-$13,920,777
County	-$5,271,942	-$4,429,330	-$3,799,242	-$19,992,166	-$26,175,865	-$59,668,546
Utilization Change	-$973,373	-$661,263	-$288,482	-$5,887,870	-$6,033,282	-$13,844,272
Cost Shift to Employees	-$802,258	-$898,448	-$889,285	-$3,949,099	-$4,294,621	-$10,833,711
Health Improvements	-$3,496,311	-$2,869,619	-$2,621,474	-$2,741,217	-$2,841,038	-$14,569,658
Switch to Group Health				-$3,597,005	-$2,903,122	-$6,500,127
Layoffs				-$3,816,975	-$10,103,802	-$13,920,777
Employees	$439,164	$445,880	$361,191	$1,659,825	$1,078,961	$3,985,022
Utilization Change	-$212,567	-$323,472	-$412,363	-$1,141,181	-$1,867,634	-$3,957,217
Cost Shift to Employees	$802,258	$898,448	$889,285	$3,949,099	$4,294,621	$10,833,711
Health Improvements	-$150,527	-$129,096	-$115,731	-$123,901	-$126,926	-$646,180
Switch to Group Health				-$1,024,192	-$1,221,100	-$2,245,292

Figure 5. County Cost Reductions, 2007-2011

- ■ Health Improvements
- ■ Plan Design Changes
- ▩ Enrollment Switch to Group Health
- ■ Layoffs
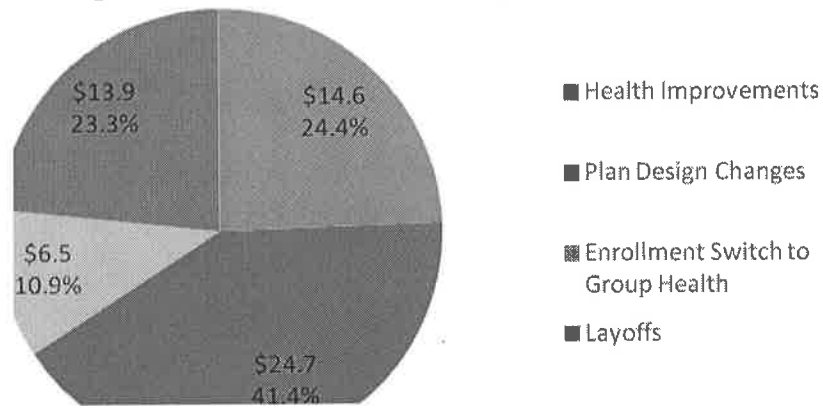
Figure 6. County Healthcare Expenditure Growth Rates, Actual vs. Estimated
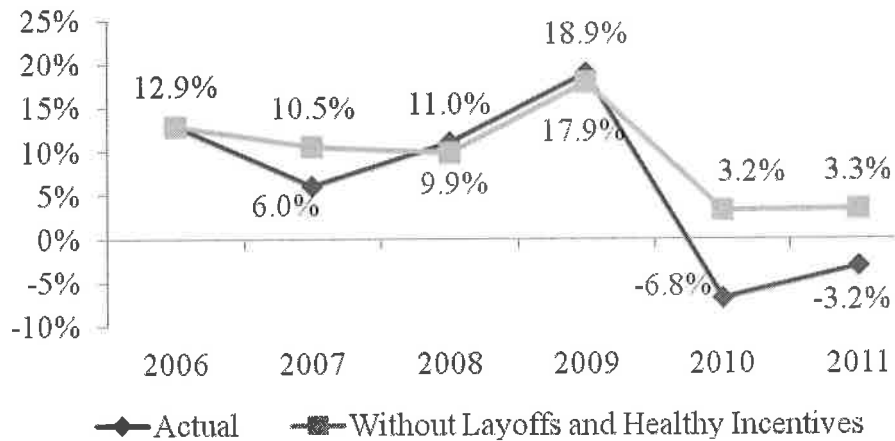
What other factors led to the reduction in expenditure growth after 2009? The most likely culprit is the poor state of the economy. Unemployment rates were historically high. Many spouses of employees were out of work and there was a persistent threat of unemployment that affected even the behavior of people who remained employed. Additionally, home equity values plummeted over the last few years. So greater uncertainty and lower incomes coupled with lower wealth produced the longest sustained period of slow economic growth since the 1930's. This led to reduced household consumption, including healthcare.

VII. Conclusion

Prior to 2007 the County routinely experienced double-digit growth rates in employee healthcare benefits costs. Since 2007 the County's expenditure growth rate has only been 4.8%. Over the past two years the growth rate has been well below zero.

Several factors have contributed to this cost deceleration. The single largest factor has been design changes to the County's health plans. Through increases in deductibles, co-insurance rates and co-payment amounts, combined County and employee expenditures decreased by $17.8 million - an amount that equals 2.0% of what would have been spent over that time span if no plan design changes had occurred. Separately, health improvements decreased expenditures by 1.8% or $15.2 million.

Starting in 2010, approximately 2,000 KingCare^{SM} members switched their enrollment to Group Health. This switch decreased combined expenditures by $8.7 million during 2010 and 2011.

Layoffs were another major contributing factor to the cost deceleration. Separately, layoffs led to $13.9 million in healthcare cost reductions in 2010 and 2011.

Cost shifts to employees contributed significantly to the drop in expenditures. Over the five-year period, $10.8 million of costs were shifted to employees. With utilization decreases, enrollment switches to Group Health and health improvements, the net increase in employee expenditures was $4 million.

Appendix A.

Background

When King County prepared to negotiate a three-year health benefits package with its 92 union bargaining units in 2004, the picture was dismal. Health care costs were rising at rates three times the Consumer Price Index (CPI), threatening to double the cost of the benefits plan in less than seven years. In response to this crisis King County convened the Health Advisory Task Force, a group of providers, economists, business, labor and government leaders was charged with examining the county's rising health care costs and developing a strategy to curb costs without shifting significant costs to employees or making substantial reductions in health care benefits. The Task Force's advice formed the basis of King County's Healthy Incentives[SM] Program.

The Task Force recommended a two-pronged approach to controlling health care costs: Control both the supply and demand sides of the health care cost equation by encouraging employees to improve their health, and work to improve the quality of health care delivered in the Puget Sound region.

At a result of these recommendations King County created Healthy Incentives[SM] to address the health care crisis from both the "demand" and the "supply" side of the equation. On the demand side, Healthy Incentives[SM] is a catalyst for improved employee health that curbs the use of costly health care. On the supply side Healthy Incentives[SM] works to improve the quality of health care in the region through the Puget Sound Health Alliance, thus reducing ineffective and costly treatment.

