2006-0386 Attachment A

King County

Health Reform Initiative

2005 Measurement and Evaluation Report

August 2006

King County

Health Reform Initiative Policy Committee

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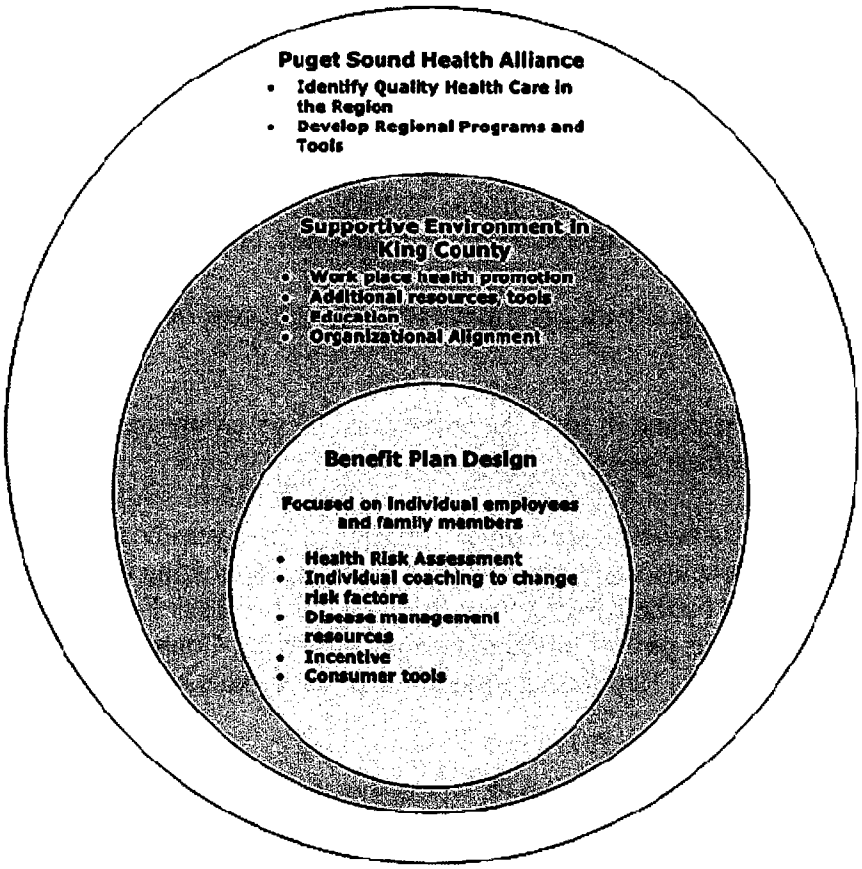
Table of Contents

Executive Summary

The Health Reform Initiative (HRI) is a comprehensive effort to take an integrated approach to improving health and health care quality and managing health care costs—one that a) seeks to address the cost and quality issues in the health care system while at the same time b) supporting accountability within King County for creating a healthy workplace, and c) encouraging personal accountability on the part of employees and their dependents for adopting healthy behaviors and using health care resources wisely. It is based on solid research as well as the advice of respected experts in health, health care systems and organizational health promotion. Specific program elements of the HRI were designed in response to the 2004 recommendations of the King County Health Advisory Task Force (HAT Force). The HAT Force produced two reports that were reviewed by the Council and adopted by Motions 11890 and 12023.

The scope of the HRI includes both the programs King County can implement internally, and changes needed in the external marketplace to create a true, integrated health care system. The figure below illustrates the major elements of the HRI design:



The outer-most ring of the HRI is the Puget Sound Health Alliance (PSHA). King County was instrumental in the creation of the PSHA, and is a strong advocate for is mission and goals. Key services from the PSHA that directly support the HRI include clinical guidelines for physicians, hospitals and other health care professionals; decision-making tools for patients and consumers; regional reports on quality, cost and value; a regional database that can be analyzed for quality, cost performance, and health care improvement in the region; and a regional infrastructure to support sustained quality improvement.

The programs of the HRI internal to King County are shown in the two inner rings. These are the county's health benefit program design for 2007 - 2009 (the Healthy Incentives[SM] program) and the Education and Outreach program that creates a supportive environment to help employees and their dependents improve their health. This Measurement and Evaluation report is focused solely on the internal programs of the HRI.

The goals of the Health Reform Initiative's internal programs are ambitious—improve the long-term health of King County employees and reduce the rate of growth in King County's health care costs by one-third over the period of 2007 – 2009. The programs focus on moving employees and family members with higher risks to lower risk, keeping people with lower risk healthy, and teaching consumers how to make more effective health care choices. Prior to launching the Healthy Incentives[SM] program the county:

- Conducted a health and productivity analysis of current and predicted future health care utilization;
- Conducted a survey and focus groups of employees to determine the best way to engage King County employees and their families; and
- Developed a business case to estimate the expected cost-benefit of various interventions.

The county used the information from the survey and focus groups to develop the Education and Outreach program.

In 2004, the executive's benefits philosophy—keeping employees healthy, teaching employees to make more effective health care choices, and reducing health risks—was reviewed and endorsed by the King County Health Advisory Task Force. The Council also reviewed the benefits philosophy and approved the King County Health Advisory Task Force Initial Findings Report that included the executive's benefits philosophy (Motion 11890).

The county used the business case (which was adopted by Council Motion 12131) to test options for designing the 2007 – 2009 benefits plan. Based on the results, the county and labor negotiated a package of pilot programs for managing claims costs and the wellness assessment and individual action plan design to reduce individual and

population health risk related to current tobacco use, high blood pressure, high cholesterol, physical activity less than 3 times per week, poor nutrition, high stress/poor well-being, high alcohol use or a body mass index greater than 26. The business case indicated that while these strategies should lead to significant cost trend reduction, additional interventions would be needed to fully reach the goal. Therefore two changes in health plan design, an increase in emergency room co-pay and a $35 per month benefit access fee, were added.

An essential component of the HRI is the design and implementation of a comprehensive measurement and evaluation system. This system will provide the county with information it needs to assess the effectiveness of each of the internal HRI interventions and determine whether the initiative as a whole is contributing to employee/dependent long-term improvements in health and slowing the projected increases in medical care costs.

In addition, the evaluation will provide critical information that will enable the county to recommend and negotiate with labor design improvements in the HRI interventions during the implementation period. This approach to plan, launch, check, and adjust, is a well-established methodology for ensuring that ongoing enhancements in program design occur in order to achieve improved results.

Although complete evaluation results will not be available until 2010, the evaluation process will yield important information that the county and labor can use to make design improvements in the HRI interventions during the implementation period. Generally speaking, evaluation results are expected to progress as follows: establish baselines in 2005, derive Indicative Findings in 2006, Directional Guidance in 2007, Early Trends in 2008, and Program Trends by 2009-2010.

Evaluation Timeline

Results	Period	Comment	Report
Baseline	2005	Establishes reference point for measuring changes	August 2006
Indicative Findings	2006	Early point estimates too preliminary to signal directional change	August 2007
Directional Guidance	2007	Initial indications of serial results that could represent emerging trends	August 2008
Early Trends	2008	Likely emerging trends	August 2009
Program Trends	2009-2010	Statements of cumulative change, 2005-2009	August 2010

2005 – Setting the Baseline

Healthy Incentives℠ Program

As noted in the table above, 2005 is a baseline year. Focus was on establishing programs and interventions, educating employees and their family members, and initiating engagement with the concepts of creating a healthy work place and taking personal accountability for maintaining health. These interventions are expected to become the basis for long term improvement in health for the King County employee population that over time will result in a lower health care cost trend rate than the county would have seen if it had not made this investment in improving health.

Key activities in 2005 included:

- Finalizing the details of the 2007 – 2009 Healthy Incentives℠ program.
- Launching pilot versions of components of the Healthy Incentives℠ program that provide support to employees and family members who have serious or chronic health conditions and need assistance in managing those conditions.[1]
- Launching the Education and Outreach program for health promotion in the workplace.
- Determining the evaluation approach and logic models for the measurement of both the Healthy Incentives℠ program and the Health Promotion/ Education and Outreach programs.
- Determining sources for data.
- Establishing the database and the process for obtaining, normalizing and integrating the data from multiple sources.
- Developing and testing the measurement methodology.
- Calculating first year baseline information.

The first intervention programs of the HRI aimed at improving health and health care quality and managing costs were launched on a pilot basis in January, 2005. These include:

- Nurse advice line (provides current, reliable information on health-related issues 24-hours a day).

[1] These programs were purchased from Aetna for the KingCare℠ program. Group Health has services similar to these embedded into their integrated model for delivering patient-centered care.

- Disease management (provides ongoing support and education to members with specific chronic conditions—chronic heart failure, coronary artery disease and diabetes).

- Case management (telephone outreach to members needing hospital or other specialized care).

- Provider best practice (provides evidence-based treatment information to providers).

- Performance provider network (identifies efficient physicians in defined specialty practices).

The nurse advice line was implemented based on the results of an in-depth employee survey and focus groups conducted in May of 2004. Participants consistently listed access to a 24/7 nurse advice line as their preferred resource for self-care.

The three disease management programs were selected because the Health and Productivity analysis conducted in July of 2004 found these conditions are prevalent in the employees and dependents covered by health plans, and are significant factors in the health care expenses of the 5 percent of claimants in the health plans who accounted for 58 percent of the medical and pharmacy costs.

The case management, provider best practice, and performance provider network programs use medical and pharmacy claims, lab results, and special modeling technology to identify opportunities to improve the health care the member is receiving.

In this baseline year key results are focused on participation levels in the five new programs. The county has been successful in educating employees and their dependents about these new programs and consequently participation levels exceed the levels achieved by other employers in Aetna's book of business.

Nurse Advice Line (Informed Health Line®)

The Informed Health Line is available to members 24 hours a day, 7 days a week via a toll-free telephone number. Registered nurses guide callers through a decision model to help the caller determine whether their condition can be treated at home, requires a provider office visit, or requires immediate attention in an urgent care center or hospital emergency room.

King County employees and their families used the nurse advice line at twice the rate of other employers who subscribe to Aetna's Informed Health Line. Nearly 42 percent of callers asked for general health information, and 35 percent requested information on self-care or home treatments. Only 5.7 percent of calls were for assistance in deciding if the member needed to go to the emergency room or could wait to make an appointment

for an office visit. Information about utilization of the nurse advice line is summarized below:

Informed Health Line – 2005 Utilization	
Total calls handled	1,232
First time callers	978
Annualized calls for every 100 eligible households	12.3%
Aetna book of business annualized call rate	5.6%
#1 reason for call –request for health information	41.8%
#2 reason for call—request for information on self-care/home treatment	35.1%

Disease Management

The disease management program directs focused support and resources toward members with chronic heart failure, coronary artery disease and diabetes in order to improve health status and quality of life. It provides education for both the member and provider. Educational services for the member include written materials and telephone coaching calls to help the member to identify and address health risk factors associated with their chronic condition. The frequency and intensity of these education services is based on the member's individual level of risk. Members in the highest risk group (Level 5) have at least a 20 percent chance of experiencing an acute exacerbation of their conditions within the upcoming year, and are at least 10 times as likely to have a sudden onset of complications in the next year compared with members at Level 1.

King County members identified as having chronic health disease, coronary artery disease (CAD) or diabetes participated in the disease management programs at slightly higher rates than members in other plans in Aetna's book of business.

The table below shows the number of KingCare members who have been flagged as having one of the target diseases along with participation statistics.

Disease Management Participation Statistics

Condition	Invited Members with Condition	Members Participating in Disease Management Program	Members receiving "high touch" disease management (telephone consultations)	Members receiving "educational" disease management (mailed a semi-annual newsletter)	Members Who Have Not Yet Selected Participation Level (Receiving No Disease Management)	Percent of Invited Members who Have Chosen to Participate and Have Chosen Participation Level
Congestive Heart Failure	175	131	14	105	12	68%
Coronary Artery Disease	291	182	13	160	9	59%
Diabetes	1,182	1,078	30	1,032	16	90%
Total	1,649	1,391	57	1,297	37	82%

Case Management (Enhanced Member Outreach℠)

A standard part of the services that KingCare℠ purchases from our medical claims administrator is a review of cases and some interventions to avoid unnecessary claims. The Enhanced Member Outreach (EMO) program supplements Aetna's standard case management program through the use of additional clinical resources from medical and pharmacy and lab results data to identify members who are at greater risk because they are going into the hospital, getting ready to leave the hospital, or have a claims history that indicates presence of an uncontrolled chronic condition or other risk factors. Specially trained EMO nurses call these members to encourage them to work closely with their health care providers and follow their treatment plans.

The EMO nurses identified 1,138 unique members whose claims profiles indicated they qualified for the EMO services. The EMO nurse was able to successfully contact 799 of those members for a 70 percent completion rate. (The EMO program is a new service from Aetna that started in fourth quarter 2004. It is based in downtown Seattle, and thus there are not yet many employers who have this program, so book of business comparisons are not yet available.)

Provider Best Practice (MedQuery®)

MedQuery uses claims history, current medical claims, pharmacy, laboratory, physician encounter reports and patient demographics along with evidence-based treatment recommendations to find possible errors, gaps, omissions (*e.g.* certain accepted treatment regimens may be absent) or co-missions in care (*e.g.* drug-to-drug or drug-to-disease interactions.) When MedQuery identifies a member whose data indicates that there may be an opportunity to improve care, outreach is made to the treating physician based on the apparent urgency of the situation.

In 2005 the MedQuery program identified 3,213 instances where the claims data indicated a variation from best practice protocols and the member's physician was

notified and provided the information. Sixty two of these instances were judged to be Severity Level 1--clinically urgent, meaning immediate action is needed to prevent serious harm or even death. The distribution of severity levels of cases for King County members versus Aetna's book of business (BOB) is shown in the table below.

MedQuery—2005 Utilization			
Severity Level	***# of Physician Contacts***	***% of Total for King County***	***% of Total for Aetna BOB***
1—Clinically Urgent	62	1.93%	2%
2—Clinically Important	2,172	67.60%	76%
3—Clinically Notable	979	30.47%	22%

Early claims data indicate that 36.8% physicians contacted by MedQuery reviewed their treatment plans, determined there were no mitigating circumstances not shown in the claims data and made the changes recommended in the MedQuery best practice protocol.

Performance provider network (Aexcel®)

The Performance provider network is comprised of Aexcel-designated specialists, participating primary care providers, and hospitals and physicians in non-Aexcel-designated specialties. The overall cost of care delivered within Aexcel-designated specialties is evaluated based on certain measures of volume, clinical performance and cost-efficiency measures.

Approximately 79 percent of KingCare members who visited specialists in 2005 used specialists who are in the Aexcel network. There are no incentives in the plan to "push" members towards using Aexcel network providers (*e.g.* lower co-insurance than if the member used a non-Aexcel specialist).

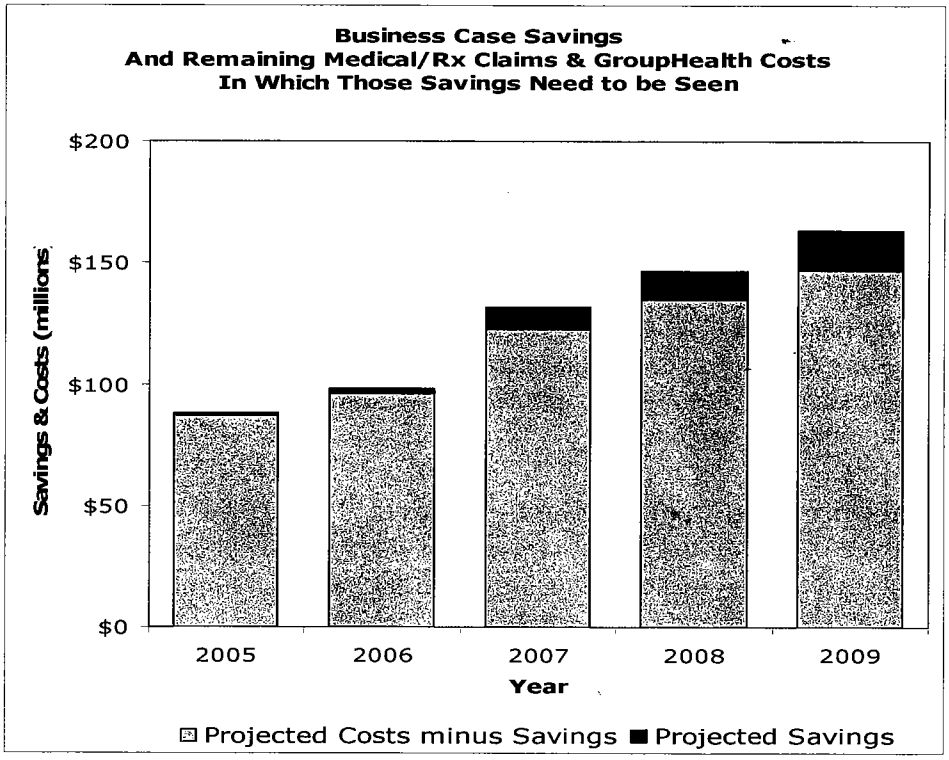
Overall Effect of the Pilot Programs on Claims in 2005

Although the major focus in 2005 was on launching programs and encouraging member participation, the county did conduct a detailed analysis of claims incurred in 2005 compared to claims in the 2002 – 2004 period to 1) test the database and establish the process for obtaining, normalizing and integrating the data from multiple sources, and 2) see if there were early patterns showing some level of correlation with these programs.

Overall, in 2005, medical billed claims for employees continued the 2002-2004 trend (9.81% from 2002 to 2003 and 9.66% from 2003 to 2004). Pharmacy claims for employees showed less than the 14% growth seen in 2003 - 2004, producing approximately $580,000 in savings, but the percent increase was within a margin of error of the estimated baseline growth. There was no statistically significant deviation from the pharmacy claims trend, so the 2005 savings can be reasonably attributed to random

variations. Total incurred medical and pharmacy claims in 2005 (based on claims processed January 1 through May 31, 2005) was $88 million.

The business case[2] for the HRI estimated that there would be small net savings in 2005 from the implementation of the five pilot programs in the KingCare℠ health plan. The total savings minus the cost of the programs was expected to be approximately $1.1 million. The amount of net savings from all HRI programs was projected to grow each year as shown below.



As this chart illustrates, the amount of expected savings ($1.1 million) versus the total amount of medical and pharmacy claims ($88 million) is quite small. Because all of claims data from the second half of 2005 have not yet been received and analyzed, it is too early to detect with certainty whether or not the expected net savings occurred.

Education and Outreach

Communications and outreach activities that are part of the comprehensive health promotion strategy were in the planning and early implementation stages in 2005. Program elements inaugurated in 2005 include:

- **First annual Leadership Forum**, May 2005. Over 200 leaders and managers from all parts of the King County organization met to become informed about the

[2] See King County Health Reform Initiative Measurement & Evaluation Reports 2005 Technical Appendix for detailed discussion of data and findings.

Health Reform Initiative and learn about their role in making King County a healthier organization.

- **First annual Health and Benefits Fair**, September 2005. Approximately 2,000 employees attended.

- **Onsite flu shot program,** November 2005. Over 3,000 employees received flu shots at various work location around the county. The flu shots were free of charge to benefits-eligible employees.

- **Manager Toolkits.** The following toolkits were created to prepare managers for the Healthy Workplace Funding Initiative that began in 2006: *Resources for Soliciting Feedback from Employees* and *Effective Partnerships with Represented Employees.*

- **Eat Smart programming.** Partnerships were established with operators of vending machines at a number of King County worksites to add healthier snacks to vending machines. Work also started on getting a contract for an on-site weight management program. (In March of 2006 the contract was awarded to Weight Watchers at Work).

- **Move More programming.** During August and September, King County employees were invited to participate in Walk Fest 2005, a pilot program that encouraged employees to walk more. (Additional programming was added in 2006).

- **Comprehensive education** programming to prepare employees for the wellness assessment and individual action plan components of the Healthy Incentives℠ program. Health Matters partners conducted a series of "road shows" that were presented at worksites all over the county and also made available on DVD and on the county's website. These road shows explained the cost and quality crisis, the direct effect on both King County and county employees, and how improving one's personal health is an effective cost control intervention. This prepared employees to participate in the wellness assessment and individual action plan program in 2006.