How it Works

The benefits plan design side of King County's Healthy Incentives[SM]

How Healthy Incentives[SM] Works

started in 2006. The goal of the benefits plan is to help employees and their families build healthy habits and manage chronic conditions more effectively. Employees who take a health risk assessment and participate in a follow up individual action plan to address behavior-related
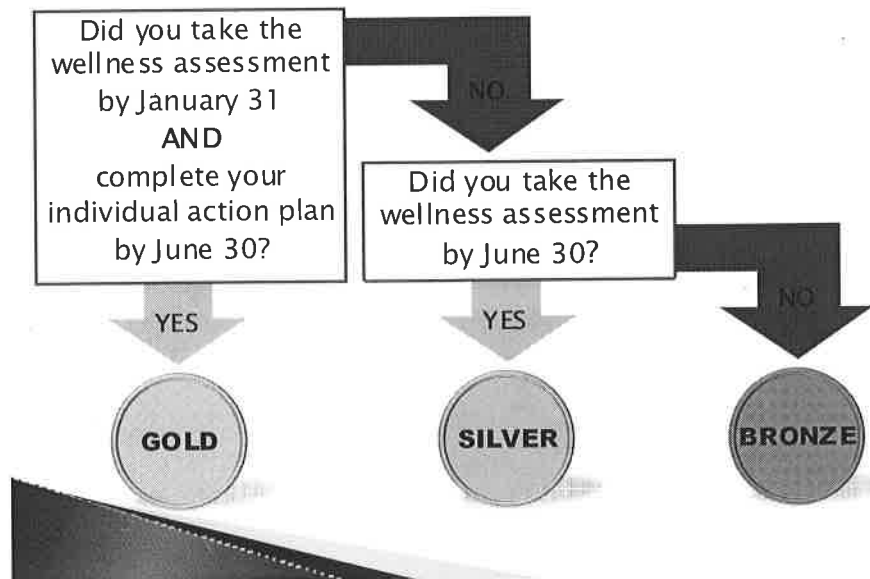
health risks are rewarded with lower out-of-pocket expenses. It is important to note that earning the lower out of pocket expense is based on participation, not the achievement of a specific health status or goal.

The financial incentive to participate started strong and was increased when the benefits program was renegotiated with the unions for the 2010 – 2012 plan. Participation can now make a difference of up to $1,200 a year for a family of four.

Out-of-Pocket Expense Levels in 2010-2012 Compared to 2006-2009			
Item	KingCare^{SM} Gold 2006-2009	KingCare^{SM} Gold 2010-2012	Group Health Gold 2010-2012 (No Change from 2009)
Deductible (medical)	$100 per individual $300 per family	$300 per individual $900 per family	None
Coinsurance (medical)	90% In network 70% Out-of-network	85% In network 65% Out-of-network	$20 copay for office visits
Annual out-of-pocket maximum for member coinsurance (medical)	*In network services* $800 per individual $1,600 per family *Out-of-network services* $1,600 per individual $3,200 per family	***No change from 2009*** *In network services* $800 per individual $1,600 per family *Out-of-network services* $1,600 per individual $3,200 per family	$1,000/ individual $2,000/family
Prescription drug copays (at pharmacy)	$10 generic drugs $15 preferred brand $25 non-preferred brand	$7 generic drugs $30 preferred brand $60 non-preferred brand	$10 generic drugs $15 preferred brand $25 non-preferred brand

Along with the benefit plan design, the county makes the healthy choice the easy choice for employees through "Healthy Workplace" programs. These include efforts to educate employees about health and wise use of health care resources, along with workplace activities supporting exercise, healthy eating and preventive care (such as annual flu shots).

Continuous Improvement

Healthy Incentives^{SM} has evolved to require a higher level of engagement in health improvements and reward more conscientious consumer engagement. In March of 2009, the county and labor announced a new agreement governing the employee health plan for 2010 – 2012 that improves the Healthy Incentives^{SM} benefit plan design and rewards smarter health care choices. Co-pays were lowered for generic drugs and increased for brand name drugs – a move

that resulted in a 9.6 percent increase in prescriptions being filled with generics during the first half of 2010. There was a 5 percent migration from the preferred provider network to the lower cost higher quality care at Group Health Cooperative, which scores best in the Washington Community Checkup Report, produced by the Puget Sound Health Alliance. The Healthy Incentives[SM] program was enhanced to address a wider range of health risks and engage participants for 10 weeks, the amount of time research shows it takes to establish a new habit. Along with physical activity and good nutrition, action plans were added to promote stress management and weight management. And, rather than an online log where all entries for past activity could be made in a day, the new online actions plans were built to pace participants over 10 weeks.

Technical Appendix B.

I. Statistical Models

We used two types of statistical regression models for this study. Models of health status used ordered-logit regression. Models of healthcare cost used cross-sectional time-series regression. Explanations of why we chose these types of models follow. All statistical models were estimated using STATA®/MP 10.1[2].

II. Health Status Models

Choice of Health Measurement

Estimating the cost effect of a change in health requires a single, comprehensive health measurement. We chose the answer to the general health question on the wellness assessment questionnaire (WAQ) as our health measurement for this study. Some people might find this perplexing. Why should we use a purely subjective and self-reported measure of health when there are dozens of objective health measurements that we gather in the WAQ? We also collect a great deal of clinical measures reported by physicians in our claims data. Surely there is a more reliable measure of health than simply the five possible responses to the general health question: excellent, very good, good, fair and poor.

The short answer to this question is no, there is not a better alternative. It is beyond the scope of this report to go into a lengthy defense of our choice of health measure; however, a brief explanation is warranted.

Using multiple measures of health simultaneously in a statistical model – such as body mass index (BMI), blood-cholesterol level and diagnosis of diabetes – could lead to double-counting because health measures are often interrelated. Someone who has a BMI in the obese range is more likely to also have a high blood-cholesterol level and to be a diabetic. The costs associated with one are also associated with the others.

Using multiple measures could also lead to a statistical phenomenon called multicollinearity. This can happen when the independent variables of a statistical model are so closely correlated with each other that the estimation calculation cannot distinguish the separate effects of the independent variables on the dependent variable (in this case the cost of healthcare).

It should also be noted that without a comprehensive measure of health some cost reductions associated with better health could go undetected. There is no purely objective comprehensive measure of health, so this leaves us with only subjective ones. The specific subjective health

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[2] StataCorp. 2007. Stata Statistical Software: Release 10. College Station, TX: StataCorp LP.

measurement we used has been used for many years in countless studies of health[3]. This exact same question is asked in the National Health Interview Survey (NHIS), the Medical Expenditure Panel Survey (MEPS), the annual survey of the Behavioral Risk Factor Surveillance System (BRFSS) and the Consumer Assessment of Healthcare Providers and Systems (CAHPS), to name just a few.

Ordered-Logit Regression Models

Our health measurement ranks a participant's health in order from excellent to poor. This is a special kind of limited-dependent variable, therefore an ordinary-least-squares linear regression model will not suffice. For this kind of dependent variable, a special kind of probability model is necessary.

Most limited-dependent variables can have only two possible values. For example, the dependent variable of a survival model equals one if the patient lives and zero if the patient dies. The model estimates the probability that the patient will live depending on the value of the independent variables.

Our health measurement differs from the typical limited-dependent variable in two significant ways. First, there are five possible values instead of only two. Second, the order of the values is important. "Fair" is better than "Poor" and "Good" is better than "Fair" and so on.

The ordered-logit regression model is widely used for this type of dependent variable[4]. It estimates the probability that each of the possible values will occur depending on the values of the independent variables. For example, a group of people might have the following distribution of health status probabilities: 25% excellent, 50% very good, 15% good, 9% fair and 1% poor. If age is negatively associated with health then below-average aged people would have higher probabilities of excellent and very good health and lower probabilities of very good to poor health. Above-average aged people would have higher probabilities of good to poor health and lower probabilities of very good to excellent health.

Instrumental Variables

From 2006 to 2009 the WAQ was written by Health Media, Inc. In 2010 and 2011 the WAQ was written by WebMD Health Services, Inc. Although both companies included a general health question on the WAQ, they did not word the questions exactly the same way. Health Media's wording of the question was identical to the above mentioned national surveys. Unfortunately, WebMD's wording was not.

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[3] The recently published report of the Oregon Health Study is a prime example. See
http://www.oregonhealthstudy.org/en/researchers/index.php.
[4] See pages 875-879 of Econometric Analysis, 4th Edition (2000) by William H. Greene.

To be comparable, health survey questions must be worded exactly the same. No change - no matter how seemingly insignificant - can be allowed. If the wording does change, it is impossible to know whether the differences in the answers to the questions are due to the change in the wording or a change in health status.

Fortunately there is a remedy for this problem. It's called instrumental variables (IV)[5]. The basic idea behind IV is to estimate what the participant would have answered to the general health question had he or she been asked it in 2010 and 2011. This is done in a multi-step process.

The first step is to identify the instrumental variables that are to be used to estimate the missing dependent variable, i.e. general health in 2010 and 2011. The selection process relies on a combination of prior knowledge and data mining. Although the WAQ's from 2006-2009 were different from the WAQ's in 2010-2011, there were many questions about objective health measurements that are not sensitive to exact wording. Since weight-management and smoking cessation were two primary goals of HI, we included BMI and a binary smoking indicator variable as instrumental variables. We also included age, five indicator variables of race/ethnicity (i.e. White, Black, Hispanic, Asian and Other) and an indicator variable for sex (i.e. Male and Female).

No other instrumental variables from the WAQ were selected. Although objective health measurements like blood-cholesterol level and blood pressure reading are important indicators of health, the response rates to these types of questions were relatively low. Many participants simply did not know the correct answers to these questions. On the other hand, weight, height and smoking status were known by almost all participants.

In addition to the WAQ responses we also had International Classification of Diseases, 9th Edition (ICD-9) diagnostic codes submitted by providers. These codes are used to classify health insurance claims by type of medical condition suffered by the insured patient. Since these codes are reported by the provider, not the participant, it was thought that they could verify the accuracy of the self-reported responses to the general health question as well as serve as instrumental variables.

There are 1,199 separate 3-digit ICD-9 codes – 1,013 of which were reported by KingCare[SM] and Group Health members from 2006 to 2011. They begin with 001 (Cholera) and end with V89 (Other suspected conditions not found). A thousand variables are far too many to include in a regression model. Some medical conditions are so minor or occur so rarely that they will not be correlated to the answers our HI participants gave in response to the general health question. To determine which of these codes were correlated with the answers to the general health question

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[5] See pages 370-375 of Econometric Analysis, 4th Edition (2000) by William H. Greene.

from 2006 to 2009, we employed a method called "data mining". This is a relatively young and interdisciplinary field of computer science[6].

Specifically we systematically estimated 1,013 separate ordered-logit regression models. In each model the ordered limited-dependent variable was general health where "excellent" equals the number 5, "very good" equals the number 4 and so on. In addition to age, race/ethnicity, sex, BMI and smoking status the list of independent variables included indicator variables that equaled one if the participant had a claim during that year that listed the ICD-9 diagnostic code in question. Only ICD-9 code indicator variables with negative coefficients that were statistically significant at the 5% level (i.e. a p-value less than 0.05) were selected as instrumental variables. Thirty-eight ICD-9 codes met the selection criteria and were used in the final ordered-logit model.

Each Group Health medical claim has up to 12 ICD-9 codes. Each KingCare medical claim has only three ICD-9 codes. To prevent measurement bias, we counted only the primary ICD-9 code from each claim.

Table B1 shows the coefficient estimates for the ordered-logit regression model of general health from WAQ's taken from 2006 to 2009. There were 62,967 observations from 22,569 members. This means on average each member completed a little less than three WAQ's over this four year period. Whenever there are repeat observations from some members, a repeat-observations bias can occur. While not biasing the model coefficients, this type of bias might skew the standard error estimate downward and make the model seem to predict better than it actually does. To prevent this type of bias, the standard error estimates were adjusted by clustering for member identification.

The variable names that start with "d_" and followed by a three-digit number are the ICD-9 indicator variables. For example, the ICD-9 code for diabetes mellitus is "250". If a member had any claims during a calendar year with a primary ICD-9 code equal to "250", then the value of d_250 in that year for that member was set to one. Otherwise the value of d_250 was set to zero.

The variables cut1, cut2, cut3 and cut4 represent the demarcations between the five values of the health status variable (i.e. excellent, very good, good, fair and poor). These are the points in the continuous probability function that establish the boundaries between the five possible responses to the general health question.

Once the general health model for 2006 to 2009 was estimated, we used it to estimate what the general health responses would have been in 2010 and 2011.

Health Status without Healthy Incentives

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[6] See http://en.wikipedia.org/wiki/Data_mining for an explanation of data mining.

To measure the effect of HI on the health status of participants, we needed to estimate what the self-reported health status would have been if there had been no participation in HI. As discussed in the main body of the report, an analysis of data from the Medical Expenditure Panel Survey (MEPS) showed that after adjusting for demographic factors such as age, race/ethnicity and sex, the net health status of 1.7% of respondents declined each year on average. This would indicate a slow decline in health status over time for people not in a wellness program similar to HI.

Another method of estimating the change in health status over time for people not in HI is to estimate a base-line model of health status of HI participants in 2006 before they were subjected to the individual action plan requirement. The major difference between the base-line model and the general health model shown in Table B1 is the lack of endogenous independent variables in the base-line model. The values of endogenous independent variables are affected by the same things that affect the value of the dependent variable (i.e. health status). In this case, the endogenous independent variables are BMI, smoking status and the ICD-9 indicator variables. The exogenous variables (i.e. variables that are not affected by participation in a wellness program) that are included in the base-line model are age, sex (i.e. male) and race/ethnicity.

Table B2 presents the results of the base-line model. The coefficient for "age" is negative and small (but statistically significant), indicating that as the participant ages, self-reported health status slowly declines on average. This model was used to estimate the general health of HI participants from 2007 to 2011 if they had not participated in HI.

III. Healthcare Cost Models

Statistical models are designed to fit the data on which they are based. Most data fit into one of two categories: cross-sectional or time-series. Each category of data has its own typical problems that must be considered when estimating a model.

Cross-sectional data measure values for many individual units regardless of time. For example, the 2006 WAQ data that the base-line general health model uses is an example of a cross-sectional data set. There were many participants and only one set of responses for each participant. Cross-sectional linear models often suffer from a statistical condition called "heterogeneity". This is a treatable condition that left unchecked will cause the estimates of the model uncertainty to be biased (i.e. too low).