- **Health Matters newsletter.** The first issue of the monthly newsletter was sent to each employee's home in December, 2004. The Education and Outreach team prepares a number of King County-specific articles for each issue.

Measurement of the effects of the Education and Outreach program will begin in 2006 with surveys that will focus on employees, spouses and partners, as well as managers and supervisors.

Conclusions

The county was successful in launching the pilot programs for the Healthy Incentives℠ Program and encouraging better than expected participation rates in both the pilot programs for the Healthy Incentives℠ program and the Education and Outreach efforts (particularly in attendance at the worksite-based education sessions designed to prepare employees for the wellness assessments that would start in 2006.) Indications from 2005 activities are that employees and their dependents are starting to take note of the messages about the crisis in health care quality and cost, and the role they have to play in managing their personal health. It is still too early to see this new thinking reflected in measurable changes in the 2005 claims data.

Chapter One

Background

History

King County, like other employers locally, regionally and nationwide, is facing continued double-digit increase in health care costs for the foreseeable future. If nothing is done, the county's benefits costs would be expected to double to $300 million by 2012. Past efforts at health care cost containment have been focused almost exclusively on controlling the "supply side" by limiting access to providers through managed care, contracting with providers for reduced fees, and after-the-fact utilization review. These approaches by themselves have not stemmed the cost trend.

There is an increasing realization that to achieve more effective cost containment employers like the county need to also focus on reducing the "demand side" of health care. Strategies for reducing demand include moving employees and family members with higher risks to lower risk, keeping people with lower risk healthy, and teaching consumers how to make more effective health care choices. The expectation that prevention and disease management will result in overall cost savings for employers stems directly from evidence that many leading causes of disability and premature death in the United States are potentially avoidable or controllable, including most injuries, and many serious and acute chronic conditions. For example, the National Institute of Health Diabetes Prevention Program study showed walking 30 minutes a day and losing 5 to 10 percent of body weight reduced the incidence of type 2 diabetes by 60%.

Given this background the King County executive proposed a benefits philosophy aimed at reducing demand for health care services by:

- Keeping employees healthy.
- Teaching employees to make more effective health care choices.
- Reducing health risks.

In 2004, the executive's benefits philosophy was reviewed and endorsed by the King County Health Advisory Task Force. The Council also reviewed the benefits philosophy and approved the King County Health Advisory Task Force Initial Findings Report that included the executive's benefits philosophy (Motion 11890).

As noted in the Health Advisory Task Force report, there are four components that are critical to the success of the county's efforts to reduce the demand side of health care costs:

1. Build a strong organizational alignment to aid/encourage health promotion in the workplace.

2. Develop and sustain an active, well-executed communication program aimed at both employees and their spouses/domestic partners.

3. Design a health care plan that rewards and reinforces member accountability for health and health care related decisions and actions.

4. Implement widely available tools to support the delivery of health education and benefits information.

The county is not alone in facing rapidly escalating medical care costs for its employees and their dependents. Businesses and governments across the nation are seeking new and improved methods of helping their employees and their dependents improve or sustain good health, and to effectively manage their health care conditions. This has led to increased attention to the development and evaluation of health promotion and health care management interventions that address both employee/dependent health and the associated medical care costs.

This approach is proving effective in other organizations because many times a relatively small proportion of employees and their dependents account for a large share of an employer's medical care costs. For example, a July 2004 Mercer Human Resources Consulting study indicated that 5% of the members in the county's KingCare℠[3] Plan accounted for 58% of the total plan costs and 20% of the members were responsible for 83% of the plan's costs. Correspondingly, 80% of the plan members used only 17% of the resources.

The county realized that the escalating cost of medical care would not abate unless it implemented a comprehensive effort to address some of the important underlying causal factors:

- Heart disease and certain types of cancer are the leading diagnoses among county employees and dependents with the most expensive medical claims.

- The high body mass index, high rates of tobacco use, and high blood pressure prevalent in the county population are significant contributors to chronic disease and the associated costs.

- An estimated 50% of the risk for conditions common in the county population is related to lifestyle and health behavior (Centers for Disease Control estimates).

[3] KingCare℠ is the name of the county's self-insured medical plan that covers approximately 80 percent of benefits-eligible employees and their families. The KingCare℠ plan in 2005 was administered by Aetna for medical claims and Caremark for pharmacy claims. The other 20 percent of employees are covered by the Group Health Cooperative HMO plan.

Given this background, in 2004 the county launched the Health Reform Initiative (HRI) a comprehensive, integrated effort to tackle both the problems in the health cares system itself and the ever-increasing utilization of health services by county employees and their families.

Health Reform Initiative

The scope of the HRI includes both the programs King County can implement internally, and changes needed in the external marketplace to create a true health care system designed to improve the quality of care and reduce health care costs by promoting coordination of care across providers, encouraging the use of evidence-based treatment guidelines, and creating a system of quality measurement used by all providers, health plans and health plan sponsors in the region. The conceptual framework of the HRI is presented in Figure 1.

Conceptual Framework of the Health Reform Initiative

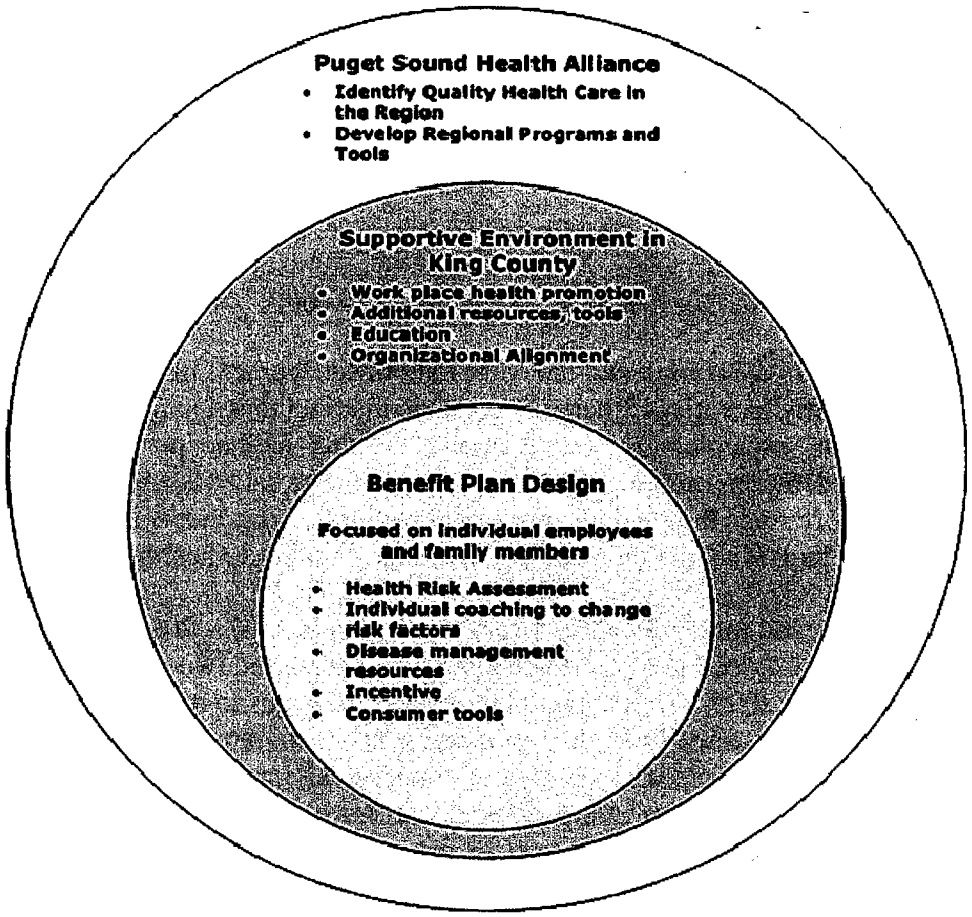


Figure 1

The Healthy Incentives[SM] Benefit Plan Design

At the heart of the HRI is the Healthy Incentives[SM] health care benefit plan. Prior to launching the Healthy Incentives[SM] program the county:

- Conducted health and productivity analysis of current and predicted future health care utilization;
- Conducted a survey and focus groups of employees to determine the best way to engage King County employees and their families; and
- Developed a business case to estimate the expected cost-benefit various interventions.

The county used the business case (which was adopted by Council Motion 12131) to test options for designing the 2007 – 2009 benefits plan. Following the business case, the Health Reform Initiative Policy Committee developed a set of criteria to be used in designing and negotiating benefit plans with the Joint Labor Management Insurance Committee[4] (JLMIC). Two key directives were:

- Improve the health of county employees and their dependents.
- Reduce the rate of growth of medical plan costs by one-third (which would produce $40M in savings from what health care would have cost if there were no interventions for the 2005-09 benefit plan years).

To those ends, in 2005 the county and the Joint Labor Management Insurance Committee negotiated the Healthy Incentives[SM] benefits package that includes 1) programs for disease management, expanded case management, nurse advice line, provider best practice care considerations, and high performance specialist network and 2) an expanded range of program offerings that include individual wellness assessments and targeted follow up through individual action plans to encourage changes to healthier behavior.

The official time period for the Healthy Incentives[SM] plan is 2007 – 2009; however the county and the unions agreed to a phased-in approach that started two years before the "official" program. In 2005, the county added several programs to its self-insured plan including a 24/7 Nurse Advice Line, disease management programs, and an active outreach program for members who are about to undergo an inpatient hospital stay, are getting ready to come home from an inpatient stay, or have medical indications that they may experience a high risk event in the next 12 months.

[4] The Joint Labor Management Insurance Committee is comprised of eight union representatives selected by the King County Labor Coalition (representing approximately 25 unions with over 92 bargaining units) who meet with management representatives to negotiate the benefits packages that are offered to employees. The King County Police Officers' Guild bargains a separate benefit package with the county through its collective bargaining agreement. Approximately 87 percent of the county's workforce is represented.

In 2006, the program starts to focus on both "healthy" and "at risk" employees and their spouse/domestic partners. All benefit-eligible employees and their spouses/domestic partners are eligible to take a wellness assessment that focuses on health behaviors such as nutrition, physical activity, perception of stress, use of tobacco and alcohol, safety habits (such as wearing seat belts when traveling in an automobile) and health consumer habits (such as getting age and gender-appropriate screenings.) This wellness assessment measures the member's level of risk[5], openness to making behavior change in each area, and the member's confidence in his/her ability to make a change.

Participation in the wellness assessment and individual action plans is voluntary, however there are financial incentives attached to participation. Members who take the assessment and participate in an individual action plan in 2006 will be eligible for the gold out-of-pocket expense level in the health plan in 2007. Members who take the wellness assessment but do not participate in an individual action plan will be eligible for the silver level, and members who do not take the wellness assessment will only be eligible for the bronze of out-of-pocket expense level. The benefits covered by each out-of-pocket expense level are the same; the only difference is amount the member pays for services. (Please note: King County pays the entire health plan premium for the employee and family.) Table 1 illustrates *some* of the differences in out-of-pocket expenses for the county's two health plan choices:

	KingCare℠		Group Health	
	Annual Deductible	Co-insurance*	Office Visit Copay	Hospital Copay**
Gold	$100/ind. $300/family	10%	$20	$200
Silver	$500/ind. $1,000/family	20%	$35	$400

*In-network provider
** Per inpatient stay

Table 1

[5] High risk is defined as self-reporting any current tobacco use **or** three or more of the following conditions: high blood pressure, high cholesterol, physical activity less than 3 times per week, poor nutrition, high stress/poor well-being, high alcohol use or a body mass index greater than 26. Moderate risk is defined as self-reporting two of these factors, and low risk is defined as reporting zero or one risk factor.

Figure 2 illustrates the process for earning eligibility for lower out-of-pocket expenses:

How the Healthy Incentives℠ Works

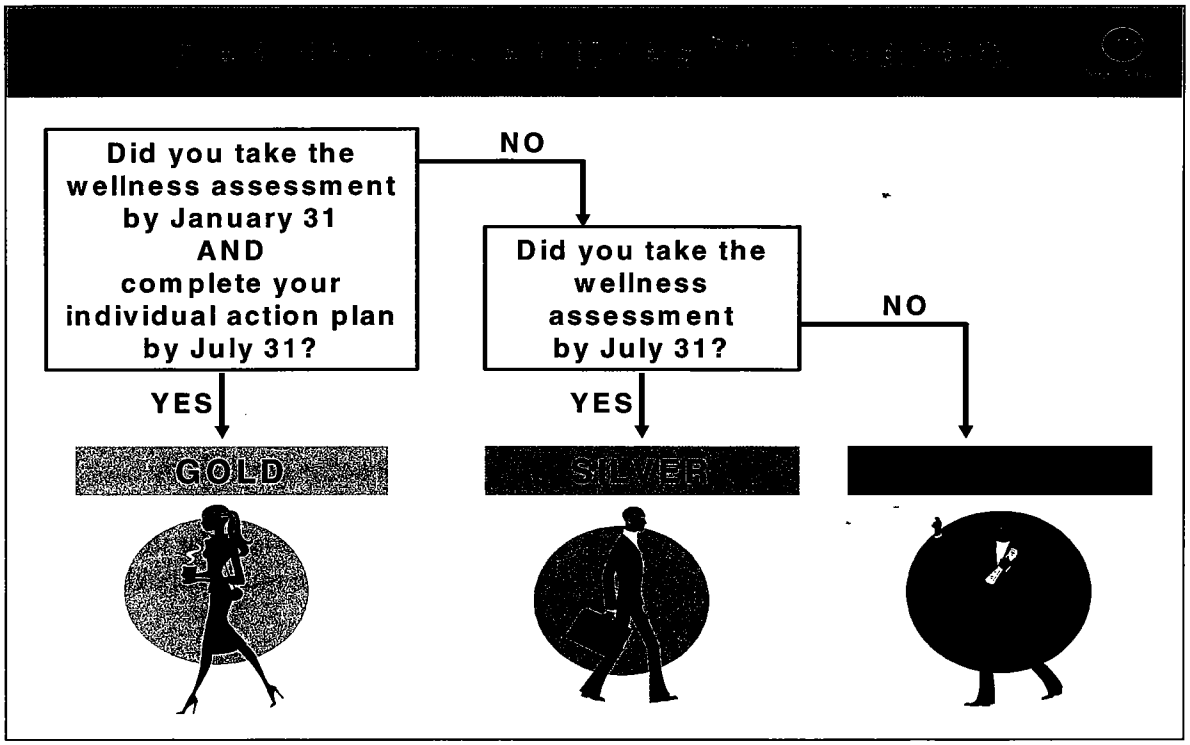


Figure 2

In 2007, 2008 and 2009 the program repeats itself – members who take the wellness assessment and participate in an individual action plan to improve their health habits in 2007 will earn lower out-of-pocket expenses in 2008, and so on.

Under the rules negotiated in 2005, participation in an individual action plan is defined as follows:

- Members who are identified as "low risk" are already engaging in health-related behaviors that are shown to reduce risk of chronic disease—such as eating right, exercising regularly, avoiding tobacco use and managing stress. These members complete eight weeks of logging of their activities related to nutrition or physical activity.
- Members who are identified as being at "moderate" or "high risk" enroll in a telephone-based coaching program for at least 90 days during which they participate in at least three coaching sessions (with follow-up activities between coaching sessions). Members are encouraged to continue participation for up to six months for moderate risk and 12 months for high risk members.

It is essential to note that earning the lowest out-of-pocket expense levels is based on participation, not the achievement of a specific health status or outcome. The goal is foster success in making significant, life-long changes in health-related behavior.

Education and Outreach and Worksite Health Promotion

In order to maximize the participation in, and reinforce lasting health behavior changes from the Healthy Incentives[SM] program, the county has also implemented a comprehensive health promotion strategy. This is the middle ring of the framework; it contains worksite-based strategies and programs to support health and healthy employees, and the education and outreach programs designed to engage both employees and family members as informed health care consumers.

The vision and goal of the Education and Outreach program is to create an organization that recognizes the value of healthy employees in delivering services to our community. Program elements are designed to build investment in health promotion; empower employees to participate in worksite-based health promotion activities; provide incentives and rewards for participation in health promotion programs; and educate managers, supervisors and employees on their respective roles, responsibilities and opportunities in creating a healthy, productive working environment.[6]

The Education and Outreach program is based on a learning model approach to change that goes well beyond simply providing information to employees and their family members. It is built on the basic hypothesis that employees/dependents will make positive changes over time, provided they have access to information that supports their change process. This approach, therefore, builds in progressive levels of information and involvement on the part of employees/dependents, timed in such a way as to enable them to take action and sustain that action over time. The stages in this approach are:

- **Learn It!** focused on providing information aimed at increasing employee awareness of the impact of health issue on cost, productivity and quality of life.

- **Believe It!** focused on increasing personal commitment to "get healthy and stay healthy".

- **Do It!** focused on motivating actual behavior change.

Studies in other organizations show that focusing education and outreach only at the employee level is not enough,[7] The county must align its organizational practices to

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[6] The World Health Organization defines a healthy workforce as characterized by four key attributes to achieve optimal performance. Individuals and organizations must be:

1. **Healthy:** demonstrating optimal health status as defined by positive health behaviors, minimal modifiable health risks and minimal illnesses, diseases and injuries.
2. **Productive:** functioning to produce the maximum contribution to achievement of personal goals and the organization's mission.
3. **Ready:** possessing an ability to respond to changing demands given the increasing pace and unpredictable nature of work.
4. **Resilient:** adjusting to setbacks, increased demands or unusual challenges, and returning to optimal "well-being" and performance without severe functional decrement.

[7] Lowe, Graham S. *Healthy Workplace Strategies: Creating Change and Achieving Results.* Report prepared for the Workplace Health Strategy Bureau, Health Canada, 2004 (www.grahamlowe.ca)

support improved health among its employees. This change in philosophy and practice will take time to accomplish. However, without this change, the other employee/ dependent interventions may not be as effective. Therefore the Education and Outreach program also includes strategies and programs designed to align the organization's practices with the goal of creating healthy employees. The goals for this aspect of the Education and Outreach program are:

1. Create a workplace that provides active support for employees' investment in improving and/or maintaining their health status.
2. Increase employee participation in workplace-sponsored health improvement activities.
3. Reduce the ways in which the workplace contributes to the deterioration of employees' health status.
4. Address the workplace-related causes of employee health problems, both acute and chronic.
5. Address the medical costs associated with preventable deteriorations in health status.

The HRI's organizational alignment interventions are built on a learning model that parallels that of the employee/dependent intervention. This model reflects the current research regarding how organizational changes can enhance the effectiveness of employee health promotion and cost containment efforts. The stages for the organizational alignment approach are:

- **Learn It!** focused on increased awareness about how organizational factors can positively affect employee health, productivity and work quality.
- **Believe It!** focused on increased commitment to aligning organizational factors that support health, healthy employees and improved business results.
- **Do It!** focused on making the changes in the organizational alignment that are needed to support health, healthy employees and improved business results.

Puget Sound Health Alliance

In the conceptual framework of the HRI (see Figure 1), the outer-most ring is the work of the Puget Sound Health Alliance (PSHA). As a part of the development of the HRI, the county provided leadership in the creation of the Puget Sound Health Alliance (also referred to as "the Alliance"). Formed in late 2004, the Alliance is a private non-profit organization that resulted from recommendations by the King County Health Advisory Task Force. The Alliance is a complementary effort that will enhance the impact of the HRI on the health of the county's employees and their dependents. The internal

programs of the HRI focus on county employees/dependents, and on building the county as a work environment that supports better health. The Alliance is putting in place a broad-based strategy that will improve the quality of our region's health care providers and systems, provide tools that will help health care consumers make use of high quality providers and systems, increase the role of prevention in helping consumers stay in good health, and contain health care costs.

Key services from the Alliance that directly support the HRI include clinical guidelines for physicians, hospitals and other health care professionals; decision-making tools for patients and consumers; regional reports on quality, cost and value; a regional database that can be analyzed for quality, cost performance, and health care improvement in the region; and a regional infrastructure to support sustained quality improvement.

This mission is captured in the Alliance's vision, mission, goals, and products and services:

Vision

A state of the art health care system in our region that consistently achieves healthier people, high quality health care and affordable costs.

Mission

To forge a sustainable leadership alliance among patients, providers, purchasers, and health plans to design and implement an innovative, high quality, and affordable health care system in the Puget Sound region.