Time-series data measure one entity over several consecutive time periods. For example, King County's monthly aggregate healthcare expenditures from 2006 through 2011 would be a time-series data set. Time-series models often suffer from a statistical condition called "serial correlation". Like heterogeneity, this is also a treatable condition.

The healthcare cost data for each member for each month from 2006 through 2011 is both cross-sectional and time-series, so a model designed to handle both types of data is necessary. We chose the "xtregar" command in STATA to estimate all of our healthcare cost models. This command estimates a cross-sectional time-series random-effects linear model with a first-order autoregressive disturbance[7].

"Random effects" refers to the cross-sectional component of the regression error term and corrects for heterogeneity. The alternative specification is "fixed effects". The difference between these two alternatives is too technical to explain at length, but this choice did not have a large effect on the model results.

"First-order autoregressive disturbance" refers to the time-series component of the regression error term and corrects for serial correlation. There are other commands in STATA that estimate cross-sectional time-series models. Xtregar was chosen because it is a relatively robust and efficient estimator.

<u>48 Different Cost Models</u>

Approximately 90% of adult members in King County's two health plans participated in HI. For these members we have multiple measures of health and other demographic variables. For the 10% of adult members and the 100% of children members who did not participate in HI, we have no measures of health or demographic variables, other than age and sex. We therefore have two types of healthcare cost models based on available health measures. One type has health measures and the other does not.

From 2006 to 2011 the County had two different health plans, KingCare[SM], a preferred provider organization (PPO) plan administered by Aetna and Express Scripts Inc. (ESI); and a health maintenance organization (HMO) plan administered by Group Health. Out-of-pocket costs for members of KingCare[SM] are determined by annual deductibles and co-insurance payments for medical expenditures and per purchase co-payments for prescription drug expenditures. Out-of-pocket costs for Group Health members are determined by per visit co-payments for medical costs and per purchase co-payments for prescription drug expenditures.

Since the plans are designed very differently, it was necessary to estimate a separate set of models for KingCare[SM] expenditures and Group Health expenditures. KingCare[SM] members are charged different coinsurance rates for out-of-network and in-network medical costs, therefore there are separate sets of medical cost models for the two types of KingCare[SM] medical costs.

Separate models for prescription drug and medical expenditures were also necessary. Each plan has six different prescription drug co-payment amounts depending on delivery method (30-day retail and 90-day mail-order) and brand (generic, preferred and non-preferred). The co-payment

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[7] See Models for Panel Data, chapter 14 of Econometric Analysis, 4th Edition (2000) by William H. Greene.

amounts for KingCare^{SM} prescription drug purchases changed in 2010. This made estimating a separate model for each of the six types of prescription drug in the KingCare^{SM} plan necessary.

Such was not the case for prescription drug purchases by Group Health members. There was no change in Group Health co-payment amounts over this time period and Group Health did not supply enough information to accurately distinguish preferred drug purchases from non-preferred drug purchases. Therefore the Group Health prescription drug analysis combined the six types of prescription drugs into one model.

This brings us up to a total of 20 cost models so far, 16 KingCare^{SM} models (six prescription cost models plus two medical cost models times two for members with health measures and members without health measures) and 4 Group Health models (one prescription model plus one medical cost model times two).

One of the questions posed by the King County Council was to estimate the cost effects of switching membership from KingCare^{SM} to Group Health. To do this we took the independent variable values for the members who switched to Group Health in 2010 and 2011 and applied them to the KingCare^{SM} cost models. One of the independent variables of the KingCare^{SM} models was a binary indicator variable that indicated whether the member had satisfied his/her deductible by the start of the month the healthcare expenditures were incurred. Since Group Health members do not pay a deductible, it was necessary to estimate a set of KingCare^{SM} cost models without the deductible indicator variable.

There are two types of medical cost models for KingCare^{SM} members (i.e. in-network and out-of-network) and two types of members (i.e. those who participate in HI and those who don't). This increases the number of models by four, which brings our total number of models up to 24. Since we estimated one set of cost models with allowed expenditures (i.e. County and employee expenditures combined) as the dependent variable and another set of cost models with paid expenditures (i.e. only County expenditures) as the dependent variable, we have a total of 48 cost models.

KingCare^{SM} Medical Cost Models

Out-of-pocket medical costs incurred by KingCare^{SM} members are determined by deductible limits and co-insurance rates. This means that the monthly out-of-pocket cost incurred by members varies a lot over time and across different members. Because of this variation, a cross-sectional-time-series regression model should be able to get a good fix on the relationship between monthly deductible payments and total medical expenditures.

Health status also varies substantially across members who participate in HI, but somewhat less across time since only one WAQ is collected from each member each year. Therefore the model should be able to get a good fix on the relationship between health status and total medical

expenditures, but not quite as good a fix as the relationship between out-of-pocket costs and total medical expenditures.

Table B3 shows the results from four cost models, in-network and out-of-network for allowed expenditures (i.e. both County and employee expenditures) and County expenditures. Table B4 shows the results of the corresponding models for KingCare[SM] members who did not participate in HI. The "Coef" columns are for the model coefficient estimates. The "z" columns are for the coefficient z statistics (i.e. the ratio of the coefficient and its standard error, a measure of statistical significance). We had data from 20,541 HI participating members for a total of 930,231 observations (i.e. member months).

The "deductible" variable equals 1 if the member has not satisfied his or her deductible at the start of the month and zero otherwise. For each group of indicator variables - like health, race/ethnicity, sex and year – there must be an omitted or comparison variable. For health the omitted variable is "excellent". For race/ethnicity the omitted variable is "white". For sex it is "female" and for year it is "2006".

Below the list of independent variables are seven diagnostic statistics of the models. A detailed explanation of their meaning is beyond the scope of this report. The interested reader should obtain a copy of a standard reference such as Econometric Analysis, 4th Edition (2000) by William H. Greene or consult the STATA manual.

Tables B5 and B6 show the KingCare[SM] medical cost model results without a "deductible" variable. These models were necessary to estimate the change in medical costs of Group Health members who switched enrollment from KingCare[SM] in 2010 and 2011.

Group Health Medical Cost Models

Table B7 shows the results from the Group Health medical cost models. The copayment amounts were constant from 2007 to 2011, so we were not able to include a copayment independent variable.

KingCare[SM] Prescription Cost Models

Tables B8 to B13 show the results of the KingCare[SM] prescription drug cost models. The copayment amounts for generic drugs were decreased in 2010 and the copayment amounts for preferred and non-preferred drugs were increased. Since the indicator variables for 2010 and 2011 are perfectly correlated with the change in copayment amounts, an independent variable for copayment amount could not be included in the regression models.

The health status indicator variables were statistically significant and increased from "very good" to "poor" for both generic drug types and for preferred and non-preferred 30-day retail prescriptions. Some health status indicator variables were not statistically significant or did not

increase as health status declined for preferred and non-preferred mail-order prescription drugs. Relatively few members use the mail-order option for these types of drugs.

Group Health Prescription Cost Models

Table B14 shows the results of the Group Health prescription drug cost models.

Table B1. Ordered-Logit Model of General Health, 2006-2009

Variable Name	Coefficient	Standard Error	z_stat	p-value
age	0.0087	0.0012	7.37	< 0.001
sex: male	0.2367	0.0233	10.17	< 0.001
bmi	-0.1273	0.0023	-56.46	< 0.001
smoker	-0.9498	0.0374	-25.37	< 0.001
race/ethnicity: black	0.1091	0.0385	2.83	0.005
race/ethnicity: hispanic	-0.0776	0.0600	-1.29	0.196
race/ethnicity: asian	-0.0876	0.0376	-2.33	0.020
race/ethnicity: other	-0.0899	0.0537	-1.67	0.095
d_139	-1.7888	0.6773	-2.64	0.008
d_174	-0.4815	0.1116	-4.31	< 0.001
d_183	-0.7817	0.5366	-1.46	0.145
d_185	-0.5169	0.3872	-1.33	0.182
d_189	-1.0308	0.3979	-2.59	0.010
d_195	-0.6334	0.3632	-1.74	0.081
d_197	-1.6696	0.6530	-2.56	0.011
d_205	-0.9349	0.5206	-1.80	0.073
d_250	-0.6639	0.0437	-15.18	< 0.001
d_274	-0.3860	0.0943	-4.09	< 0.001
d_296	-0.5458	0.0545	-10.02	< 0.001
d_298	-0.5708	0.2423	-2.36	0.019
d_307	-0.2880	0.1097	-2.62	0.009
d_338	-0.1642	0.1488	-1.10	0.270
d_401	-0.2184	0.0287	-7.60	< 0.001
d_414	-0.6144	0.0778	-7.90	< 0.001
d_492	-0.8116	0.3257	-2.49	0.013
d_496	-1.3129	0.4902	-2.68	0.007
d_571	-0.3112	0.1195	-2.60	0.009
d_577	-0.7216	0.1956	-3.69	< 0.001
d_596	-0.8523	0.2027	-4.20	< 0.001
d_601	-0.2713	0.1307	-2.08	0.038
d_680	-0.5873	0.1854	-3.17	0.002
d_693	-0.4368	0.2275	-1.92	0.055
d_695	-0.1349	0.0832	-1.62	0.105
d_710	-0.9134	0.1739	-5.25	< 0.001
d_714	-0.9084	0.1357	-6.69	< 0.001
d_729	-0.2015	0.0320	-6.30	< 0.001
d_754	-0.2331	0.1785	-1.31	0.192
d_786	-0.2536	0.0263	-9.64	< 0.001
d_892	-0.3231	0.1848	-1.75	0.080
d_932	-1.5108	0.9381	-1.61	0.107
d_944	-0.1263	0.3067	-0.41	0.680
d_v58	-0.1977	0.0451	-4.39	< 0.001
d_v79	-1.2760	0.6609	-1.93	0.054
cut1	-9.1971	0.1194		
cut2	-6.8437	0.0904		
cut3	-4.3013	0.0835		
cut4	-1.9768	0.0811		

Number of observations = 62,967; Number of members = 22,569
Wald chi-square(43) = 5,680.65; prob > chi-square = 0.000

Table B2. Ordered-Logit Model of Base-Line General Health

Variable Name	Coefficient	Standard Error	z_stat	p-value
age	-0.0102	0.0015	-6.61	< 0.001
sex: male	0.0805	0.0294	2.73	0.006
race/ethnicity: black	-0.2811	0.0494	-5.69	< 0.001
race/ethnicity: hispanic	-0.2412	0.0857	-2.81	0.005
race/ethnicity: asian	0.0716	0.0465	1.54	0.124
race/ethnicity: other	-0.2455	0.0656	-3.74	< 0.001
cut1	-5.4804	0.1229		
cut2	-3.3298	0.0839		
cut3	-1.2402	0.0779		
cut4	0.7188	0.0774		

Number of observations = 15,962
wald chi-square(9) = 98.85
prob > chi-square = 0.000

Table B3. KingCare[SM] Medical Cost Models for Healthy Incentives[SM] Participants, 2006-2011

| | In-Network | | | | Out-of-Network | | | |
| | Allowed | | County | | Allowed | | County | |
Independent Variable	Coef.	z	Coef.	z	Coef.	z	Coef.	z
deductible	-159.08	-20.63	-199.26	-26.06	-5.96	-4.03	-8.02	-5.51
health: very good	60.35	4.47	56.40	4.21	2.05	0.72	1.95	0.69
health: good	187.92	11.57	178.79	11.10	5.66	1.62	5.24	1.52
health: fair	472.58	15.58	456.68	15.18	47.69	7.37	44.23	6.92
health: poor	1,299.05	16.53	1,277.83	16.40	24.94	1.50	18.89	1.15
race/ethnicity: black	-20.41	-0.83	-23.53	-0.96	-1.88	-0.31	-0.29	-0.05
race/ethnicity: hispanic	11.28	0.30	9.25	0.25	-4.40	-0.49	-3.55	-0.40
race/ethnicity: asian	-55.51	-2.46	-49.81	-2.23	-8.53	-1.57	-6.62	-1.24
race/ethnicity: other	-12.66	-0.63	-10.82	-0.55	-1.11	-0.25	-0.73	-0.17
sex: male	-78.82	-5.33	-66.51	-4.54	-8.44	-2.27	-5.72	-1.57
age	-49.75	-9.08	-47.64	-8.77	-0.05	-0.04	-0.27	-0.21
age-squared	0.664	11.42	0.634	11.00	0.007	0.49	0.008	0.59
year: 2007	65.11	5.16	62.54	4.99	-5.79	-2.25	-6.12	-2.40
year: 2008	98.36	7.45	93.84	7.16	-5.30	-1.93	-5.51	-2.03
year: 2009	142.30	10.82	137.50	10.54	-4.94	-1.79	-4.86	-1.79
year: 2010	166.02	12.38	153.35	11.52	-4.89	-1.73	-4.43	-1.59
year: 2011	176.50	12.83	161.67	11.84	-2.65	-0.91	-2.26	-0.78
intercept	1,129.50	8.90	1,088.79	8.66	19.51	0.64	21.13	0.71
rho_ar	0.207		0.209		0.355		0.360	
sigma_u	861.79		853.77		230.28		225.72	
sigma_e	2,806.25		2,779.28		489.06		480.82	
rho_fov	0.086		0.086		0.181		0.181	
wald chi-square(18)	1,848.71		1,993.78		106.52		108.19	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.008		0.008		0.001		0.001	

Number of observations = 930,231; Number of members = 20,541

Table B4. KingCare^{SM} Medical Cost Models for Non-Participants of Healthy Incentives^{SM}, 2006-2011