Goals

1. Improve the quality of health care provided throughout the five-county region (King, Pierce, Kitsap, Snohomish, and Thurston Counties).

2. Improve the health outcomes for people living and working in the region.

3. Slow the rate of increase in health care expenditures experienced by consumers and purchasers of health care throughout the region.

4. Improve the ability of the region's consumers and health care professionals to become partners in managing health.

5. Ensure that evidence-based health care decision-making becomes the norm throughout the region.

6. Develop a regional ethic that incorporates collaborative approaches into health care quality improvement efforts. Collaboration and synthesis guide the Alliance's work, rather than duplication of effort and competition.

Products and Services

The Alliance's broad focus on providers, consumers, health plans, and purchasers will result in the development and implementation of a variety of products and services that will create the structures and information required to continuously measure, analyze, report, and communicate critical information regarding the performance of our region's health care systems. The Alliance is currently in the process of developing the following products and services:

- A shared repository of clinical guidelines for providers.
- A shared repository of tools for consumers/patients.
- A data repository/warehouse.
- Regional reports on quality and cost.

A regional infrastructure to support quality improvement.

Measurement and Evaluation of the HRI

An essential component of the HRI is the design and implementation of a comprehensive measurement and evaluation system. This system will provide the county with information it needs to assess the effectiveness of each HRI intervention and determine whether the initiative as a whole is contributing to employee/dependent health and slowing the projected increases in medical care costs.

In addition, the evaluation will provide critical information that will enable the county to recommend and negotiate with labor design improvements during the implementation period. This approach to plan, launch, check, and adjust is a well-established methodology for ensuring that ongoing enhancements in program design occur in order to achieve improved results. Figure 3 below depicts this process.

How the Healthy Incentives[SM] Works

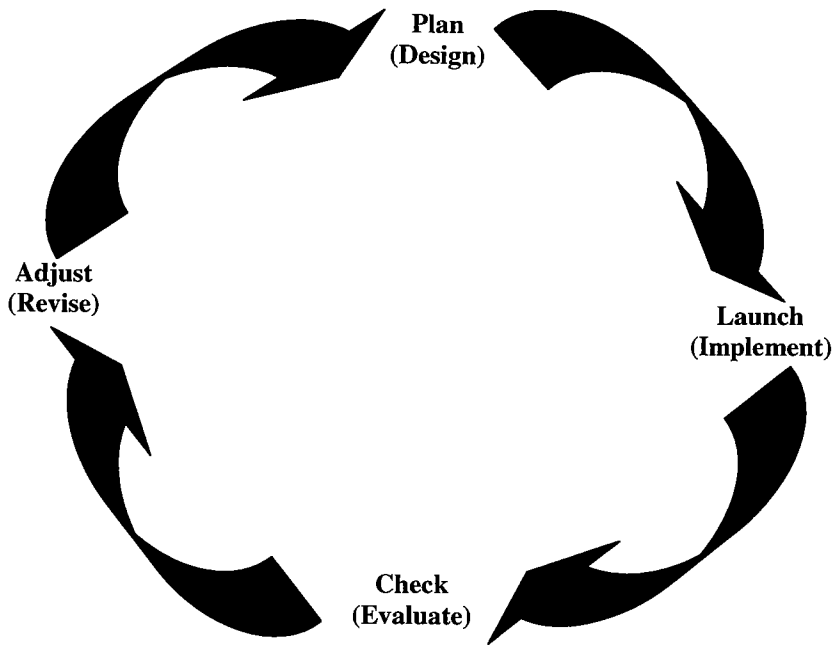

Figure 3

Evaluation Timeline

The timing outlined in the plan, launch, check and adjust cycle leads to an interval between the initiation of HRI interventions and the ability to make definitive statements regarding their effectiveness. However, while complete evaluation results will not be available immediately, the process will yield important information that county and labor can use to make adjustments. Generally speaking, evaluation results can be expected to do the following: establish baselines in 2005, derive *Indicative Findings* in 2006, *Directional Guidance* in 2007, *Early Trends* in 2008, and *Program Trends* by 2009-2010.

Evaluation Timeline

Results	Period	Comment	Report
Baseline	2005	Establishes reference point for measuring changes	August 2006
Indicative Findings	2006	Early point estimates too preliminary to signal directional change	August 2007
Directional Guidance	2007	Initial indications of serial results that could represent emerging trends	August 2008
Early Trends	2008	Likely emerging trends	August 2009
Program Trends	2009-2010	Statements of cumulative change, 2005-2009	August 2010

Table 2

As noted in the table above, 2005 is a baseline year. The rest of the 2005 Measurement and Evaluation Report describes the HRI activities which occurred in 2005 and information about early participation in the programs as they came on line.

Chapter Two

Healthy Incentives℠ Plan Measures

As noted in Chapter One, 2005 is a baseline year. The focus was on establishing programs and interventions, educating employees and their family members, and initiating engagement with the concepts of creating a healthy work place and taking personal accountability for maintaining health. These interventions are expected to become the basis for long term improvement in health for the King County employee population that over time will result in a lower health care cost trend rate than the county would have seen if it had not made this investment in improving health.

Key activities in 2005 included:

- Finalizing the details of the 2007 – 2009 Healthy Incentives℠ program.
- Launching pilot versions of components of the Healthy Incentives℠ program that provide support to employees and family members who have serious or chronic health conditions and need assistance in managing those conditions.[8]
- Launching the Education and Outreach program for health promotion in the workplace.
- Determining the evaluation approach and logic models for the measurement of both the Healthy Incentives℠ program and the Health Promotion/Education and Outreach programs.
- Determining sources for data.
- Establishing the database and the process for obtaining, normalizing and integrating the data from multiple sources.
- Developing and testing the measurement methodology.
- Calculating first year baseline information.

The first intervention programs of the HRI aimed at improving health and health care quality and managing costs were launched on a pilot basis in January, 2005. These include:

- Nurse advice line (provides current, reliable information on health-related issues 24-hours a day).

[8] These programs were purchased form Aetna for the KingCare℠ program. Group Health has services similar to these embedded into their integrated model for delivering patient-centered care.

- Disease management (provides ongoing support and education to members with specific chronic conditions—chronic heart failure, coronary artery disease and diabetes).

- Case management (telephone outreach to members needing hospital or other specialized care).

- Provider best practice (provides evidence-based treatment information to providers).

- Performance provider network (identifies efficient physicians in defined specialty practices).

The nurse advice line was implemented based on the results of an in-depth employee survey and focus groups conducted in May of 2004. Participants consistently listed access to a 24/7 nurse advice line as their preferred resource for self-care.

The three disease management programs were selected because the Health and Productivity analysis conducted in July of 2004 found these conditions are prevalent in the employees and dependents covered by health plans, and are significant factors in the health care expenses of the 5 percent of claimants in the health plans accounted for 58 percent of the medical and pharmacy costs.

The case management, provider best practice, and performance provider network programs use medical and pharmacy claims, lab results, and special modeling technology to identify opportunities to improve the health care the member is receiving.

In this baseline year key results are focused on participation levels in the five new programs. The county has been very successful in educating employees and their dependents about these new programs and consequently participation levels exceed the levels achieved by other employers in Aetna's book of business.

Summary/ Key Findings

The main focus for the 2005 baseline is on the participation rates in the pilot programs. These types of interventions have an immediate effect on the quality of the member's health and health care, however it may take time for that better quality to show up as savings in claims data. The county did conduct a detailed analysis of claims incurred in 2005 compared to claims in the 2002 – 2004 period to 1) test the database and establish the process for obtaining, normalizing and integrating the data from multiple sources, and 2) see if there were early patterns showing some level of correlation with these programs. At this time there is not a measurable effect on claims using these analytic methods.

The results of both the participation review and claims analysis are described in detail below.

Terminology

Several terms are used in this section whose differentiation needs to be clear in the reader's mind. "Trend" is used to describe changes in health benefits cost over several years time. Changes in costs from one year to the next are referred to as "year over year change".

Claims costs in this report are reported in terms of "incurred claims", meaning claims data has been organized and used on the basis of the date on which the member received the service. There is always some lag between the date of service and the date the billing is processed and finally paid by the county. This lag time is often a month or more, and in extreme cases might be up to 36 months. That means the claims that are actually paid in a particular budget year are not exactly the same as the claims that are incurred in that year—some of the bills paid will be from previous years, and some will not be submitted to the county until the next (or on rare occasions a later) budget year.

In contrast, the county's budget is based on claims actually paid by the county for active employees, COBRA participants and retirees during the calendar year plus additions to the Incurred But Not Reported (IBNR) reserve, program administration fees, and in-house administrative expenses. The claims that are paid may be for services rendered in that plan year or prior years; some claims incurred in the current budget year may not come to the county to be paid until the next budget year. Therefore "paid claims" in the county's budget will never exactly equal the incurred claims discussed in this report.

Costs in this section are generally shown in terms of per employee per month (PEPM.) That amount is derived by dividing the total cost for an employee and all dependents by the number of covered employees.

Caveats for the claims data analysis

- Savings can only be estimated, and the estimates do not have the reliability that would be obtained from a randomized controlled experiment.
    - The five pilot programs begun in 2005 were not instituted in an experimental design created to reveal the savings from those programs. All five programs and the Benefits newsletter, *Health Matters*, were inaugurated simultaneously.
    - Because the programs were introduced simultaneously and made available to all benefits-eligible persons, it is not possible to sort out which program should receive the "credit" for any specific change in the claims data.
- Measurement & Evaluation results are preliminary.
    - Not all claims incurred in 2005 have been billed to King County by the time this analysis was done in 2006. More conclusive results regarding 2005 will be available and provided in the 2007 report when more claims data are available.

  - Some savings from Health Reform Initiative work in 2005 will not appear until 2006 or later. For example, someone who is encouraged to exercise may not produce savings in the first year of exercising.
- Baseline trends have been established.
  - Medical billed claims rose 9.806 percent from 2002 to 2003 and 9.665 percent from 2003 to 2004.
  - Pharmacy billed claims trends are more variable, averaging 14% in 2003-2004.
- This report gives the Health Reform Initiative no credit for all savings produced by Health Reform Initiative work with retirees and other non-employees and their dependents. At this point, savings in claims from non-active employees cannot be measured reliably. Because their data could not be integrated, non-employees (including COBRA and self-paying retirees) and their dependents could not be included in the 2005 analysis. Data issues related to non-employees will be addressed in the coming year so that they can be included in the analysis for the Health Reform Initiative 2006 Measurement and Evaluation Report.

Initial Indications

Overall, medical billed claims for employees in 2005 continued the 2002-2004 trend (9.81% from 2002 to 2003 and 9.66% from 2003 to 2004). Pharmacy claims for employees showed less than the 14% growth seen in 2003 - 2004, producing approximately $580,000 in savings, but the percent increase was within a margin of error of the estimated baseline growth. There was no statistically significant deviation from the pharmacy claims trend, so the 2005 savings can be reasonably attributed to random variations. Total incurred medical and pharmacy claims in 2005 (based on claims processed January 1 through May 31, 2005) was $88 million.

The business case[9] for the HRI estimated that there would be small net savings in 2005 from the implementation of the five pilot programs in the KingCare[SM] health plan (nurse advice line, disease management, case management, provider best practice and provider performance network.) The total savings minus the cost of the programs was expected to be approximately $1.1 million. The amount of net savings from all HRI programs was projected to grow each year as shown in Figure 4 on the next page.

[9] See King County Health Reform Initiative Measurement & Evaluation Reports 2005 Technical Appendix for detailed discussion of data and findings.

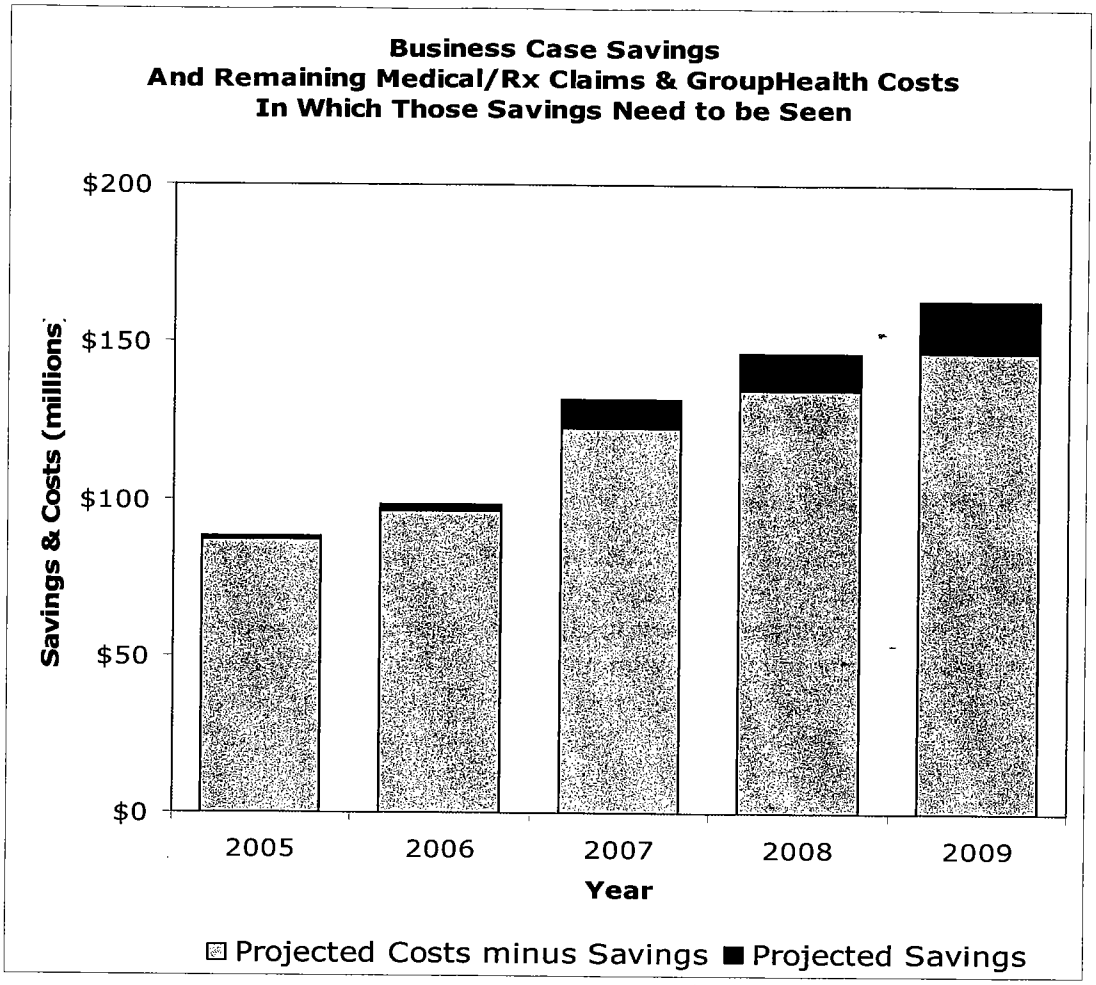

Figure 4

As Figure 4 illustrates, the amount of expected savings ($1.1 million) versus the total amount of medical and pharmacy claims ($88 million) is quite small. Because all of claims data from the second half of 2005 have not yet been received and analyzed, it is too early to detect with certainty whether or not the expected net savings occurred.

King County Health Care Database

For the first time, King County is collecting and storing insurance claims for medical and pharmacy KingCare[SM] benefits. This data collection is the foundation of the analyses reported here, and will support future analyses to determine which current and future interventions can improve employee health and health care, and provide savings.

De-Identification & Integration

The county strictly adheres to the Health Insurance Portability and Accountability Act of 1996 (HIPAA) to ensure confidentiality of individual employee and dependent information. The county uses an external data integrator service to 1) integrate data from

multiple sources and then 2) de-identify individual records and assign a new, random identifier that cannot be traced back to the original employee/dependent. This process allows all of an employee's household's medical and pharmacy claims to be summed without identifying which employee or dependent is involved.

Some analyses (e.g., monthly summaries) are not possible with HIPAA de-identified data. For this reason, some of the data collected for this report were collected from online reports of aggregated data from Aetna and Caremark, the claims administration services for medical and pharmacy claims, respectively.

2005 Savings Estimated from King County Prior Trends

Historical health care cost trends

Because the five pilot Health Reform Initiative programs were provided to all employees at once, the measurement of the programs' financial impact cannot use a comparison group of King County employees. Thus, the analysis must use past trends to forecast what claims would have been in 2005 without the pilots and compare that statistic to claims observed in 2005. Savings are then estimated by subtracting observed claims from forecasted claims. The analysis of medical and prescription drug claims from 1996 through 2004 indicate an annual health care costs trend of 11%.

Medical Claims in 2005

Table 4 shows that the trend seen in 2002 – 2004 predicts that medical claims cost in 2005 will be $1,077 PEPM +/- $15. However, the 2005 claims cost (estimated from the claims processed for January 1 through May 31, 2005) is $1,100 PEPM +/- $8.

2002-2004 Trend in Medical Billed Claims for Employees by the Year the Claims Were Incurred
2005 Forecast Based on 2002-2004 Trend
2005 Estimate Based on Claims Processed Before June 2006

Year	Billed Medical Claims Per Employee Per Month	Year-to-Year Percent Increase
2002	$815	
2003	$895	9.81%
2004	$981	9.66%
2005 Forecasted from 2002-2004 Trend	$1,077 +/- $15	9.76% +/- 1.5%
2005 Estimated from Claims Process before June 2005	$1,100 +/- $8	12.12% +/- 0.8%

Table 3

At this point, 2005 billed claims incurred in 2005 can only be estimated. More claims from 2005 will come to King County over the next year. For this reason, the 2005 statistic has a margin of error ($8) as does the 2005 statistic forecasted from the 2002-2004 trend ($15).

The data so far indicate that incurred claims in 2005 are running slightly higher than the level that the 2002 – 2004 trend would suggest.

Pharmacy Claims in 2005

Claims history for pharmacy claims before 2003 is not available. In Table 5 the trend seen in 2003 – 2004 predicts that pharmacy claims costs in 2005 will be $179.05 PEPM +/- $19.52. However, the 2005 claims cost (estimated from the claims processed for January 1 through May 31, 2005) is $174.13 PEPM.

Pharmacy Trends, 2005 Forecast, & 2005 Billed Pharmacy Claims

Year	Billed Claim Per Employee Per Month	Year-to-Year Percent Increase
2003	$138.63	
2004	$157.55	13.64%
2005 Forecasted from 2003-2004 Trend	$179.05 +/- $19.52	13.64% +/-12.39%
2005 Estimated from Claims Process before June 2005	$174.13	11.52%

Table 4

Pharmacy billed claims per employee per month in 2005 were $4.92 below forecast. A $4.92 per employee per month savings is a total savings of $575,852 for the year. Because of wide variation in prior pharmacy costs, the $4.92 is not a statistically significant savings off of the forecasted pharmacy billed claims. Because the contract with Caremark does not provide details on discounts and rebates Caremark receives from drug manufacturers and pharmacy chains, it is unclear what proportion of any savings in pharmacy billed claims resulted in savings in costs for King County.

Program-by-Program Analyses

Nurse Advice Line (Informed Health Line®)

The Informed Health Line is available to members 24 hours a day, 7 days a week via a toll-free telephone number. Registered nurses guide callers through a decision model to help the caller

determine whether their condition can be treated at home, requires a provider office visit, or requires immediate attention in an urgent care center or hospital emergency room.

King County employees and their families used the nurse advice line at twice the rate of other employers who subscribe to Aetna's Informed Health Line. Nearly 42 percent of callers asked for general health information, and 35 percent requested information on self-care or home treatments. Only 5.7 percent of calls were for assistance in deciding if the member needed to go to the emergency room or could wait to make an appointment for an office visit. Information about utilization of the nurse advice line is summarized below:

Informed Health Line – 2005 Utilization	
Total calls handled	1,232
First time callers	978
Annualized calls for every 100 eligible households	12.3%
Aetna book of business annualized call rate	5.6%
#1 reason for call –request for health information	41.8%
#2 reason for call—request for information on self-care/home treatment	35.1%

Table 5

Disease Management

The disease management program directs focused support and resources toward members with chronic heart failure, coronary artery disease and diabetes in order to improve health status and quality of life. It provides education for both the member and provider. Educational services for the member include written materials and telephone coaching calls to help the member to identify and address health risk factors associated with their chronic condition. The frequency and intensity of these education services is based on the member's individual level of risk. Members the highest risk group (Level 5) have at least a 20 percent chance of experiencing an acute exacerbation of their conditions within the upcoming year, and are at least 10 times as likely to have a sudden onset of complications in the next year compared with members at Level 1.