Independent Variable	In-Network Allowed Coef.	z	In-Network County Coef.	z	Out-of-Network Allowed Coef.	z	Out-of-Network County Coef.	z
deductible	-16.14	-1.77	-52.07	-5.74	-3.34	-3.61	-4.47	-4.97
sex: male	-64.65	-3.61	-57.80	-3.25	-8.45	-3.21	-7.14	-2.76
age	-17.22	-9.37	-17.13	-9.38	0.16	0.63	0.00	0.00
age-squared	0.385	14.06	0.375	13.78	0.005	1.33	0.006	1.69
year: 2007	23.17	1.54	21.68	1.45	-0.67	-0.44	-0.76	-0.51
year: 2008	32.50	2.14	29.96	1.98	0.52	0.33	0.36	0.24
year: 2009	94.13	6.20	89.82	5.95	0.92	0.59	0.65	0.42
year: 2010	73.33	4.48	67.05	4.12	1.21	0.71	1.22	0.73
year: 2011	58.72	3.49	50.28	3.00	1.05	0.59	0.64	0.37
intercept	316.11	11.69	322.99	12.01	10.73	2.88	10.72	2.93
rho_ar	0.312		0.314		0.316		0.320	
sigma_u	1,106.50		1,099.25		186.12		183.37	
sigma_e	2,707.89		2,687.92		269.51		261.51	
rho_fov	0.143		0.143		0.323		0.330	
wald chi-square(10)	544.08		527.50		82.00		76.67	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.003		0.003		0.001		0.001	

Number of observations = 796,203; Number of members = 25,884

Table B5. KingCare[SM] Medical Cost Models for Healthy Incentives[SM] Participants, 2006-2011

| Independent Variable | In-Network | | | | Out-of-Network | | | |
| | Allowed | | County | | Allowed | | County | |
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
health: very good	66.86	4.95	64.03	4.78	2.41	0.84	2.32	0.82
health: good	212.19	13.11	204.32	12.71	6.56	1.89	6.09	1.78
health: fair	582.63	19.37	566.38	18.97	52.88	8.26	49.36	7.80
health: poor	1,896.63	24.44	1,871.58	24.30	43.15	2.63	37.34	2.30
race/ethnicity: black	-26.66	-1.07	-30.54	-1.24	-2.13	-0.35	-0.58	-0.10
race/ethnicity: hispanic	12.22	0.32	10.79	0.29	-4.32	-0.48	-3.44	-0.39
race/ethnicity: asian	-60.35	-2.67	-56.72	-2.53	-8.70	-1.60	-6.89	-1.29
race/ethnicity: other	-16.97	-0.85	-15.90	-0.80	-1.23	-0.28	-0.88	-0.20
sex: male	-90.87	-6.12	-82.34	-5.59	-8.86	-2.39	-6.33	-1.74
age	-50.36	-9.15	-48.41	-8.87	-0.06	-0.05	-0.29	-0.22
age-squared	0.677	11.61	0.651	11.25	0.007	0.51	0.009	0.63
year: 2007	62.04	4.91	57.29	4.57	-6.01	-2.33	-6.49	-2.55
year: 2008	98.85	7.48	93.17	7.10	-5.39	-1.97	-5.70	-2.10
year: 2009	141.88	10.78	135.81	10.39	-5.10	-1.85	-5.14	-1.89
year: 2010	116.10	8.72	94.70	7.17	-7.16	-2.56	-7.14	-2.58
year: 2011	150.45	10.98	127.92	9.40	-3.83	-1.31	-3.90	-1.36
intercept	1,052.93	8.27	996.76	7.89	16.36	0.54	17.27	0.58
rho_ar	0.208		0.210		0.355		0.360	
sigma_u	867.86		860.02		230.45		225.84	
sigma_e	2,805.75		2,779.62		489.04		480.82	
rho_fov	0.087		0.087		0.182		0.181	
wald chi-square(17)	1,830.23		1,708.56		106.75		92.55	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.007		0.007		0.001		0.001	

Number of observations = 930,231; Number of members = 20,541

Table B6. KingCare[SM] Medical Cost Models for Non-Participants of Healthy Incentives[SM], 2006-2011

Independent Variable	In-Network				Out-of-Network			
	Allowed		County		Allowed		County	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
sex: male	-65.53	-3.65	-60.45	-3.38	-8.61	-3.27	-7.36	-2.84
age	-17.29	-9.39	-17.27	-9.43	0.15	0.60	-0.01	-0.05
age-squared	0.387	14.08	0.378	13.85	0.005	1.38	0.007	1.76
year: 2007	21.77	1.45	17.16	1.15	-0.96	-0.63	-1.16	-0.78
year: 2008	31.48	2.07	26.67	1.76	0.30	0.19	0.06	0.04
year: 2009	93.34	6.15	87.12	5.77	0.75	0.48	0.42	0.27
year: 2010	69.28	4.28	53.95	3.34	0.39	0.23	0.11	0.06
year: 2011	55.27	3.30	39.03	2.34	0.35	0.20	-0.31	-0.18
intercept	308.46	11.55	297.09	11.18	9.02	2.44	8.44	2.33
rho_ar	0.312		0.314		0.316		0.320	
sigma_u	1,112.33		1,105.32		186.31		183.51	
sigma_e	2,707.23		2,687.37		269.48		261.50	
rho_fov	0.144		0.145		0.323		0.330	
wald chi-square(9)	538.77		492.36		68.85		51.95	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.002		0.002		0.001		0.001	

Number of observations = 796,203; Number of members = 25,884

Table B7. Group Health Medical Cost Models, 2006-2011

| Independent Variable | Healthy Incentives[SM] Participants | | | | Non-participants | | | |
| | Allowed | | County | | Allowed | | County | |
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
health: very good	25.34	1.18	24.61	1.16				
health: good	198.93	7.96	194.24	7.84				
health: fair	280.79	6.17	272.81	6.05				
health: poor	936.32	7.46	922.86	7.42				
race/ethnicity: black	49.26	1.93	48.19	1.91				
race/ethnicity: hispanic	-21.26	-0.50	-21.40	-0.51				
race/ethnicity: asian	-18.45	-0.68	-17.22	-0.64				
race/ethnicity: other	0.92	0.03	0.54	0.02				
sex: male	-65.84	-3.73	-63.08	-3.61	-4.50	-0.25	-3.72	-0.21
age	-34.49	-5.07	-33.87	-5.03	-4.67	-2.46	-4.54	-2.41
age-squared	0.453	6.24	0.445	6.19	0.148	5.28	0.144	5.18
year: 2007	49.36	2.38	47.16	2.29	12.34	0.79	10.40	0.67
year: 2008	91.18	4.18	88.47	4.09	6.25	0.40	4.51	0.29
year: 2009	69.25	3.16	67.57	3.10	6.98	0.43	5.73	0.36
year: 2010	60.58	2.99	58.79	2.93	26.02	1.63	24.33	1.54
year: 2011	67.06	3.28	64.07	3.16	37.36	2.30	34.71	2.15
intercept	758.71	4.86	740.91	4.80	130.61	4.72	125.15	4.56
rho_ar	0.073		0.072		0.122		0.122	
sigma_u	490.94		483.81		644.71		639.01	
sigma_e	2,495.37		2,480.46		1,775.08		1,761.88	
rho_fov	0.037		0.037		0.117		0.116	
wald chi-square(17 & 9)	321.62		313.47		152.23		147.00	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.003		0.003		0.002		0.002	

Participants models: Number of observations = 230,722; Number of members = 6,396
Non-participants models: Number of observations = 228,773; Number of members = 8,434

Table B8. KingCare[SM] Prescription Cost Models for Healthy Incentives[SM] Participants, 2006-2011

Independent Variable	Generic 30-Day Retail				Generic 90-Day Mail-Order			
	Allowed		County		Allowed		County	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
health: very good	1.14	4.90	0.70	3.30	0.60	3.31	0.55	3.24
health: good	3.07	10.68	1.96	7.44	1.66	7.45	1.51	7.22
health: fair	7.26	13.79	4.25	8.79	5.38	13.10	4.76	12.29
health: poor	20.72	15.46	16.25	13.13	6.22	5.94	5.50	5.53
race/ethnicity: black	-0.55	-0.82	-0.93	-1.62	-2.36	-5.15	-1.93	-4.80
race/ethnicity: hispanic	-1.30	-1.38	-1.03	-1.25	-2.94	-4.42	-2.50	-4.25
race/ethnicity: asian	-4.12	-7.01	-3.24	-6.31	-1.64	-4.02	-1.39	-3.86
race/ethnicity: other	-2.05	-5.20	-1.86	-5.26	-1.29	-4.36	-1.18	-4.35
sex: male	-4.87	-10.39	-3.24	-8.20	-1.35	-4.47	-1.07	-4.17
age	-0.34	-2.46	-0.24	-2.00	-1.08	-11.20	-0.82	-9.58
age-squared	0.008	5.43	0.005	3.98	0.015	14.73	0.011	12.47
year: 2007	-2.84	-14.01	-3.86	-20.83	-0.10	-0.63	-0.46	-2.99
year: 2008	-1.97	-9.00	-3.06	-15.34	-0.33	-1.92	-0.70	-4.34
year: 2009	0.67	2.98	-0.16	-0.77	1.45	8.41	1.08	6.68
year: 2010	2.49	10.68	2.55	12.12	1.98	11.17	1.91	11.54
year: 2011	6.12	24.72	5.51	24.73	3.63	19.48	3.34	19.29
intercept	14.44	4.47	11.07	3.92	20.51	9.16	15.77	7.96
rho_ar	0.351		0.367		0.026		0.067	
sigma_u	31.69		26.45		20.02		16.76	
sigma_e	38.20		34.29		42.76		38.90	
rho_fov	0.408		0.373		0.180		0.157	
wald chi-square(17)	4,050.27		4,119.53		2,641.51		2,301.18	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.019		0.013		0.009		0.007	

Number of observations = 930,231; Number of members = 20,541

Table B9. KingCare[SM] Prescription Cost Models for Non-participants, 2006-2011

Independent Variable	Generic 30-Day Retail				Generic 90-Day Mail-Order			
	Allowed		County		Allowed		County	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
sex: male	-2.52	-8.46	-1.44	-5.78	-0.52	-3.98	-0.36	-3.17
age	0.15	4.96	0.15	5.88	-0.10	-7.47	-0.06	-5.32
age-squared	0.002	5.06	0.000	1.22	0.003	16.39	0.002	12.69
year: 2007	-1.06	-5.67	-1.33	-7.63	0.07	0.92	-0.01	-0.07
year: 2008	-0.40	-2.11	-0.82	-4.59	0.21	2.61	0.09	1.25
year: 2009	1.46	7.57	1.02	5.68	0.59	7.37	0.47	6.29
year: 2010	2.57	12.41	2.38	12.42	0.70	8.12	0.57	7.08
year: 2011	3.25	15.11	2.98	15.01	0.80	8.97	0.68	8.22
intercept	2.44	5.77	1.24	3.43	0.73	3.96	0.45	2.80
rho_ar	0.367		0.383		< 0.001		0.030	
sigma_u	20.61		16.73		9.14		7.71	
sigma_e	31.38		28.87		18.93		17.28	
rho_fov	0.301		0.251		0.189		0.166	
wald chi-square(9)	2,366.15		1,669.73		1,477.36		1,048.28	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.017		0.009		0.005		0.003	

Number of observations = 796,203; Number of members = 25,884

Table B10. KingCare[SM] Prescription Cost Models for Healthy Incentives[SM] Participants, 2006-2011

| Independent Variable | Preferred 30-Day Retail | | | | Preferred 90-Day Mail-Order | | | |
| | Allowed | | County | | Allowed | | County | |
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
health: very good	4.04	1.88	3.64	1.71	0.46	0.25	0.12	0.07
health: good	13.33	5.02	11.73	4.44	7.89	3.53	6.63	2.96
health: fair	35.55	7.35	31.13	6.43	20.90	5.09	17.82	4.32
health: poor	68.01	5.48	57.58	4.62	-2.20	-0.21	-6.36	-0.60
race/ethnicity: black	-6.68	-1.38	-6.37	-1.33	-11.25	-2.65	-10.50	-2.51
race/ethnicity: hispanic	-5.01	-0.69	-5.06	-0.71	-4.61	-0.74	-4.47	-0.72
race/ethnicity: asian	-13.36	-3.02	-12.22	-2.81	-6.61	-1.73	-6.34	-1.68
race/ethnicity: other	-3.96	-1.14	-3.68	-1.07	-7.85	-2.68	-7.60	-2.62
sex: male	1.28	0.42	2.15	0.72	1.04	0.38	1.18	0.44
age	-1.39	-1.25	-1.14	-1.04	-1.72	-1.87	-1.37	-1.50
age-squared	0.031	2.65	0.026	2.26	0.034	3.47	0.029	2.98
year: 2007	-13.89	-7.67	-11.45	-6.39	5.08	3.16	5.44	3.40
year: 2008	-15.31	-7.05	-12.52	-5.81	8.30	4.77	8.71	5.01
year: 2009	-24.74	-10.80	-20.49	-9.01	4.17	2.37	4.84	2.75
year: 2010	-8.42	-3.55	-7.10	-3.01	14.96	8.30	14.93	8.31
year: 2011	-5.60	-2.22	-4.79	-1.91	14.45	7.66	14.13	7.51
intercept	39.56	1.54	32.48	1.28	23.06	1.08	16.71	0.79
rho_ar	0.750		0.755		0.445		0.460	
sigma_u	169.28		164.88		173.35		169.83	
sigma_e	221.23		217.41		275.44		269.37	
rho_fov	0.369		0.365		0.284		0.284	
wald chi-square(17)	426.45		308.16		405.27		348.89	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.004		0.003		0.003		0.003	