King County members identified as having chronic health disease, coronary artery disease (CAD) or diabetes participated in the disease management programs at approximately 6 percent higher rates than members in other plans in Aetna's book of business. Table 7 shows the number of KingCare members who have been flagged as having one of the target diseases along with participation statistics. Table 7's statistics include all members, including COBRA and self-paying retirees.

Disease Management Participation Statistics

Condition	Invited Members with Condition	Members Participating in Disease Management Program	Members receiving "high touch" disease management (telephone consultations)	Members receiving "educational" disease management (mailed a semi-annual newsletter)	Members Who Have Not Yet Selected Participation Level (Receiving No Disease Management)	Percent of Invited Members who Have Chosen to Participate and Have Chosen Participation Level
Congestive Heart Failure	175	131	14	105	12	68%
Coronary Artery Disease	291	182	13	160	9	59%
Diabetes	1,182	1,078	30	1,032	16	90%
Total	1,649	1,391	57	1,297	37	82%

Table 6

For 4 percent of members who are receiving "high touch" services (57 in 2005), Aetna provided telephone consultations to improve their healthcare and ability to manage their diseases. For the rest of the patients who agreed to receive it, Aetna mailed a semi-annual newsletter about managing their diseases.

The greatest opportunity to both improve health and quality of life and produce immediate savings is through helping the members at risk levels 3, 4 and 5 to bring their condition under better control. At the time the analysis was done, however, the data about households who included members receiving "high touch" disease management services was not complete enough to be able to determine if the apparent increase costs for families that included a member with congestive heart failure or coronary artery disease was the result of the members proactively getting treatment to manage their condition or continuing to not manage it and experiencing emergency interventions.

Case Management (Enhanced Member Outreach[SM])

A standard part of the services that KingCare[SM] purchases from our medical claims administrator is a review of cases and some interventions to avoid unnecessary claims. The Enhanced Member Outreach (EMO) program supplements Aetna's standard case management program through the use of additional clinical resources from medical and pharmacy and lab results data to identify members who are at greater risk because they are scheduled for in-patient hospital care, are preparing for discharge from in-patient hospital care, or have a claims history that indicates presence of an uncontrolled chronic condition or other risk factors. Specially trained EMO nurses call these members to encourage them to work closely with their health care providers and follow their treatment plans.

The EMO nurses identified 1,138 unique members whose claims profiles indicated they qualified for the EMO services. The EMO nurse was able to successfully contact 799 of those members for a 70 percent completion rate. (The EMO program is a new service from Aetna that started in fourth quarter 2004. It is based in downtown Seattle, and thus there are not yet many employers who have this program, so book of business comparisons are not yet available.)

Part of the history behind the development of the EMO program is that years ago it was common for hospitals to bill for extended hospital stays after patients had gone home. The original case management included visiting patients at hospitals daily to ensure that payments for hospital stays did not continue after patients were discharged. Since then, case management has grown to include a wide variety of interventions and communications.

Before 2005, case management interventions were limited to the cases that, in Aetna's judgment, were most likely to yield savings. By purchasing Aetna's Enhanced Member Outreach, the KingCare[SM] plan contracted to have the case management interventions applied to more KingCare members. The members who received Enhanced Member Outreach were expected to experience a "catastrophic event" in the next 12 months, and EMO offered outreach services to get that member into programs to reduce the risk of the catastrophic event. The hope here is that, while these new cases may be less likely to yield savings, they still promise some savings beyond the cost of the program

The modeling Aetna uses to identify members for EMO services is based on a number of "triggers." In 2005 these triggers included:

- Surgeries: Contacts were made pre- and post-admissions/surgeries for all elective procedures except maternity
- Predicted to benefit from Disease Management (e.g., diagnosed with diabetes, coronary artery disease, or congestive heart disease): Patient referred to Disease Management.
- Pharmacy non-compliance (e.g., long-term prescription not refilled)
- In any 6-month period:
    - Incurred 3 or more ER visits
    - Visited one provider 30 times
    - Visited 10 or more specialists & 3 or more distinct providers
    - Visited primary care provider 10 or more times

The impact of Enhanced Member Outreach is through the increased actions of disease management and case management.

Case management works with disease management to yield savings in the diseases that Disease Management targets. The analyses reported above regarding the disease management indicated that changes in the target diseases were too small compared to the variation in such diseases for those changes to be statistically significant (attributable to

anything other than random variation). With additional years of data, it may become possible to see an impact of case management and disease management on these diseases.

After rising 8.96% in 2003 and 5.74% in 2004, hospitalization costs rose 7.43% in 2005. From 2002 through 2004, the overall annual trend in in-patient claims was 7.34%, slightly less than the rate seen in 2005.

Provider Best Practice (MedQuery®)

The MedQuery uses claims history, current medical claims, pharmacy, laboratory, physician encounter reports and patient demographics along with evidence-based treatment recommendations to find possible errors, gaps, omissions (*e.g.* certain accepted treatment regimens may be absent) or co-missions in care (*e.g.* drug-to-drug or drug-to-disease interactions.) When MedQuery identifies a member whose data indicates that there may be an opportunity to improve care, outreach is made to the treating physician based on the apparent urgency of the situation.

Many hospitals and large pharmacies contract with First Data Bank for a similar service to review prescriptions for such mistakes. The advantage of Aetna's MedQuery over the pre-existing First Data Bank service is that MedQuery reviews patients' full medical insurance claims of the last year as they search for such errors, while First Data Bank reviews each prescription individually.

In 2005 the MedQuery program identified 3,213 instances where the claims data indicated a variation from best practice protocols and the member's physician was notified and provided the information. Sixty-two of these instances were judged to be Severity Level 1--clinically urgent, meaning immediate action is needed to prevent serious harm or even death. The distribution of severity levels of cases for King County members versus Aetna's book of business (BOB) is shown in the table below.

MedQuery—2005 Utilization			
Severity Level	***# of Physician Contacts***	***% of Total for King County***	***% of Total for Aetna BOB***
1—Clinically Urgent	62	1.93%	2%
2—Clinically Important	2,172	67.60%	76%
3—Clinically Notable	979	30.47%	22%

Early claims data indicate that 36.8% physician contacts from MedQuery for all three severity levels combined resulted in a change in the treatment plan to reflect the best practice protocol recommended in the MedQuery. Over 55 percent of contacts to physicians for severity 1 level cases resulted in a treatment change. Examples of severity 1 level care considerations include drug /drug interactions (*e.g.* PDE-5 Inhibitor-nitrate interaction that could cause low blood pressure or stroke); add/intensify a drug (*e.g.* atrial fibrillation/no anticoagulation that could cause a blood clot or stroke); and stop a drug (*e.g.* Wellbutrin contraindication for seizure disorder that could cause worsening of

seizures.) Aetna is considering expanding the MedQuery program to include sending a notice to the patient if there is no indication that the provider has reviewed the case and either made the recommended change or determined there are mitigating circumstance in the case that are good reasons to deviate from the recommended best practice.

Performance provider network (Aexcel)

The Aexcel network is comprised of Aexcel-designated specialists, participating primary care providers, hospitals and physicians in non-Aexcel-designated specialties. The overall cost of care delivered within Aexcel-designated specialties is evaluated based on certain measures of volume, clinical performance and cost-efficiency measures.

Approximately 79 percent of KingCare[SM] members who visited specialists in 2005 used specialists who are in the Aexcel network. There are no incentives in the plan to "push" members towards using Aexcel network providers (*e.g.* lower co-insurance than if the member used a non-Aexcel specialist).

Chapter Three

Education and Outreach— Health Promotion in the Workplace

In May of 2004 the county conducted an in-depth survey and a series of focus groups among employees to determine:

- What employees knew and believed about the cost and quality issues in health care.
- How employees and their families make health care decisions.
- How and what kind of information employees and their families currently access and use and what they wish they had to make better health care decisions.
- How certain programs/services/tools (*e.g.* disease management, health risk assessment, *etc.*) would be received.

Participation in this process was high, and the results were used to define the vision, goals, strategies and program elements of the Education and Outreach program. Key findings of the 2004 study included[10]:

Choosing Your Plan

- Employees were aware of the national health care crisis; they were less certain of the county's specific situation and how it would affect them.
- Freedom of choice (doctors), having their current doctor in the plan, and lower out-of-pocket costs most influenced plan selection.
- Many employees were less aware of or concerned with quality, and they defined quality only in terms of their relationship with their doctor.
- Plan descriptions were a key source of information when making enrollment decision.
- Employees needed and wanted easy-to-read information on the county's situation, how to choose and communicate with a doctor, costs for actual procedures, and what their out-of-pocket costs would be.

Using Your Health Care

- While many employees reported being actively involved in decisions with their doctor, more than 25 percent of survey respondents reported "never" doing many of the active behaviors identified (*e.g.* preparing questions, bringing a list of

[10] Complete findings of the employee survey and focus groups can be found in the September 2004 report from Mercer: *Health Education Communication Strategy and Work Plan 2004 – 2006.*

prescription drugs and over the counter medications and supplements they are currently taking).

- Key sources of health care information were the doctor and the Internet (disease-specific websites in particular) and self-care guides.

- While employees rely heavily on on-line information and services, they did not find the county's and the plans' existing website useful.

- Employees were seeking health care information on general health topics (diet, fitness, *etc.*), specific illnesses/conditions (including the best way to treat), medications and alternative care.

- Barriers to actively participating in decisions with the doctor included: don't know the questions to ask, limited time with the doctor and don't know where to go for information.

- Employees indicated they believed it is important to be an active participant and could easily list active behaviors.

Managing Your Health

- Employees were motivated to take care of their health so that they could "be there" for family members, and be able to do things they wanted to do; older employees were more motivated by the thought of enjoying retirement.

- Disease management programs generally received favorable ratings.

- Confidentiality and trust were significant barriers to employees' participation in a health risk assessment; employees were very concerned that the information would be used against them in employment and health care coverage decisions, and they did not believe that anything would be safe on the Internet.

- Focus group participants were far more focused on preventive care than managing illnesses and chronic conditions.

- Employees reported doing many healthy behaviors and 93 percent said they are in excellent, very good or good health; paradoxically 20 percent of employees reported having 3 or more chronic conditions.

2005 programs

The Education and Outreach program was formally initiated in January 2005. Program elements inaugurated in 2005 include:

- **First annual Leadership Forum**, May 2005. Over 200 leaders and managers from all parts of the King County organization met to become informed about the Health Reform Initiative and learn about their role in making King County a healthier organization.

- **First annual Health and Benefits Fair**, September 2005. Approximately 2,000 employees attended.

- **Onsite flu shot program,** November 2005. Over 3,000 employees received flu shots at various work location around the county. The flu shots were free of charge to benefits-eligible employees.

- **Manager Toolkits.** The following toolkits were created to prepare managers for the Healthy Workplace Funding Initiative that began in 2006: *Resources for Soliciting Feedback from Employees* and *Effective Partnerships with Represented Employees.*

- **Eat Smart programming.** Partnerships were established with operators of vending machines at a number of King County worksites to add healthier snacks to vending machines. Work also started on getting a contract for an on-site weight management program (in March of 2006 the contract was awarded to Weight Watchers at Work).

- **Move More programming.** During August and September, King County employees were invited to participate in Walk Fest 2005, a pilot program that encouraged employees to walk more (additional programming was added in 2006).

- **Comprehensive education** programming to prepare employees for the wellness assessment and individual action plan components of the Healthy Incentives℠ program. Health Matters partners conducted a series of "road shows" that were presented at worksites all over the county and also made available on DVD and on the county's website. These road shows explained the cost and quality crisis, the direct effect on both King County and county employees, and how improving personal health is an effective cost control intervention. This prepared employees to participate in the wellness assessment and individual action plan program that began January 1, 2006.

- **Health Matters newsletter.** The first issue of the monthly newsletter was sent to employees' homes in December, 2004. The Education and Outreach team prepares a number of King County-specific articles for each issue.

The Education and Outreach program uses a wide range of vehicles as a part of its general and program element-specific communications approach. These vehicles include:

- Newsletter mailed to home
- Global emails
- Posters and brochures
- Focus on Employees Web site (www.metrokc.gov/employees)
- Presentations at specific worksites and via DVD and on the Web
- Media
- Word of mouth
- Payroll stuffers and messages

Program Measurement

Interventions that cannot be measured through claims data must be measured through other means, such as surveys of employees and their dependents. Surveys are an important component of the evaluation design, as they seek information from employees and their dependents that is not obtainable through other means.

In addition, surveys for the interventions related to health promotion, consumer education, and organizational alignment track the progression of these interventions through the Learn It!, Believe It!, and Do It! phases. The surveys help evaluate the impact of these interventions in achieving this type of change among employees/dependents from year to year.

The surveys for the Learn It! And Believe It! Phases will be developed during 2006. Movement by employees into the Do It! Phase will be measured in 2007.

In 2006 three surveys will focus on employees, spouses and partners, and managers and supervisors. Below is an overview of what each will cover.

Employees: Random sample online survey, with paper/mail option.
Target date: September 2006
Includes measurement of:

- Opinions of and satisfaction with the overall HRI, including importance of managing one's own health and satisfaction with HRI information and assistance.
- Employees' opinions and experiences with the Wellness Assessment and Individual Action Plan, including awareness of HRI resources.
- Effectiveness of communication tools.
- Opinions of and experience with Live Well (Eat Smart, Move More and Quit Tobacco).
- Awareness of and opinions of organizational alignment to support health and healthy employees.

Spouses/Partners: Random sample telephone survey.
Target date: September 2006
Includes measurement of:

- Opinions of and satisfaction with the overall HRI including importance of managing one's own health and satisfaction with HRI information and assistance.
- Spouses'/partners' opinions and experiences with the Wellness Assessment and Individual Action Plan, including awareness of HRI resources.
- Effectiveness of communication tools.

Managers and supervisors: Survey at Leadership Forum.
Target Date: May 2006
Includes measurement of:

- Mangers' opinions of the organizational alignment and experiences with changing the work environment to support health and healthy employees.

Chapter Four

Summary and Conclusions

The Health Reform Initiative is a bold, innovative, and comprehensive effort to take an integrated approach to managing health care costs—one that a) seeks to address the cost and quality issues in the health care system while at the same time b) supporting organizational accountability for creating a healthy workplace, and c) encouraging personal accountability for adopting healthy behaviors and using health care resources wisely. The goals of the program are ambitious—reduce the rate of growth in King County's health care costs by one-third over the period of 2007 – 2009.

Five pilot programs aimed at managing claims costs were launched in January 2005. At this point there is not yet evidence that these five pilot programs produced savings in 2005 using the analytical methods applied in 2005. This is not a surprising result since it takes time to identify members eligible for these services, and the effect of most of these services would not take immediate effect in any case. Both the business case and the evaluation model anticipate that final results of the Health Reform Initiative will not be fully known until the final report in 2010.

Communications and outreach activities that are part of the comprehensive health promotion strategy were in the planning and early implementation stages in 2005. The results of two surveys of employees and their spouses/partners aimed at establishing a baseline for where members are within the learning model of *Learn It! Believe It! Do It!*, plus the results of a survey of managers aimed at measuring how the organization is aligning itself to support the goals of the Health Reform Initiative, will be part of the 2006 Measurement and Evaluation Report.

King County

Health Reform Initiative
Measurement & Evaluation Report

Technical Appendix
on the
Evaluation of HRI Savings in 2005
Based on Claims Data

August 2006

King County

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Table of Contents

Summary / Key Findings

- The King County Healthcare Measurement and Evaluation Database is set up. Data collection, de-identification, and integration systems are established, and the database is operational.
- Measurement & Evaluation statistics are not budget numbers
    - The analysis in this appendix is based on medical and pharmacy claims in the year they were incurred, not in the year they were paid. Because of time lags in the billing process, claims incurred in a year are not the same as claims paid in that year. This appendix looks at incurred claims, because costs of medical care provided in a year are indicated by claims incurred in that year, not by what was paid in that year.
    - The King County Budget is developed based on costs actually paid for services for the County's active employees, for COBRA participants and for some retirees, for additions to the Incurred But Not Reported (IBNR) reserve, for claims processing fees, and for administrative expenses. The claims that are paid may be for services rendered in that year or prior years; some claims incurred in the current year may not get to the county to be paid until the next budget year.
    - The actual amount the county pays for claims is less than the amount originally billed by a provider for the following reasons:
        - Not all of the services billed are expenses that are covered by the plan. After removing billing errors and not-covered expenses from the invoices, what remains is the "billed claims" that were analyzed for this appendix.
        - Before King County pays, billed claims are further reduced by
            - Preferred provider savings (discounts)
            - Coordination of benefits with other plans when a member is covered by more than one medical plan
            - Costs paid by members including deductibles, co-payments and co-insurance.
    - The resulting net bills paid by the county are approximately fifty percent of the billed claims.
- Savings can only be estimated, and the estimates do not have the reliability that would be obtained from a randomized controlled experiment.
    - This year, this report gives the Health Reform Initiative no credit for any savings produced by Health Reform Initiative work with retirees and other non-employees and their dependents. At this point, savings in claims from non-active employees and their dependents cannot be measured reliably. Because their data could not be integrated, non-employees (including COBRA and self-paying retirees) and their dependents could not be included in the analysis for this appendix. Data issues related to non-employees will be addressed in the coming year so that they can be included in the analysis for the 2007 Health Reform Initiative.
    - The five pilot programs begun in 2005 were not instituted in an experimental design created to reveal the savings from those programs. All five programs and the Benefits newsletter, *Health Matters*, were provided simultaneously.
    - To say which program produced which effect on expenses, we have to make some unreliable assumptions. We have to rely on logical inference to deduce how each program might work to produce savings. But, how the programs actually produce savings may not be logical, direct, or work as originally planned. Our deductions may be wrong, so any savings that appear could actually be the result of any of the programs begun in 2005. For example, Disease Management calls intended to reduce diabetes costs may lead to more walking to work, less driving, fewer car accidents, and a drop in emergency room visits for cuts and scrapes. By logical inference, the credit for this savings would go to the Nurse Line, because emergency room visit reduction is a goal of the Nurse Line.

- Measurement & Evaluation results are preliminary.
    - Not all claims incurred in 2005 have been billed to King County. More conclusive results regarding 2005 will be available in 2007.
    - Some savings from Health Reform Initiative work in 2005 will not appear until 2006 or later. For example, someone who is encouraged to exercise is unlikely to produce savings in the first year of exercising.
- Baseline trends have been established.
    - Because discounts are negotiated by the claims administrator for King County's self-insurance program, KingCare℠, King County does not pay 100% of the claims that medical providers bill for King County employees and dependents. To avoid crediting the HRI with additional savings due to negotiations, this appendix focuses on the total claims billed to KingCare summarized by the year in which services were provided. Medical billed claims for employees and dependents per employee per month rose 9.806% from 2002 to 2003, and rose approximately 9.665% from 2003 to 2004. Because not all claims from 2004 and 2003 have been reported, the statistics for 2004 will change over the next two years. The margin of error for both year-to-year percent increases is approximately 0.107%.
    - Pharmacy billed claims trends are more variable, averaging 13.64% in 2003-2004.
    - Pharmacy co-pays are fixed. Because of this, all increases in the cost of drugs are absorbed by King County, and King County's pharmacy cost trends rose 17% from 2003 to 2004.
- There is not yet evidence that the five pilot programs produced savings in 2005.
    - Overall, medical billed claims for employees and their dependents followed the 2002-2004 trend (9.7% to 9.8%) through 2005, indicating no savings in medical costs due to the five pilot programs. There is some evidence that the 2004-2005 percent increase exceeded the 2002-2004 trend.
    - Pharmacy claims for employees and their dependents showed less than the 14% growth seen in 2003 - 2004, producing approximately $580,000 in savings, but the percent increase was within a margin of error of the estimated baseline growth. There was no statistically significant deviation from the pharmacy claims trend, so the 2005 savings can be reasonably attributed to random variations.

Overview

In 2005, the King County Health Reform Initiative began five pilot programs intended to reduce King County healthcare claims by improving employee health and healthcare. The business case for the Health Reform Initiative estimated that, in 2005, savings in healthcare insurance claims due to the five pilot programs would add up $1.96M. (The $1.96M is gross savings. It is not net of the programs' $845,002 in costs.) The goal of this appendix is to analyze the savings in claims costs these programs produced in 2005.

King County Healthcare Database

For the first time, King County is collecting and storing insurance claims for medical and pharmacy KingCare℠ benefits. This data collection is the foundation of the analyses reported here, and will support future analyses to discover what projects can provide savings by improving employee health and healthcare.

De-Identification & Integration

None of the healthcare data at King County are identified as relating to any specific employee or dependent. Before claims data are delivered to King County, they are de-identified in accordance with the Health Insurance Portability and Accountability Act of 1996 (HIPAA). New random identifiers that cannot be traced back to the original patients are added to the data to allow data from multiple sources to be integrated. This integration allows all of an employee's household's medical and pharmacy claims to be summed without identifying which employee is involved.

Some analyses (e.g., monthly summaries) are not possible with HIPAA de-identified data. For this reason, some of the data collected for this report were collected from online reports of aggregated data from Aetna and Caremark, the claims administration services for medical and pharmacy claims, respectively.

A Note on Measurement & Evaluation Statistics Versus Budget Numbers

The analyses in this appendix are based on claims on an incurred basis – meaning that the claims data have been rolled up by the year services were provided, rather than by the year invoices were paid. Many invoices from 2004 services were paid in 2005. The Health Reform Initiative could not affect the cost of these services incurred in 2004, so what matters for the Health Reform Initiative is the claims incurred in 2005, and that includes claims incurred in 2005 and paid in 2006. The budget is developed on the basis of what claims will be paid in the budget year. So budget numbers for 2005 and expenditures in 2005 do not match claims incurred in 2005.

The King County budget must allocate adequate funds to cover KingCare's entire share of medical and pharmacy claims, as well as the claims administration claims and IBNR reserve maintenance, and must do so for all of the patients making claims to KingCare. These claimants include active employees and their dependents as well as some retirees and some ex-employees covered through COBRA. Because complete data on non-employees is not yet available, this report will not include their costs.

Because of the processes of the five pilot Health Reform Initiative programs, the five pilot programs' effects are seen in the total bills for health care. Aetna negotiates discounts and employees pay a portion of claims through deductibles, coinsurance, and co-pays. So KingCare's portion does not match the billed claims reported here, and the analysis here does not include claims administration or IBNR reserve claims. For these reasons, the claims statistics reported here do not match King County's budgeted health care costs.

A Note on Return-On-Investment (ROI) Statistics

It is customary in healthcare cost-benefit analyses to report ROI (return on investment) statistics, which are savings divided by program costs. Return on investment statistics can be misleading in two ways. First, ROI calculations are sometimes based on drops in billed costs. For example, if a program cost KingCare $100,000 and saved $150,000 in billed claims, it could be reported to have an ROI of 1.5. Of $150,000 in billed claims, KingCare would usually pay roughly $75,000, so KingCare's savings would be $75,000, and there would be a net loss of $25,000. The return on investment statistics reported in this appendix are savings in paid costs divided by program costs, so a program that claims $100,000 and saves $150,000 in billed claims would have an ROI of .75. That is, for every dollar spent, 25 cents were lost.

The second way that ROI statistics can be misleading appears when one assumes that if the ROI is 2, then for every dollar spent, two dollars will be saved. This leads analysts to estimate savings by multiplying program price by ROI. Consider how that could work out: Let's say that organization X has the same number and kind of employees and dependents that KingCare covers. Organization X pays $100,000 for a program and saves $200,000 in paid claims. Having documentation of the value of the program, a vendor sells the same program to King County for $300,000. According to calculations based on this mistaken use of ROI, projected savings will be $600,000. But this is the same program. The best guess of savings for KingCare is $200,000, which produces a KingCare ROI of .67. The idea that savings can be estimated by multiplying program cost by ROI suggests that every increase in price produces increased savings. This is not sensible. When the price for a given service increases, savings go down.

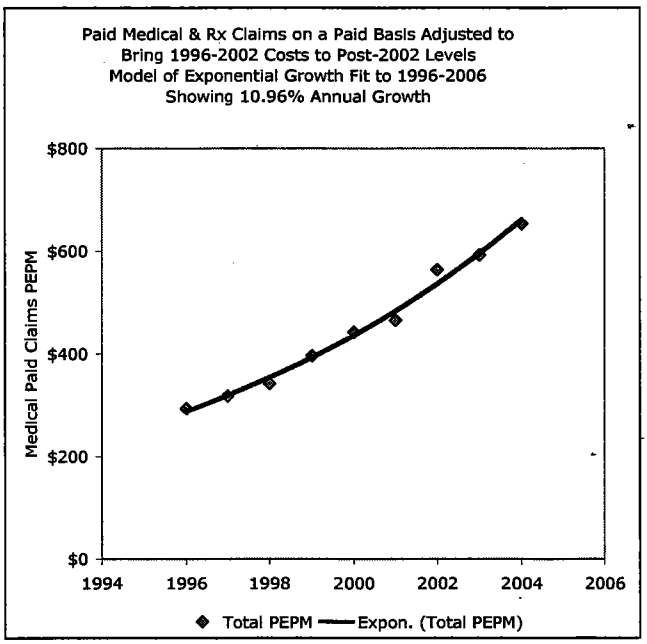
A last concern about ROI is the issue of time. When a program is begun in one year, the impact may appear in two years or even mostly in a second year. Also, a single program may have a low first-year ROI, high second-year ROI, and a moderate ROI is subsequent years. One has to keep in mind that, while ROI seems simple and easy to work with, there are difficulties in its use.

2005 Savings Estimated from King County Prior Trends

Because the five pilot Health Reform Initiative programs were provided to all employees at once, the measurement of the programs' financial impact cannot use a comparison group of King County employees. Thus, the analysis must use past trends to forecast what claims would have been in 2005 without the pilots and compare that statistic to claims observed in 2005. Savings are then estimated by subtracting observed claims from forecasted claims.

Figure 1 provides some indication of the history of KingCare's medical and prescription drug claim history on a paid basis. Figure 1 shows medical and pharmacy claims costs on a per employee per month basis (PEPM) from 1996 through 2004, after adjusting pre-2003 statistics in light of plan changes that came into affect in 2003. The adjustment attempted to adjust the pre-2003 paid claims PEPM to reveal what they would have been had the 2003 plan design been in place from 1996 onward. Figure 1 shows the analyst's estimates.

Figure 1



Source: Mercer Human Resources Consulting

Figure 1 indicates that, from 1996 through 2004, KingCare medical and pharmacy claims rose by 11% annually.

The Health Reform Initiative began five pilot programs in January 2005:

- Disease Management (advice and education for members with chronic diseases)
- Case Management (advice for members with expensive care use)
- Provider Best Practices (advice to physicians to improve care)
- Specialist Efficiency (a list of efficient specialists for patients to visit)
- And a Nurse Line (begun in December 2004)

The five HRI pilot programs are intended to reduce KingCare's costs by improving healthcare. There are other events that could reduce KingCare's costs. Payments from other insurance companies could increase. Employees could pay higher deductibles, coinsurance, or co-pays, and Aetna could negotiate deeper discounts. All of these events would reduce KingCare costs, but these events are not the work of the Health Reform Initiative. For this reason, the analyses in this appendix are based on billed claims. Billed claims are the bills for covered services. Billed claims do not reflect changes in negotiated discounts, changes in payments from other insurance companies, or changes in employee payments. Paid claims reflect changes in discounts and other payments. That is why this appendix does not use paid claims.

The King County Healthcare Database includes electronic lists of employees that were collected from Benefits and Retirement Operations. Because of ambiguity in bills for patients who are not active employees, this analysis focuses on employee claims, excluding claims that cannot be attributed to an employee who was employed in the year that the claim was incurred.

Insurance claims data include billed claims along with the date services were provided. Most of the analysis reported here was performed on the King County healthcare database. In that database, to comply with the privacy regulations of the Health Insurance Portability and Accountability Act of 1996 (HIPAA), the service dates in the

healthcare claims used in this analysis are represented only by the year of service. When necessary, aggregate statistics based on quarters, months, or days can be calculated by King County's data integration service. Most of the analyses done for this appendix was based on years.

The first question is what the total savings were in 2005. Once the total savings are known, analysis can move to the task of allocating credit for that savings to each of the five pilot programs. Table 1 shows average billed claims incurred in each year from 2002 through 2005 per employee per month. Table 1 shows that the 2005 billed claims per employee per month forecasted from the 2002-2004 trend was $1,077. Based on the claims available so far, 2005 billed claims appear to have been $23 higher than forecasted, per employee per month. This is not an indication of savings due to the five Health Reform Initiative pilot programs.

Table 1

2002-2004 Trend in Medical Billed Claims for Employees by the Year the Claims Were Incurred
2005 Forecast Based on 2002-2004 Trend
2005 Estimate Based on Claims Processed Before June 2006

Year	Billed Medical Claims Per Employee Per Month	Year-to-Year Percent Increase
2002	$815	
2003	$895	9.81%
2004	$981	9.66%
2005 Forecasted from 2002-2004 Trend	$1,077 +/- $15	9.76% +/- 1.5%
2005 Estimated from Claims Process before June 2005	$1,100 +/- $8	12.12% +/- 0.8%

At this point, 2005 billed claims incurred in 2005 can only be estimated. More claims from 2005 will come to King County over the next year. For this reason, the 2005 statistic has a margin of error ($8) as does the 2005 statistic forecasted from the 2002-2004 trend ($15).

The pilot programs begun in 2005 did not reduce medical claims in 2005. Medical claims in 2005 are statistically significantly higher than what would have been forecast from the steady 2002-2004 trend.

Pharmacy Claims

Claims history for pharmacy claims before 2003 are not available. In 2003, KingCare switched from Aetna to Caremark for pharmacy claims administration. Although Aetna continued as medical claims administrator, Aetna no longer retains records of KingCare's pre-2003 pharmacy claims, and, until 2005, King County did not retain claims locally.

Table 2

Pharmacy Trends, 2005 Forecast, & 2005 Billed Pharmacy Claims

Year	Billed Claim Per Employee Per Month	Year-to-Year Percent Increase
2003	$138.63	
2004	$157.55	13.64%
2005 Forecasted from 2003-2004 Trend	$179.05 +/- $19.52	13.64% +/-12.39%
2005 Estimated from Claims Process before June 2005	$174.13	11.52%

Pharmacy billed claims have almost no claims flow. Almost all pharmacy claims are processed within one month of when prescriptions were filled. A benefit of this quick turnaround in pharmacy costs is that impacts of programs can be seen more rapidly in pharmacy claims than they can be seen in medical claims.

As with medical claims, the statistics reported here are billed claims. They do not reflect discounts negotiated by our claims administrator for KingCare. In pharmacy claims administration, discounts appear as manufacturer rebates. Those negotiated rebates were not the target of the five Health Reform Initiative pilot programs, and they are not reflected in the analyses in this appendix.

Pharmacy billed claims per employee per month in 2005 were $4.92 below forecast. A $4.92 per employee per month savings is a total savings of $575,852 for the year. Because of wide variation in prior pharmacy costs, the $4.92 is not a statistically significant savings off of the forecasted pharmacy billed claims. Because the contract with Caremark does not provide transparency, it is unclear what proportion of any savings in pharmacy billed claims resulted in savings in costs for King County.

Summary of Estimated 2005 Savings

So far, there has been no evidence that the five Health Reform Initiative pilot programs produced savings in 2005.

Overall Five-Program Cost Benefit Analysis

There was no statistically significant impact of the five pilot programs on healthcare claims in 2005. Overall, healthcare claims rose more in 2005 than they had in recent years, but this higher year-to-year percent increase can be reasonably attributed to random variation.

The impacts of the 2005 programs may be seen over the coming years. For example, teaching a patient who has recently developed type 2 diabetes to manage his diabetes produces savings throughout his future years employed at King County. So there will be a 2006 ROI for the 2005 expenditures, as well as a 2007 ROI. So far, we can only estimate the 2005 ROI of the pilot programs' work in 2005. In early 2007, the last of the healthcare claims from 2005 will have appeared at King County.

Program-by-Program Analyses

Nurse Line

The Nurse Line provides health information through toll-free telephone consultations that are available 24 hours a day 7 days a week. During these consultations, KingCare members can speak with registered nurses about a variety of health topics. The nurses can contribute to informed health care decision-making and optimal patient/provider relationships through coaching and support. The nurses cannot diagnose, prescribe treatment or give medical advice, but they can provide members with information on a broad spectrum of health issues, including self-care, prevention, chronic conditions and complex medical situations.

The Nurse Line's method of producing savings is through getting appropriate care to employees and their dependents. Problems that can be treated at home are not taken to an emergency room or physician. Critical problems are directed to immediate care, and do not grow into more expensive crises. In the Health Reform Initiative business case, a suggested measure of the Nurse Line savings is "changes in emergency room/urgent care utilization for conditions amenable to self-care."

Nurse Line Usage

Aetna reports on the Nurse Line include the following:

- In 2005, the Nurse Line was made available to 10,439 households. (In 2005, King County averaged 8,852 employees enrolled in KingCare each month. Because of turnover, the total number of employees in 2005 was higher: 10,594.)
- By the end of 2005, the Nurse Line had received 1,232 calls from 981 households (an average of 1.26 calls per calling household).
- In the second half of 2005, King County took advantage of the Nurse Line at rates that were twice what is typical at other organizations: There were 12.30 calls per 100 employees. At other organizations, Aetna finds an average of 5.6 calls per 100 employees. The Nurse Line per call claim to KingCare was half what it would have been had King County employees called at the rates seen elsewhere.
- Throughout the year, from 69 to 100 new households called the Nurse Line each month.

Emergency Room Usage

After holding steady at .032 emergency room visits PEPM from 2002 through 2004, the emergency room visit rate rose 9.8% at the beginning of 2005 to a new steady rate of 0.035 visits PEPM. For this increase to be due solely to the Nurse Line, 1/3rd of Nurse Line calls would have had to produce an ER visit. After rising 17% and 12% in 2003

and 2004, ER costs PEPM rose 23% in 2005. Office visits held steady at .8 visits PEPM from 2002 through the end of 2005. There is no evidence that the Nurse Line shifted medical care from the emergency room to office visits. So far, there is no evidence of savings due to the Nurse Line. Increased emergency room use was a major cost driver in the utilization increase from 2004 to 2005.

Disease Management

The disease management program communicates with employees and dependents with at least one of the target diseases: congestive heart failure, coronary artery disease, and diabetes. For 4% of those patients (57 in 2005), Aetna provided telephone consultations to improve their healthcare and ability to manage their diseases. For the rest of the patients who agreed to receive it, Aetna mailed a semi-annual newsletter about managing their diseases.

The greatest opportunity to produce savings is in the telephone consultations. In order to cover the $200,144 cost of the program, the 57 telephoned patients would have to show an average savings of $3,511 in 2005, which would be a drop of $7,000 in billed claims, or $583 PEPM. On average, after controlling for age, gender, and the number of dependents, employees whose families include someone with diabetes produce approximately $600 PEPM in billed claims over the average billed claims from families without diabetes (approximately $700 PEPM). Families that include someone with congestive heart failure produce approximately $7,500 in additional billed claims PEPM, and families with a patient with coronary artery disease produce an additional $1,500. A worst-case analysis is that the semi-annual newsletter does not produce savings. Even if there were no savings from the semi-annual newsletter, the savings projected for disease management are not enormous, compared to the costs of these chronic diseases. Even if the newsletter produced no savings, the savings to cover the programs claims would amount to approximately 20% of the additional claims due to families having the disorders.

Disease Management Invitation & Usage Statistics

Table 3 shows the number of KingCare members who have been flagged as having one of the target diseases along with participation statistics. Table 3's statistics include all members, including COBRA and self-paying retirees.

Table 3

Disease Management Participation Statistics

Condition	Invited Members with Condition	Members Participating in Disease Management Program	Members receiving "high touch" disease management (telephone consultations)	Members receiving "educational" disease management (mailed a semi-annual newsletter)	Members Who Have Not Yet Selected Participation Level (Receiving No Disease Management)	Percent of Invited Members who Have Chosen to Participate and Have Chosen Participation Level
Congestive Heart Failure	175	131	14	105	12	68%
Coronary Artery Disease	291	182	13	160	9	59%
Diabetes	1,182	1,078	30	1,032	16	90%
Total	1,649	1,391	57	1,297	37	82%

Aetna reports that King County Disease Management participation rates have been approximately 6% higher than participation rates at other organizations.

Disease Management Savings Estimated from Risk Adjusted Model of Participant Claims

In 2005, employees with the target diseases of disease management (diabetes, coronary artery disease, and congestive heart disease) showed no lower costs than would have been expected from trends in 2003 and 2004.

So far, Disease Management has not been demonstrated to have produced savings.

Case Management

A standard part of the services that KingCare purchases from our medical claims administrator is a review of cases and some interventions to avoid unnecessary claims. Part of the history behind this is that, years ago, it was common for hospitals to bill for extended hospital stays after patients had gone home. The original case management included visiting patients at hospitals daily to ensure that payments for hospital stays did not continue after patients were discharged. Since then, Case Management has grown to included a wide variety of interventions and communications.

Before 2005, Case Management interventions were limited to the cases that, in Aetna's judgment, were most likely to yield savings. By purchasing Aetna's Enhanced Member Outreach, KingCare contracted to have the Case Management interventions applied to more KingCare members. The members who received Enhanced Member Outreach were expected to experience what Aetna termed a "catastrophic event" in the next 12 months, and Enhanced Member Outreach offered outreach services to get that member into programs to reduce the risk of the catastrophic event. The hope here is that, while these new cases may be less likely to yield savings, they still promise some savings beyond the cost of the program.

The following text from Aetna helps describe Enhanced Member Outreach (the Case Management program KingCare bought in 2005):

> The Enhanced Member Outreach (EMO) program supplements and intensifies Aetna's standard case management program through the use of additional clinical resources for medical and pharmacy data and member outreach calls. The additional calls, based on predetermined triggers, result in increased case and disease management screenings and participation rates.

In 2005, the predetermined triggers for Enhanced Member Outreach were as follows. Where known, EMO actions are listed:

- Surgeries: Contacts were made Pre- and post-admissions/surgeries for all elective procedures except maternity
- Predicted to benefit from Disease Management (e.g., diagnosed with diabetes, coronary artery disease, or congestive heart disease): Patient referred to Disease Management.
- Pharmacy non-compliance (e.g., long-term prescription not refilled)
- In any 6-month period:
    - Incurred 3 or more ER visits
    - Visited one provider 30 times
    - Visited 10 or more specialists & 3 or more distinct providers
    - Visited primary care provider 10 or more times

The impact of Enhanced Member Outreach is through the increased actions of disease management and case management.

Case Management Invitation & Usage Statistics

In 2005, Enhanced Member Outreach referred 15 cases to Aetna's Case Management. Table 4 lists the number of cases referred and accepted by Aetna Case Management each year since 2002.

Table 4

Case Management Cases Referred and Accepted Each Year

Year	New Case Management Cases	Year-to-Year Percent Increase	Cases Declined Because Case Management Unable to Contact Patient	Cases Declined Because Patient Declined to participate
2002	66		0	0
2003	99	50%	7	13
2004	196	98%	0	2
2005	258	32%	116	21

Aetna reports on reasons for cases being declined are inconsistent. It is unclear that cases of inability to contact were recorded in 2004 and 2002. Nonetheless, it does seem that the big difference in Case Management activity in 2005 compared to previous years is a huge jump in the number of patients whom Aetna attempted and failed to contact.

Case Management Savings Estimated from Deviation from Claims Trends

Target Diseases

Case management works with Disease Management to yield savings in the diseases that Disease Management targets. The analyses reported above regarding the Disease Management diseases revealed that changes in the target disease costs were too small compared to the variation in such costs for those changes to be statistically significant (attributable to anything other than random variation). With additional years of data, it may become possible to see an impact of Case Management and Disease Management on these diseases.

Hospitalization Claims

After rising 8.96% in 2003 and 5.74% in 2004, hospitalization costs rose 7.43% in 2005.

From 2002 through 2004, the overall annual trend in in-patient claims was 7.34%. 2005's 7.43% does not demonstrate a reduction in in-patient claims compared to what would have been expected from the 2002-2004 trend.