Number of observations = 930,231; Number of members = 20,541

Table B11. KingCare^SM Prescription Cost Models for Non-participants, 2006-2011

| | Preferred 30-Day Retail | | | | Preferred 90-Day Mail-Order | | | |
| | Allowed | | County | | Allowed | | County | |
Independent Variable	Coef.	z	Coef.	z	Coef.	z	Coef.	z
sex: male	0.40	0.41	0.81	0.88	-0.12	-0.10	0.03	0.03
age	0.22	2.37	0.24	2.74	-0.49	-4.53	-0.44	-4.16
age-squared	0.009	6.63	0.007	5.57	0.017	10.46	0.015	9.78
year: 2007	-3.26	-7.13	-2.56	-5.87	2.45	4.57	2.46	4.64
year: 2008	-1.26	-2.68	-0.55	-1.23	3.67	6.75	3.69	6.88
year: 2009	-4.34	-9.08	-3.34	-7.32	3.69	6.69	3.74	6.87
year: 2010	-5.68	-11.00	-5.58	-11.32	5.05	8.45	4.85	8.23
year: 2011	-4.91	-9.05	-4.64	-8.96	5.73	9.14	5.58	9.01
intercept	6.93	5.21	5.29	4.22	2.86	1.82	2.41	1.56
rho_ar	0.307		0.311		0.116		0.124	
sigma_u	72.04		67.61		85.37		83.98	
sigma_e	80.45		76.63		113.63		111.27	
rho_fov	0.445		0.438		0.361		0.363	
wald chi-square(9)	1,189.65		1,052.13		662.38		602.93	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.016		0.014		0.003		0.003	

Number of observations = 796,203; Number of members = 25,884

Table B12. KingCare^{SM} Prescription Cost Models for Healthy Incentives^{SM} Participants, 2006-2011

Independent Variable	Non-Preferred 30-Day Retail				Non-Preferred 90-Day Mail-Order			
	Allowed		County		Allowed		County	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
health: very good	0.66	2.05	0.52	1.74	0.50	3.18	0.54	3.37
health: good	1.76	4.51	1.54	4.21	0.65	3.39	0.81	4.15
health: fair	2.09	2.90	1.84	2.72	1.90	5.43	2.27	6.26
health: poor	11.30	6.14	11.14	6.40	0.76	0.85	0.85	0.91
race/ethnicity: black	0.50	0.70	0.05	0.08	-1.08	-2.97	-0.88	-2.55
race/ethnicity: hispanic	1.40	1.32	1.10	1.14	-0.70	-1.31	-0.59	-1.14
race/ethnicity: asian	-1.75	-2.71	-1.46	-2.50	-0.67	-2.04	-0.43	-1.38
race/ethnicity: other	0.75	1.48	0.77	1.66	-0.47	-1.87	-0.28	-1.10
sex: male	-2.22	-4.95	-1.70	-4.22	-0.19	-0.80	-0.13	-0.60
age	0.55	3.55	0.61	4.34	0.15	1.83	0.04	0.49
age-squared	-0.003	-1.99	-0.005	-3.11	0.000	-0.17	0.001	1.05
year: 2007	4.44	15.40	3.06	11.31	1.73	12.99	2.04	13.89
year: 2008	3.52	11.54	2.73	9.57	0.76	5.05	1.56	10.19
year: 2009	4.02	13.14	3.42	11.94	1.09	7.06	1.94	12.65
year: 2010	0.56	1.79	-0.38	-1.30	-0.01	-0.09	0.58	3.71
year: 2011	-0.07	-0.21	-0.47	-1.55	-0.86	-5.15	0.32	1.97
intercept	-12.74	-3.57	-13.57	-4.19	-4.99	-2.68	-3.16	-1.83
rho_ar	0.257		0.249		0.613		-0.048	
sigma_u	28.63		25.39		14.47		12.47	
sigma_e	60.71		57.44		18.81		37.95	
rho_fov	0.182		0.163		0.372		0.097	
wald chi-square(17)	671.37		564.96		538.11		513.41	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.003		0.002		0.005		0.002	

Number of observations = 930,231; Number of members = 20,541

Table B13. KingCare Prescription Cost Models for Non-participants, 2006-2011

| Independent Variable | Non-Preferred 30-Day Retail | | | | Non-Preferred 90-Day Mail-Order | | | |
| | Allowed | | County | | Allowed | | County | |
	Coef.	z	Coef.	z	Coef.	z	Coef.	Z
sex: male	-0.74	-2.37	-0.42	-1.49	-0.20	-2.15	-0.16	-1.61
age	0.09	2.97	0.08	3.04	-0.02	-2.20	-0.02	-2.03
age-squared	0.001	1.98	0.000	1.16	0.001	6.09	0.001	6.20
year: 2007	2.01	10.46	1.53	8.78	0.35	6.58	0.40	5.41
year: 2008	1.94	9.99	1.61	9.13	0.26	4.46	0.30	4.15
year: 2009	2.45	12.50	2.15	12.09	0.21	3.52	0.31	4.20
year: 2010	1.43	6.82	0.86	4.51	0.17	2.70	0.22	2.76
year: 2011	1.64	7.54	1.22	6.17	0.01	0.17	0.11	1.33
intercept	-0.58	-1.32	-0.65	-1.64	0.19	1.43	0.07	0.50
rho_ar	0.233		0.222		0.598		-0.072	
sigma_u	21.73		19.43		6.22		5.57	
sigma_e	37.01		34.09		6.98		16.59	
rho_fov	0.256		0.245		0.443		0.101	
wald chi-square(9)	588.27		468.43		304.06		324.34	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.003		0.003		0.004		0.001	

Number of observations = 796,203; Number of members = 25,884

Table B14. Group Health Prescription Drug Cost Models, 2006-2011

| Independent Variable | Healthy Incentives Participants | | | | Non-participants | | | |
| | Allowed | | County | | Allowed | | County | |
	Coef.	z	Coef.	z	Coef.	z	Coef.	z
health: very good	2.25	0.96	1.87	0.82				
health: good	10.62	3.64	8.73	3.08				
health: fair	26.76	5.20	22.60	4.51				
health: poor	54.41	3.72	47.12	3.31				
race/ethnicity: black	-2.25	-0.38	-3.31	-0.57				
race/ethnicity: Hispanic	8.51	1.00	7.98	0.97				
race/ethnicity: asian	-11.20	-1.97	-9.95	-1.81				
race/ethnicity: other	-2.49	-0.65	-2.34	-0.63				
sex: male	-1.76	-0.35	-0.51	-0.11	-0.08	-0.03	1.12	0.39
age	-4.64	-3.41	-3.87	-2.95	-0.53	-1.79	-0.36	-1.26
age-squared	0.070	4.81	0.057	4.06	0.023	5.37	0.017	4.06
year: 2007	2.34	1.14	1.35	0.68	3.51	2.03	3.01	1.77
year: 2008	9.47	4.33	8.18	3.84	8.74	4.90	7.93	4.52
year: 2009	10.33	4.55	8.99	4.07	10.44	5.68	9.45	5.23
year: 2010	10.34	4.59	9.67	4.42	12.17	6.55	11.30	6.20
year: 2011	15.04	6.29	14.19	6.12	13.16	6.86	12.21	6.49
intercept	95.18	3.03	78.72	2.60	5.16	1.22	2.27	0.55
rho_ar	0.040		0.047		0.288		0.297	
sigma_u	191.84		182.97		120.75		115.52	
sigma_e	243.90		235.95		163.40		159.17	
rho_fov	0.382		0.376		0.353		0.345	
wald chi-square(17 & 9)	327.23		253.03		290.21		198.98	
prob < chi-square	< 0.001		< 0.001		< 0.001		< 0.001	
R-squared	0.007		0.005		0.006		0.004	

Participants models: Number of observations = 230,722; Number of members = 6,396

Non-participants models: Number of observations = 228,773; Number of members = 8,434