Emergency Room Visits

Enhanced Member Outreach contacts patients who have visited emergency rooms frequently. These calls would produce savings by diminishing emergency room visits. As noted in section on the Nurse Line above, after holding steady for three years, emergency room visits rose in 2005.

Provider Visits

Enhanced Member Outreach contacts patients who have visited providers with an unusually high frequency. Discouraging such patients from such visits would diminish physician visits. As noted in the Nurse Line section above, there was no drop in physician visits in 2005.

Summary of Estimated Case Management Savings

So far, there has been no evidence of savings due to Case Management (Aetna's Enhanced Member Outreach). This analysis is not based on all of the data that was hoped from Aetna. More experience and more complete data may reveal savings in the future.

Case Management Cost Benefit Analysis

So far, no additional savings beyond previous years' Case Management services have been documented.

Provider Best Practices

The Provider Best Practices program (Aetna's MedQuery) reviewed medical and pharmacy claims to alert doctors to mistakes and oversights in care. Hospitals and large pharmacies contract with First Data Bank to review prescriptions for such mistakes. The advantage of Aetna's MedQuery over the pre-existing First Data Bank service is that MedQuery reviews patients' full medical insurance claims of the last year as they search for such errors, while First Data Bank reviews each prescription individually.

Provider Best Practices Contact Statistics

Most (70%) of MedQuery communications can be documented to have not resulted in a change in care by physicians who received them. The cases with possible compliance include cases in which the physician followed the advice, as well as cases in which the physician would have made the same change without prompting (either due to further consideration or patient complaints).

To cover the MedQuery costs for employees, the MedQuery communications that may have produced compliance would have to have produced an average of $398 in billed claims savings per communication.

Savings Estimated from Trends in Poisonings by Medications and Adverse Reactions to Treatment

Diagnoses indicating adverse reactions to treatments and medication poisonings indicated no changes in 2005.

Healthcare claims show no evidence that the MedQuery program was able to provide protection beyond what was already provided through providers' subscriptions to First Data Bank.

KingCare Savings Estimated by Aetna Staff

As part of the MedQuery package, Aetna provides analysis of savings due to the MedQuery communications. These self-evaluative calculations begin by dismissing all communications that can be proven by the healthcare claims record to have been dismissed by the physicians receiving the communications. MedQuery's analyses proceed by assuming the rest of the communications were effective in changing treatment. This is an optimistic assumption, because some of those treatment programs would have changed without the communication. Finally, MedQuery's analysis uses the HCUP database that reports average billed charges associated with each adverse event that MedQuery takes responsibility for making less likely. MedQuery then takes credit for the cost of that event multiplied by the change in the probability of that event due to MedQuery's communications. For example, imagine that research has suggested that the probability of an adverse event is 10% with a particular drug, and that the probability of that event without that drug is 2%. Let's say that the event produces $50,000 in billed claims. Now imagine that MedQuery emailed the doctor to ask that the drug be stopped, and the drug was then stopped. MedQuery would then consider 8% of the $50,000 ($3,500) as savings due to the communication. If following MedQuery's advice produces claims, those claims are subtracted from MedQuery's estimates of their savings. For example, if they suggest prescribing a new drug for a patient, the cost of that drug is subtracted from MedQuery's estimated savings.

MedQuery reports that, for their ROI calculations, they depend on cost data from the HCUP database. The HCUP database reports billed claims, rather than paid claims. If all of MedQuery's assumptions held, the savings for KingCare would be approximately one half of the savings MedQuery reports, because KingCare pays approximately a half of billed claims. Aetna was asked repeatedly for a comment on this issue, and declined to explain their calculations for this report.

MedQuery's analysis indicates that KingCare savings from communications in 2005 were $16.08 PEPM, or $2M. MedQuery calculates savings that are expected to appear within one year. This biases their estimate downward, because it disregards savings that would appear in following years. The one-year timeframe also means that much of the savings from communications in 2005 will appear in 2006.

Summary of Estimated Provider Best Practices Savings

Evaluations of the savings due to Provider Best Practices are inconsistent. KingCare claims reveal no change in adverse events or medication errors, and overall claims show no change in trend. This indicates that MedQuery did not produce savings. MedQuery's own calculations suggest billed claims savings of $2M will appear by the end of 2006. It is unclear what portion of those savings should have been expected in 2005. A theory that would be consistent with all of these analyses is that almost all of the savings due to 2005 communications will appear in 2006.

Provider Best Practices Costs

In 2005, MedQuery cost King County $1.60 PEPM.

Provider Best Practices Cost Benefit Analysis

The theory described above, which is consistent with all tests, suggests that the first-year ROI of the MedQuery program is close to zero, and that the MedQuery program's 2005 communications will produce $1M in savings in

paid claims in 2006, or $8.04 PEPM. With a cost of $1.60 PEPM and savings in paid claims of $8.04, the ROI of MedQuery would be 5.03. So far, none of this ROI has been documented in KingCare billed claims.

Specialist Efficiency

The products that Specialist Efficiency provided were 1) a list of efficient doctors on an Aetna website, and 2) a project of having healthcare purchaser staff (including King County Benefits staff) collaborate with healthcare providers to improve provider efficiency.

The list of efficient doctors can be seen by following links from http://metrokc.gov/employees/health_matters/new_programs2.aspx. Unfortunately, this page appears to be in preparation and not part of the King County network of web pages. An analysis of links in Google indicates that there are no pages that link to this page, and this is the only webpage that links to http://www.kingcare.com, where the list of efficient doctors is. If employees type "KingCare" into Google, they may find their way to the list of efficient doctors. It is unclear how they could find the list otherwise. It is not possible to find the list by following links from http:// http://www.metrokc.gov/employees/benefits/ or http://www.metrokc.gov/employees/default.aspx. It is highly likely that no employee, other than a few Health Reform Initiative staff, saw this list all year.

Future Measurement through the Puget Sound Health Alliance Healthcare Claims Database

The Puget Sound Health Alliance is expected to have set up a healthcare claims database and to be providing evaluations of the efficiency of regional doctors in 2007. The Puget Sound Health Alliance is currently planning to use the same technology (Symmetry episode grouping) that Aetna's Aexcel networks has used for the last two years. This software will provide an efficiency score for each local practice. Aetna's experience with this software over the last two years has been disappointing. Top management in the Aexcel program reported that, on rescoring phsycian after a year, Aetna found that the scores provided zero test-retest correlation. This indicates no test-retest reliability, and is an indicator of likely low or no validity. The Puget Sound Alliance expects that their experience will be better with the software, based on their being able to apply the software to claims from more patients. If the Alliance experience is better than Aetna's, the scores from the Puget Sound Health Alliance may provide a clearer image of the value of the Aexcel Network scoring for the 2007 Measurement & Evaluation report.

Efficient Provider Network Usage Statistics 2003-2005

From 2002 through 2004, 79% (+/-2%) of KingCare dollars that could go to Aexcel specialists did so. In 2005, that proportion was 79%. After risk adjustment, KingCare employees whose families went to Aexcel-network specialists had slightly higher billed claims than KingCare employees and dependents who went to non-network specialists, but this difference was not statistically significant.

At this point, there is no evidence of savings from Specialist Efficiency.

Health Reform Initiative Evaluation of Savings in 2005 Based on Claims Data

Health Reform Initiative Goals

The ultimate goal of King County's Health Reform Initiative is to save King County $40M in healthcare costs by 2010 by improving employee health and healthcare.

HRI 2005 Components

In 2005, the King County Health Reform Initiative simultaneously began five pilot programs. The following list includes only brief descriptions of each program. The work performed by each program is described in more detail below in sections devoted to each program individually.

1) Disease Management (Aetna's Healthy Outlook program)

   For patients with diabetes, coronary artery disease, and/or congestive heart disease: telephone coaching by nurses for high-claim patients, and semi-annual newsletters to the rest of the patients.

2) Case Management (Aetna's Enhanced Member Outreach program)

   Nurse telephone consultations with patients whose healthcare claims indicate high usage.

3) Nurse Line (Aetna's Informed Health Line)

KingCare members can telephone nurses to obtain information on health issues, including self-care, prevention, chronic conditions and complex medical situations.

4) Provider Best Practices (Aetna's MedQuery)

Data mining software reviews healthcare claims, flagging physician errors. Physicians are alerted to life threatening errors by telephone calls from Aetna physicians, and are alerted to less important errors by telephone calls from Aetna nurses or by mail.

5) Specialist Efficiency (Aetna's Aexcel Network)

Aetna provides King County with access to a list of physicians whom Aetna has scored as treating disorders efficiently.

Target Population

The five 2005 pilot programs were provided only to employees and their dependents covered by King County's self-insurance medical program, KingCare[SM]. Group Health members were not provided these services, partly because doing so would somewhat duplicate pre-existing Group Health efforts.

Data Sources

Currently, systems have been created, tested, and established for the de-identification, delivery, and integration of data from eight sources:

1. Aetna-processed claims for medical treatments
2. Caremark-processed claims for pharmacy claims
3. King County's Benefits & Retirement Operations enrollment lists
4. Aetna online monthly aggregate reports
5. Caremark online aggregate reports
6. Aetna participation lists for the pilot programs
7. Flexible spending account administrator enrollment lists for COBRA ex-employees & retirees covered by KingCare
8. Online reports of the claims costs of the Uniform Medical Plan of Washington State

Data feeds from two more sources are being set up currently:

1. Group Health medical & pharmacy claims for Group Health covered King County employees and their dependents (not yet available)
2. Group Health Claim & Utilization summaries of claims associated with Group Health coverage for King County employees (not yet established)

For the 2007 measurement and evaluation report, data feeds from Harris Health Trends will be added to the King County database system. This will allow for tests of the Wellness Assessment begun in 2006.

Although the systems to add program participation data to the database have been created, Aetna has only sent two sample datasets. For this report, Aetna was not able to provide complete data on which employees and dependents participated in which programs and when. Participation data was first requested from Aetna on July 25th, 2005. So far, Aetna has promised data on program participation for the Nurse Line, Case Management, and Disease Management. Negotiations are continuing in the hopes of obtaining data on Provider Best Practices communications.

In March 2006, Group Health agreed to provide claims data on King County employees and dependents who are covered by Group Health. That data was not delivered by July 17, 2006, and could not be included in the analyses of this report. But it has been recently delivered to the de-identification service and will be at King County soon.

Discussions with Washington State indicate that Washington State will be providing healthcare claims data in time for the analyses for the 2007 measurement and evaluation report. These claims will allow for tests of how much

changes in King County claims reflect regional claim trends. Efforts have been made to obtain City of Seattle claims data.

Cost Measure Used in this Analysis: Claims Incurred for Medical Services & Drugs

To analyze the impact of the five pilot programs, most of this appendix focuses on incurred claims. "Incurred claims" means that claims are reported by the time frames in which claims were incurred. There have been prior analyses of KingCare claims. These prior analyses have been based on KingCare's claims on a paid basis – that is, based on when King County paid for the care.

There can be a large difference between claims on an incurred basis and claims on a paid basis. After claims for services are incurred, many delays intervene before those services are paid for:

- Pharmacy providers usually invoice immediately, but medical providers take up to six months or more before sending invoices to KingCare's claims administrator, Aetna. Delays are typically longer for larger bills.
- Aetna may take up to a year or more to process invoices. This processing may include returning invoices to providers for corrections. (Often, medical invoices include duplicate billing for single procedures.) Aetna's processing may include adjudication of disputed claims, and/or coordination with other insurers, and/or negotiation of additional discounts, all of which add time to the process.
- Once Aetna has determined what will be paid for the service, Aetna allocates the funds to the provider's account at Aetna. Each provider is later paid by Aetna on a schedule. Large providers are paid frequently, small providers less often. When a provider is paid, Aetna sends a check for the balance in the provider's account at Aetna.
- After a check is sent to a provider, the provider may take time before depositing the check.
- Once the check has cleared, Aetna invoices King County to cover King County's portion of the check.

For medical bills, approximately 99.5% of claims from a year are allocated to the providers' accounts at Aetna by the end of the following year. (The percentage of claims settled within 12 months varies from year to year.) Some testing has indicated that the delay from allocating the funds to the provider to invoicing King County varies around an average of approximately one month.

The length of these processing steps varies. This variation occurs because of factors such as changes in personnel. When a new administrator processes less efficiently, the average gap between service date and invoice-to-King-County date increases. When bills are delayed, KingCare claims on a paid basis look lower because bills are not getting to King County. These delays produce only temporary savings before a push to catch up on delayed invoices brings a large number of bills to KingCare. This catch-up exaggerates the cost trend, especially because it appears immediately after a period of artificially low invoicing.

Because of the artificial changes in cost growth caused by reviewing claims on a paid basis, this appendix works primarily with claims on an incurred basis. Claims on a paid basis are the actual claims that King County has to cover. This appendix begins with a summary of prior claims on a paid basis.

Measurement Population: Employees

KingCare covers medical and pharmacy expenses for more than just active employees and their dependents. The other patients include ex-employees and their dependents covered under COBRA and retirees who, like COBRA beneficiaries, pay KingCare for their healthcare coverage.

Complete electronic lists for COBRA and retiree members are not currently available. For this reason, it is not possible to count the number of covered former employees. Without such counts, it is not possible to calculate statistics per person. For this reason, the analyses reported here are limited to active employees and their dependents.

Unit of Analysis: Employees

This report works with each employee as a single unit – as a single claim center. The reasons for this are, first, identifiers for dependents have inconsistencies that make them unreliable. Second, predictable claims at a

household level may not be predictable at an individual level. For example, a household receiving pre-natal care can be expected to later have claims associated with the new child, but claims from a woman receiving pre-natal care do not show those later claims, because the later claims are associated with the child, rather than the mother. At the household level, such claims are predictable. Finally, the critical issue for King County is not how much each individual costs, but how much each employee costs to cover.

In the process of risk adjusting (predicting next year's claims for each employee from this year's healthcare data), the number and experiences of employee's dependents are taken into account in order to improve the accuracy of the risk adjustment.

Logarithms

The analysis in this appendix uses natural logarithms in several ways. It is worth taking a moment now to clarify how logarithms work. The natural logarithm of a number is what e has to be raised to the power of to get that number. "e" is 2.718. There are some mathematical qualities to e that make it work well for many purposes. All that is important here is that, while there are other kinds of logarithms (e.g., what 10 has to be raised to the power of, and what 2 has to be raised to the power of) e is the most common base for logarithms and what is used here.

To get a feel for logarithms, one can play with them in Excel. The Excel function, "LN()" produces logarithms, and "EXP()" exponentiates numbers, undoing the effect of "LN()". For example, EXP(LN(25)) = 25.

The first use of logarithms in this appendix is to estimate exponential growth. Inflation is exponential growth, in that each year's price is the result of multiplying the previous year's price by 1 + inflation. After transforming prices by taking their logarithms, exponential growth becomes additive. That is, the log of each year's price is the log of the previous year's price plus the log of 1 + inflation. For example, Table 5 shows some hypothetical prices along with 50% inflation. Table 5 also shows the logarithms of those prices and shows that the change in logarithms from year to year is an addition.

Table 5

An Example of How Logarithms Make Inflation Additive, Rather than Exponential

Year	Price	This Year's Price Minus Last Year's Price	Inflation	Natural Logarithm of Price	This Year's Logarithm Minus Last Year's Logarithm
1	$1,000			6.9078	
2	$1,500	$500	50%	7.3132	0.4055
3	$2,250	$750	50%	7.7187	0.4055
4	$3,375	$1,125	50%	8.1242	0.4055
5	$5,063	$1,688	50%	8.5296	0.4055

Figure 2 shows what the exponential growth in prices looks like. Figure 2 shows the prices in column 2 of table 5 plotted against their years.

Figure 2

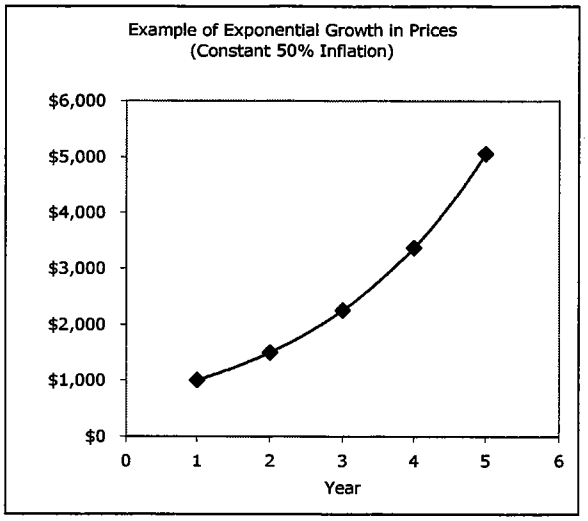
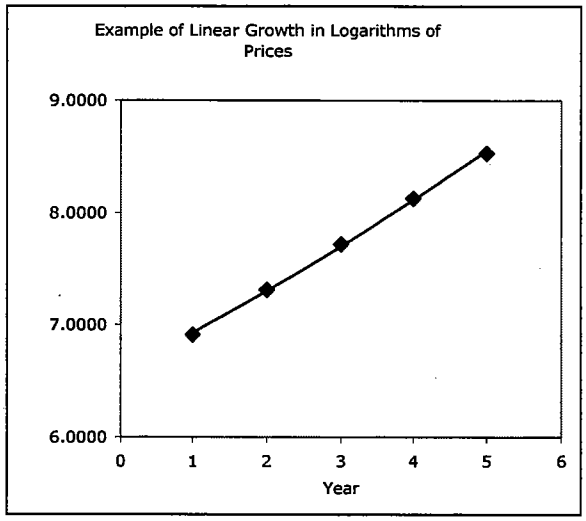


Figure 3 shows how logarithms flatten out the curve of exponential growth. Figure 3 shows the logarithms from column 5 of table 5.

Figure 3



So logarithms show periods of constant inflation as straight lines. Another value of logarithms is that they estimate trends well. For example, consider the hypothetical price data in table 6.

Table 6

Year	Price	Inflation	Natural Logarithm of Price	This Year's Logarithm Minus Last Year's Logarithm	Projections Based on 12.5%	Projections Based on 8.5%, which is EXP(.082)-1
1	$1,000		6.908		$1,000	$1,000
2	$1,500	50%	7.313	0.405	$1,125	$1,085
3	$1,050	-30%	6.957	-0.357	$1,266	$1,177
4	$1,260	20%	7.139	0.182	$1,424	$1,277
5	$1,386	10%	7.234	0.095	$1,602	$1,386
	Averages:	12.5%		0.082		

Table 6 shows that estimating the trend by averaging the inflation rates over estimated the 5-year trend. Averaging the differences in the logarithms produced an average of .082. To turn that into an inflation rate, 1 is subtracted from the result of exponentiating, which results in an inflation rate of 8.5%. Figure 4 shows how the two trend estimates work out.

Figure 4

Example of How Trends Are Best Estimated by Averaging Logarithms

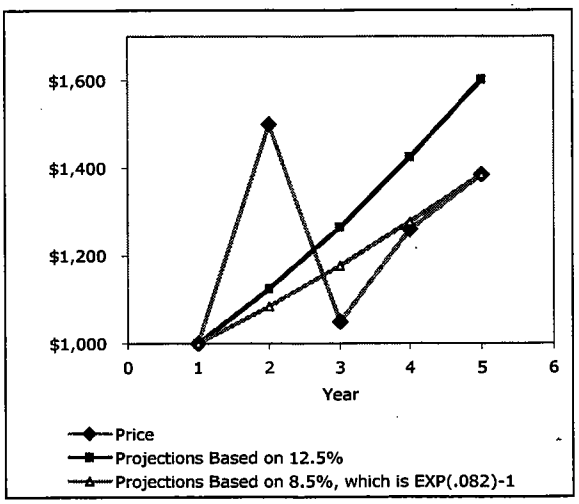


Figure 4 shows how a trend estimated by averaging year-to-year percent increases produces results that veer off what happened. In figure 4 the line connecting squares shows what happens by applying the 12.5% estimate repeatedly to year 1's $1,000. The line connecting triangles shows what happens by applying 8.5% to that $1,000. 8.5% is the inflation trend estimated by taking logs and averaging.

2005 Savings Estimated from King County Prior Trends

2000-2004 Trend in King County Healthcare Paid Costs

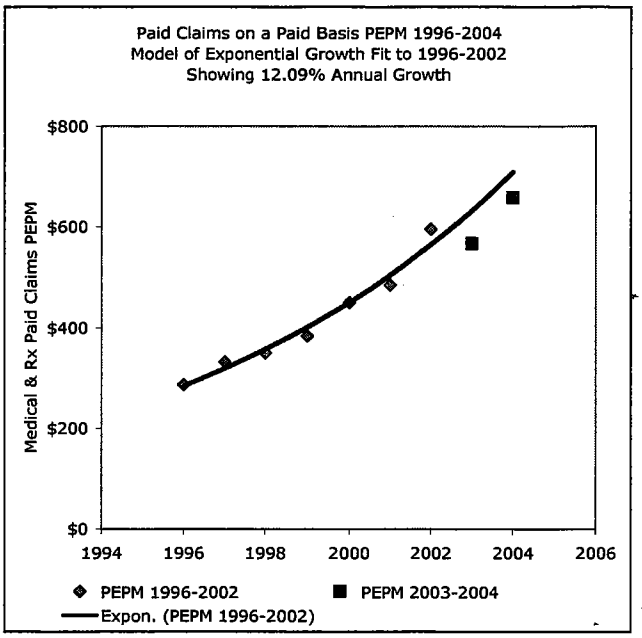
Because the five pilot Health Reform Initiative programs were provided to all employees and their dependents at once, the measurement of the programs' financial impact cannot use a control group of King County employees. Thus, the analysis must use past trends to forecast what claims would have been in 2005 without the programs and compare that forecast to claims reported incurred in 2005. Savings are then estimated by subtracting claims reported incurred in 2005 from forecasted claims.

KingCare's Paid Claims on a Paid Basis

The clearest image of how claims for KingCare medical services have increased are claims on an incurred basis: that is, how much in claims were incurred in each year.

Figures 5 through 8 provide some indication of the history of KingCare's claim history on a paid basis. Figure 5 shows medical and pharmacy claims costs on a per employee per month basis (PEPM). That is, the total amount paid in each month is divided by the number of employees in that month.

Figure 5



PEPM statistics on a paid basis can be misleading, because PEPM statistics are calculated from claims produced by employees and their dependents over the last 12 to 24 months, which are divided by employee counts of the current month. For example, if half of the employees were removed from the KingCare plan at the end of January, February's PEPM claims would nearly double, because most of the bills for the removed employees and their dependents would show up in February. To adjust for this, some analysts lag the employee counts, which helps some, but the ideal solution is to work with the claims on an incurred basis, as is done later in this appendix.

Figure 5 is based on employee counts from reports from King County's human resources consultants. For figure 5's data, claims for 1996-1999 were drawn from consultant reports. 2000-2004 claims were collected from King County's ARMS financial reports.

In figure 5, there is a drop in PEPM paid claims from 2002 to 2003. This drop occurred mostly because of changes in deductibles, coinsurance, and co-pays. Another part of the drop is the result of KingCare switching from Aetna to Caremark for pharmacy claims administration, which resulted in greater manufacturer rebates. To highlight the trend in medical claims that occurred independent from plan changes, figure 5 shows a growth trend fit only to 1996-2002. That fit indicates an average annual growth of 12%.

In a recent report, an analyst at Mercer Human Resources Consulting attempted to adjust the pre-2003 paid claims PEPM to reveal what they would have been had the 2003 plan design been in place from 1996 on. Figure 6 shows the analyst's estimates.

Figure 6

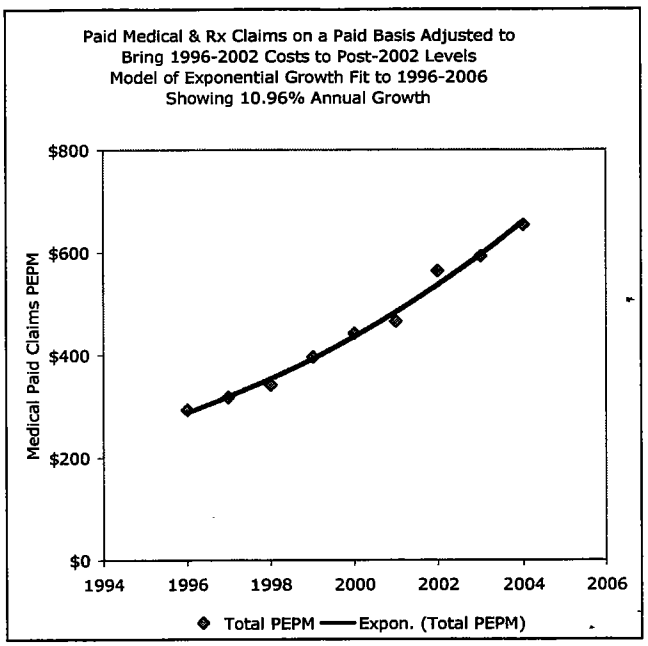


Figure 6 indicates that, from 1996 through 2004, KingCare medical and pharmacy claims rose by 11% annually. The analyst also broke apart the total claims into medical and pharmacy claims, as shown in figures 7 and 8.

Figure 7

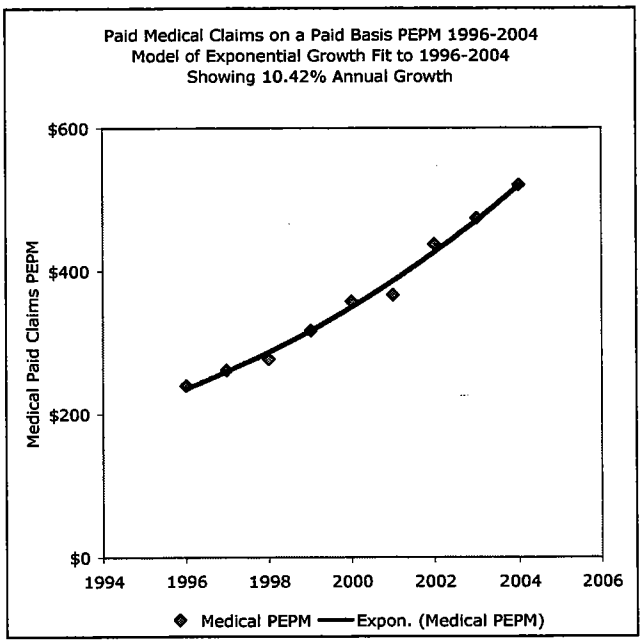


Figure 7 indicates that medical claims have risen at 10.4% annually since 1996. Figure 7 also shows the sorts of artificially high year-to-year percent increases that appear in claims costs on a paid basis. In figure 7, 2001 appears off trend – artificially low. That "savings" is then balanced by catch up in 2002. The result is that the 2001-2002 percent increase appears very high, even though the overall trend is very steady. This is the sort of pattern that is seen when a portion of bills are delayed in one year, and then show up in the following year.

Figure 8

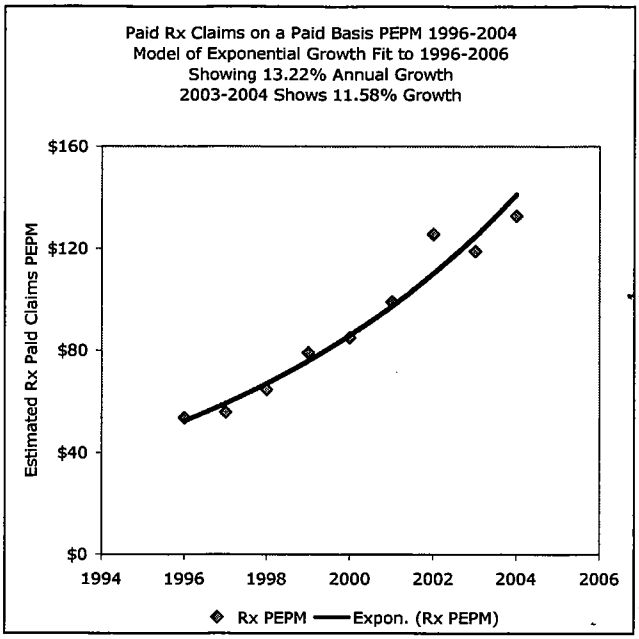


Figure 8 indicates that, from 1996 to 2006, pharmacy claims rose by 13.22% annually. From 2003 to 2004, the year-to-year percent increase was 11.6%. That may indicate that the 2003 switch to Caremark reduced the pharmacy trend, but reliable conclusions about a change in trend cannot be made on the basis of just these two data points.

All of the analyses based on the consultant's data and shown in figures 5 through 8 are only rough approximations. In each month, the human resources consultant obtains enrollment counts for that month. In the following months, Benefits is informed of recently hired or departed employees who were covered in that month. These retroactive changes to the enrollment counts are sent to the claims administrators, but not to the human resource consultants. It is King County Benefits department policy that it is not worthwhile reporting these changes to the human resources consultants, because the human resources consultant's work does not require such precision. Over the last three years, the retroactive changes have varied from 2% to 5% of the initial enrollment counts, so the consultant's PEPM statistics reported above are accurate only within 5%.

Figure 8, above, is the last of the analysis based on the consultant's enrollment counts. Most of the analysis reported in this appendix below is based on the King County Healthcare Database, and is based on Benefits records reflecting the retroactive enrollment changes.

Employee Billed claims on an Incurred Basis

Medical Claims

In the claims payment process, there are some intermediate claim statistics:

- Billed Claims - The providers send bills for services to the claims administrator. After duplicate billings and invoices for non-covered services have been removed, these bills are termed the "billed claims".
- Allowed Claims - The claims administrator applies negotiated discounts to the billed claims. The remaining amounts are the "allowed claims".
- Benefits Payable Claims - Employee co-pays and deductibles are subtracted from the allowed claims to determine the amounts that will be paid by insurance. These amounts are referred to as "benefits payable claims".
- Paid Claims - After any other insurance company pays their portion of the claims (through "coordination of benefits", or "COB" payments), KingCare's portion remains. These are referred to as "paid claims".

The five HRI pilot programs are intended to reduce KingCare's costs by improving healthcare. There are other events that could reduce KingCare's costs. Payments from other insurance companies could increase. Employees could pay higher deductibles, coinsurance, or co-pays. Aetna could negotiate deeper discounts. All of these events would reduce KingCare costs, but these events are not the work of the Health Reform Initiative. For this reason, the analyses in this appendix are based on billed claims. Billed claims are the bills for covered services. Billed claims do not reflect changes in negotiated discounts, changes in payments from other insurance companies, or changes in employee payments. Paid claims reflect changes in discounts and other payments. That is why this appendix does not use paid claims.

The King County Healthcare Database includes employee information as well as claim information. Benefits and Retirement Operations provided electronic lists of employees. Because of ambiguity in claims for patients who are not active employees, this analysis focuses on employee claims, excluding claims that cannot be attributed to anyone who was not employed by King County in the year that the claim was incurred. Insurance claims data include billed claims along with the date services were provided.

Most of the analysis reported here was performed on the King County healthcare database. In that database, to comply with the privacy regulations of the Health Insurance Portability and Accountability Act of 1996 (HIPAA), the service dates for the healthcare claims used in this analysis are represented only by the year of service. When necessary, aggregate statistics based on quarters, months, or days can be calculated by King County's data integration service. Most of the analyses done here are based on calendar years.

Table 7 shows summaries of total costs for employees and non-employees for the various claims statistics.

Table 7

KingCare[SM] Claims Processed by June 1, 2006

By the Year They Were Incurred In

Total KingCare Medical Claims

Year	Billed claims	Negotiated Savings	Member Share	COB Share	KingCare Share
2002	$75,209,935	$28,067,321	$3,863,889	$1,651,639	$41,627,086
2003	111,325,596	42,730,741	7,232,680	3,356,660	58,005,514
2004	123,404,758	47,148,348	7,588,451	3,439,072	65,228,887

Employee Claims

Year	Billed claims	Negotiated Savings	Employee Share	COB Share	KingCare Share
2002	68,425,247	25,310,602	3,651,759	1,245,153	38,217,732
2003	104,091,468	39,362,958	6,936,285	2,653,755	55,138,471
2004	114,992,864	43,367,092	7,273,029	2,826,189	61,526,554

Non-Employee Claims

Year	Billed claims	Negotiated Savings	Member Share	COB Share	KingCare Share
2002	6,784,688	2,756,719	212,129	406,486	3,409,354
2003	7,234,128	3,367,784	296,394	702,906	2,867,044
2004	8,411,894	3,781,256	315,422	612,883	3,702,333

Figure 9 shows the billed medical claims PEPM (for employees and their dependents only), on an incurred basis for 2002 through 2004, and Table 8 shows the data behind those statistics.

Figure 9

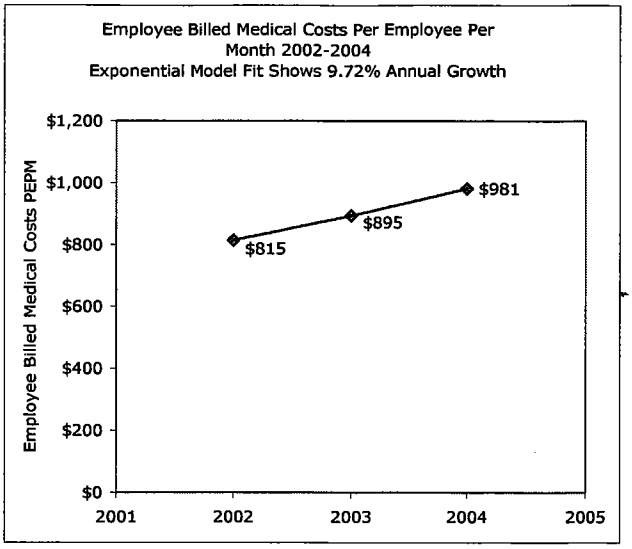


Table 8

Data & Calculations of Billed Medical Claims for Employees and their dependents PEPM

That Appeared in KingCare Claims Processed by the End of May 2006.

Year	Employee Days Covered	Billed claims For Employees	Billed Claim Per Employee Per Covered Day	Billed Claim Per Employee Per Month	Year-to-Year Percent Increase
2002	2,555,511	68,425,247	$26.78	$814.98	
2003	3,540,370	104,091,468	$29.40	$894.90	9.806%
2004	3,566,459	114,992,864	$32.24	$981.39	9.665%

In table 8, to calculate billed claims PEPM, claims are calculated per covered day, and then multiplied by 30.4375, which is the average number of days in a month. This approach avoids variations caused by different numbers of days in months and varying numbers of days in years. (A leap year has 0.3% more days, and therefore 0.3% more claims than a 365-day year.)

Assuming that the system producing billed claims for employees and their dependents was constant from 2002 through 2004, a 95% confidence interval for the annual trend is from 8.84% to 10.64%, and a 95% confidence prediction interval for the next year's growth would be from 8.19% to 11.30.[1]

[1] To estimate the underlying annual trend in medical claims, the PEPM statistics in table 2 were transformed by doing logarithmic calculations using the natural log function (see calculations in table 4). Each year's log PEPM was subtracted from the following year's log PEPM to calculate two differences in log PEPM values. Confidence intervals and prediction intervals were then calculated from the two differences, using a t-distribution ($t_{.025,1}$=12.706). The resulting values were then exponentiated to calculate annual percent growth.

Table 9
KingCare Enrollment Counts from Benefits and Retirement Operations Files
Listing Only Active employees, Not COBRA or Self-Paying Retirees

Month	Employee Enrollment Count	Days in Month	Employee-Days Covered
Jan-2002	6,982	31	216,442
Feb-2002	6,980	28	195,440
Mar-2002	6,981	31	216,411
Apr-2002	6,997	30	209,910
May-2002	7,014	31	217,434
Jun-2002	7,010	30	210,300
Jul-2002	6,990	31	216,690
Aug-2002	6,980	31	216,380
Sep-2002	7,002	30	210,060
Oct-2002	7,039	31	218,209
Nov-2002	7,036	30	211,080
Dec-2002	7,005	31	217,155
		SUM	2,555,511
Jan-2003	9,815	31	304,265
Feb-2003	9,576	28	268,128
Mar-2003	9,640	31	298,840
Apr-2003	9,686	30	290,580
May-2003	9,710	31	301,010
Jun-2003	9,700	30	291,000
Jul-2003	9,708	31	300,948
Aug-2003	9,684	31	300,204
Sep-2003	9,729	30	291,870
Oct-2003	9,757	31	302,467
Nov-2003	9,691	30	290,730
Dec-2003	9,688	31	300,328
		SUM	3,540,370
Jan-2004	9,853	31	305,443
Feb-2004	9,726	29	282,054
Mar-2004	9,718	31	301,258
Apr-2004	9,707	30	291,210
May-2004	9,742	31	302,002
Jun-2004	9,736	30	292,080
Jul-2004	9,712	31	301,072
Aug-2004	9,708	31	300,948
Sep-2004	9,742	30	292,260
Oct-2004	9,746	31	302,126
Nov-2004	9,765	30	292,950
Dec-2004	9,776	31	303,056
		SUM	3,566,459

Table 10

Calculations of Confidence Interval of 2002-2004 Trend and Prediction Interval of Next Year's Percent Increase

Year	Natural Log of Billed Claim PEPM	Year-to-Year Difference in Logs		
2002	6.7032			
2003	6.7967	0.0935		
2004	6.8890	0.0923		
	Mean Difference	0.0929		
	SD	0.0009		
	SE (N=2)	0.0006		
	T	12.7062		
	Margin of Error of Mean Difference in Logs	0.0082		
	Margin of Error of Prediction of Difference in Logs	0.0142		
	95% Confidence Interval for Mean Difference in Logs	0.0847	to	0.1011
	95% Prediction Interval for Mean Difference in Logs	0.0787	to	0.1071
	95% Confidence Interval for Annual Growth Trend	8.84%	to	10.64%
	95% Prediction Interval for Year-to-Year Percent Change	8.19%	to	11.30%

Pharmacy Claims

Claims history for pharmacy before 2003 are not available. Prior to 2003, Aetna was the administrator for both medical and pharmacy claims. In 2003, KingCare switched from Aetna to Caremark for pharmacy claims administration. Although Aetna continued as medical claims administrator, Aetna no longer retains records of KingCare's pre-2003 pharmacy claims, and, until 2005, King County did not retain claims locally.

Pharmacy claims are different from medical claims in several ways:

- There has been no coordination of benefits.
- Negotiated savings have returned to King County as rebates that are separate from pharmacy claims.
- Employees pay only co-pays for pharmacy, not coinsurance or deductibles.
- Analysis is based on the year the prescription was filled, which may be years after the prescription was originally written.
- There is usually a very short delay between when a prescription was filled and when the claim was invoiced to King County, so that claims on a paid basis are fairly close to claims on an incurred basis.

The three pharmacy claim statistics that are available are billed claims (drug ingredient claims, dispensing fees, and sales taxes), the employees' share (co-pays), and KingCare's share. Table 11 shows the 2003-2004 change in billed claims.

Table 11

Data & Calculations of Employee Billed Pharmacy Claims PEPM

As Seen in Pharmacy Claims Processed by April 2006

Year	Employee Days Covered	Billed claims For Employees	Billed claims Per Employee Per Covered Day	Billed claims Per Employee Per Month	Year-to-Year Percent Increase
2003	3,540,370	$16,125,312	$4.55	$138.63	
2004	3,566,459	$18,460,128	$5.18	$157.55	13.64%

Although pharmacy claims rose 13.64%, KingCare's pharmacy costs rose 16.8%, as shown in table 12. This is because the King County plan insulates employees from pharmacy inflation. All employee contributions towards pharmacy claims are steady co-pays. The only way for employees' pharmacy claims to increase is by the employees switching from generic to brand drugs. In 2003, employees spent an average of $29.52 PEPM in pharmacy co-pays. When the employees' share in 2003 rose by 13.64%, that rise added another $4.03 PEPM to the pharmacy claims.

Because co-pays do not increase, that $4.03 was added to KingCare's costs. That is why KingCare's share of pharmacy costs rose 16.76%, when billed claims rose only 13.64%.

Table 12

Year-to-Year Percent Increases in Employee Pharmacy Claims PEPM

Year-to-Year	Billed	Employee Share	KingCare Share
2003-2004	13.64%	2.23%	16.76%

Having a PEPM statistic for 2003 and a PEPM statistic for 2004 provides only two data points. With only two data points, it is not possible to see how claims amounts vary around their underlying trend. That makes it impossible to estimate the random variation in the claims amounts and makes it impossible to calculate the margin of error of statistics related to the pharmacy trend. To gather multiple data points that would reveal the random variation, monthly statistics were collected from Caremark's online reports. Figure 10 shows the monthly statistics, and table 13 lists the data shown in figure 10.

Figure 10

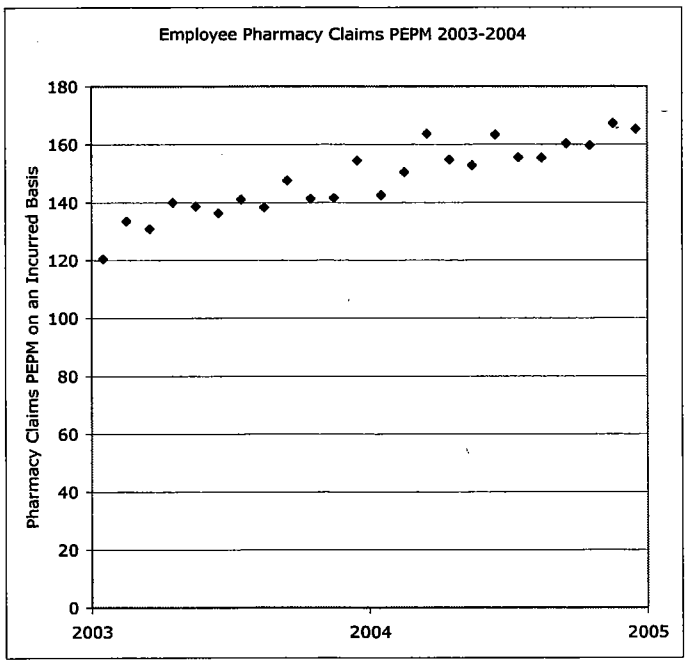
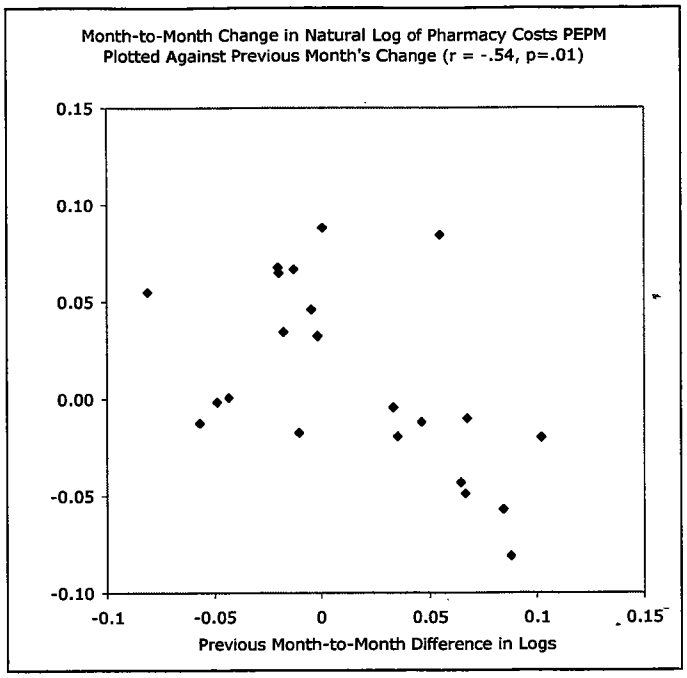


Table 13
Monthly PEPM Billed Pharmacy Claims for Employees

Month	Sum of Billed claims	Billed claims PEPM
Jan-03	1,204,317	120.48
Feb-03	1,175,436	133.43
Mar-03	1,284,382	130.82
Apr-03	1,336,482	139.99
May-03	1,370,608	138.59
Jun-03	1,302,256	136.21
Jul-03	1,393,949	140.98
Aug-03	1,363,870	138.28
Sep-03	1,414,816	147.54
Oct-03	1,404,458	141.33
Nov-03	1,350,823	141.42
Dec-03	1,523,915	154.44
Jan-04	1,429,121	142.41
Feb-04	1,394,316	150.47
Mar-04	1,620,476	163.72
Apr-04	1,479,643	154.65
May-04	1,515,390	152.73
Jun-04	1,566,949	163.29
Jul-04	1,538,236	155.51
Aug-04	1,535,249	155.27
Sep-04	1,540,156	160.40
Oct-04	1,585,255	159.71
Nov-04	1,609,661	167.24
Dec-04	1,645,676	165.28

The statistical analysis of the pharmacy claims statistics will work with the statistics after they have been converted to logarithms. Converting to logarithms and finding the changes in those logarithms makes it easier to estimate the underlying trend. Statistical work to obtain margins of error depends on independence of the observations: that is, the estimate of the margin of error relies on one not being able to predict the next change from the most recent change. Figure 11 plots the change in log claims PEPM against the change in log claims PEPM of the previous month, showing that there is a significant dependence from month to month. If the changes were dependent, then the scatter plot in figure 11 would show a diagonal pattern, which figure 11 does show.

Figure 11

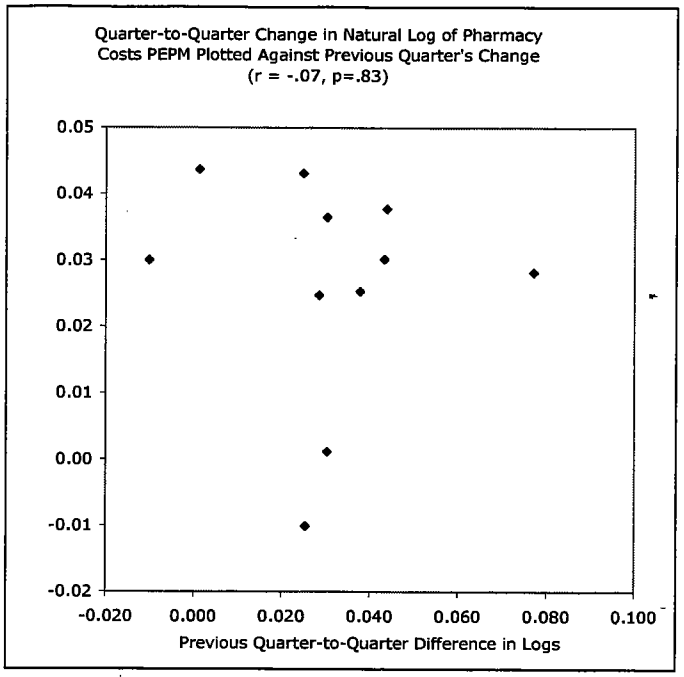


Because figure 11 shows a diagonal from upper left to lower right, it means that a rise in one month tends to be followed by a fall in the following month. That month-to-month dependence prevents the statistical calculations necessary to find the margin of error of those changes.

A possible solution to the problem in figure 11 is to work with the PEPM statistics on quarterly basis. Figure 12 shows the lack of dependence that allows statistical calculations to proceed.[2]

[2] Figure 8 shows the change in log pharmacy claims PEPM for each quarter plotted against the change in log claims PEPM of the previous quarter, showing that quarterly changes were close to independent.

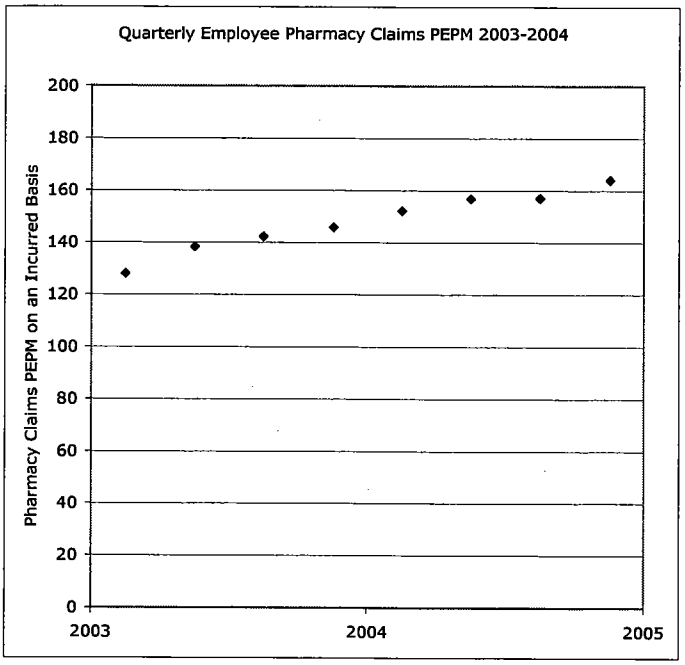
Figure 12



In order to work with data that will not produce misleading results, this baseline analysis of pharmacy claims works with quarterly data.

Figure 13 shows the quarterly pharmacy statistics, and table 14, below, lists the values that are plotted in figure 13.

Figure 13



By showing the logs of the PEPM claims amounts shown in figure 13, figure 14 is more revealing about the 2003-2004 history of pharmacy claims.

Figure 14

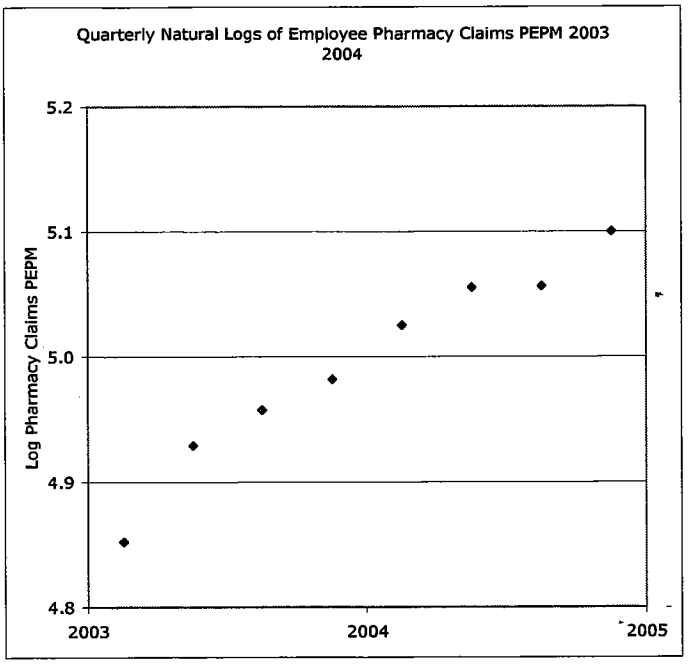


Figure 14 shows that first quarter 2003 showed lower pharmacy claims than would fit with the rest of 2003 and the first half of 2004. This may have happened due to disruptions related to switching from Aetna to Caremark for pharmacy claims. After that quarter, there is a consistent trend through second quarter 2004, which is interrupted from Q2 to Q3 2004, and then resumes.

Because first quarter 2003 appears to be a one-time disruption, its data are not used to estimate the 2003-2004 trend.

Table 14 shows the quarterly statistics for pharmacy claims.

Table 14

Quarter	Sum of Pharmacy Claims Billed for Employees	Rx Claims PEPM	Trend Annualized
2003 Q1	3,664,136	128.01	
Q2	4,009,346	138.27	36.1%
Q3	4,172,635	142.22	11.9%
Q4	4,279,196	145.77	10.4%
2004 Q1	4,443,914	152.19	18.8%
Q2	4,561,983	156.85	12.8%
Q3	4,613,641	157.03	0.5%
Q4	4,840,591	164.05	19.1%

Table 15 includes calculations showing that, after first quarter 2003, the average trend was 12.07%, and that a 95% confidence prediction interval for what will be seen in 2005 is from 4.48% to 20.21%. (If 2004's Q3-Q4 transition is ignored, the prediction interval is from 10% to 19%.)

Table 15

Quarter	Sum of Billed Claims For Employees	Employee Days	PEPM Claims	Trend Annualized	Logs of PEPM	Difference in Logs
2003 Q1	3,664,136	871,233	128.01		4.8521	
2003 Q2	4,009,346	882,590	138.27	36.12%	4.9292	0.0771
2003 Q3	4,172,635	893,022	142.22	11.93%	4.9574	0.0282
2003 Q4	4,279,196	893,525	145.77	10.36%	4.9820	0.0247
2004 Q1	4,443,914	888,755	152.19	18.83%	5.0251	0.0431
2004 Q2	4,561,983	885,292	156.85	12.81%	5.0553	0.0301
2004 Q3	4,613,641	894,280	157.03	0.46%	5.0564	0.0012
2004 Q4	4,840,591	898,132	164.05	19.11%	5.1002	0.0437
					Mean	0.02849
					SD	0.01556
					SE	0.006
					$t_{.25,5}$	2.571
				Margin of Error for Predicting a Change from one quarter to the next		0.043
					Annualized Trend in Log of Claims	0.114
					SD for SUM of 4 changes	0.031
					$t_{.25,20}$	2.086
				Margin of Error for Predicting the Change from one Year to the Next		0.070
					Bottom of Prediction Interval	0.044
					Top	0.184

2003-2004 Medical & Pharmacy Billed Claims Combined

Table 16 shows the total year-to-year percent increase in billed claims from 2003 to 2004. Because pharmacy billed claims are not available for 2002, the medical-pharmacy claims totals cannot include 2002. Pharmacy billed claims increased 13.64% from 2003 to 2004, but pharmacy billed claims are only 14% of total claims. So total claims increase is much closer to the medical increase.

Table 16
Total (Medical & Pharmacy) Billed Claims PEPM Incurred in 2004 & 2005

Year	Incurred Billed Medical Claims PEPM	Incurred Billed Pharmacy Claims PEPM	Total	Year-to-Year Percent Increase
2003	$894.90	$138.63	$1,033.53	
2004	$981.39	$157.55	$1,138.94	10.20%

2005 Billed Claims Forecasted from 2000-2004 Trend

Forecasted 2005 Medical Billed Claims

If the 2002-2004 medical billed claims trend continued, 2005 would show medical billed claims of $1,077.18 PEPM. This extrapolation can be thought of as the result of regressing log claim values against year, and extrapolating from the regression model. Or the extrapolation can be thought of as applying the trend to the log of the PEPM for each year from 2002 to 2004, taking the average of those logs, and then exponentiating. The two methods produce the same result.

The margin of error associated with the trend indicates that 2005 may come in between $1,061.80 and $1,092.32, if King County's healthcare system were unchanged in 2005.

Forecasted 2005 Pharmacy Billed Claims

If the 2002-2004 trend seen in annual pharmacy billed claims (13.64%) continues from 2004's average of $157.55, 2005 will show claims of $179.05 PEPM.

If a projection is based on the trend seen in quarterly billed claims from second quarter 2003 through 2004 (which was 14.55%), in 2005 employees and their dependents will show PEPM billed pharmacy claims of $176.33 (95%

confidence prediction interval from $160.14 to $194.46). These estimates are calculated by applying trends to each quarterly log claims from Q2 2003 through Q4 2004 to bring them to each quarter of 2005. The resulting PEPM estimates were averaged (after exponentiating). This extrapolation process produces results that are within $0.50 of what would be found by simply extrapolating from a regression model.

Estimates of Billed Claims Incurred in 2005

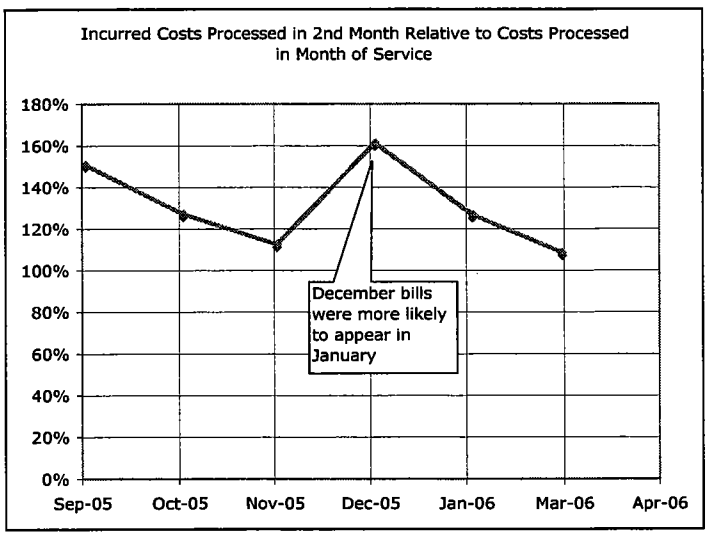
Estimates from 2005 & 2006 Data of the Medical Billed Claims Incurred in 2005

Claims for medical services provided in any given month may not be finalized and recorded for up to two years. For this reason, this report, written in mid-2006, is not based on final statistics on claims from 2005. Instead, for this report, the outstanding 2005 claims are estimated from the 2005 claims that have appeared so far.

We could make error-free estimates of the delayed claims if there were a regular pattern in how much of each month's claims show up in each subsequent month. It is a common practice to estimate the "flow" of insurance claims, and to use this model of the flow to forecast coming claims. Because King County's flow has been irregular, forecasts based on a flow model have a margin of error.

To see the irregularity of King County's flow, see figure 15, which shows the ratio of the claims appearing in a second month relative to the claims appearing in the month of service. Figure 15 shows that the claims incurred in September 2005 that were processed by the claims administrator in October 2005 were 150% of the September 2005 claims that were filed in the month of service. The October 2005 claims that appeared in November were 122% of the October claims that appeared in October.

Figure 15



Because the King County Healthcare database does not include month of service, the data for figure 15 were collected from Aetna's online claims analysis tool. The online analysis tool does not report billed claims, so this flow analysis is done with paid claims. Billed claims are then estimated by multiplying by the average ratio of billed claims to paid claims in the claims data. The ratio of paid claims to billed claims is fairly consistent: From 2003 through 2005, the ratio of billed claims to paid claims has ranged from 1.89 to 1.92.

In order to be able to analyze 2005 accurately, it is necessary to create a flow model to estimate claims for 2005 that will appear later in 2006 and 2007. The following text explains how future claims flows were estimated for this report, followed by table 20, which shows the calculations to estimate the ultimate total billed claims for 2005.

Over the six months shown in figure 15, the mean ratio of claims processed by the end of the second month to claims processed in the first month is 2.312 (SD=.209). Ratios are generally not normally distributed. By transforming the statistics to logs, the ratios become differences, which do tend to be normally distributed. Table 17 shows calculations to create a model of second-month claims flow from claims processed in month of service.

The key data in table 17 (below) is the differences in the logs, which appears at the middle. It indicates how much the log of claims went up from the month of service to the end of the following month. The average of those differences is .83480 (SE=.03645). Based on a t-distribution, a 95% confidence interval for the mean would be .83480 +/- .09372. A prediction interval based on the t-distribution would be .83480 +/- .24795. (The margin of error of the prediction is here calculated as $t_{.025}SD\sqrt{1+1/n}$.) In the case of March 2006, that means that a 95% confidence interval for the log of the total claims processed by the end of April would be 14.7446 + .587 to 14.745 +1.1083. Exponentiating reveals that the interval is from $4,553,609 to $7,476,868. The right half of the table 17 shows how this model of the second month's total performs by applying the model to the one-month totals in column 2. The last column in table 17 shows the difference between the model's estimates and recorded two-month totals in column 3.

Table 17
Calculating Average Change in Claims

Month of Service	Claims Reported in Month of Service	Claims Reported by End of Month After Service	Log of Claims Reported in Month of Service	Log of Claims By End of 2nd Month	Difference in Logs	Lower Edge of 95% Confidence Prediction Interval	Model's Estimate	Upper Edge of 95% Confidence Prediction Interval	Model's Error
Oct-05	$1,970,151	$4,945,261	14.4936	15.4139	0.920	$3,542,966	$4,539,929	$5,817,428	-$405,332
Nov-05	$1,954,956	$4,436,308	14.4859	15.3053	0.819	$3,515,641	$4,504,914	$5,772,560	$68,606
Dec-05	$2,265,064	$4,818,038	14.6331	15.3879	0.755	$4,073,315	$5,219,513	$6,688,242	$401,475
Jan-06	$1,666,726	$4,353,877	14.3264	15.2866	0.960	$2,997,311	$3,840,729	$4,921,480	-$513,148
Feb-06	$1,852,208	$4,200,768	14.4319	15.2508	0.819	$3,330,867	$4,268,146	$5,469,168	$67,378
Mar-06	$2,532,143	$5,281,657	14.7446	15.4798	0.735	$4,553,609	$5,834,958	$7,476,868	$553,301
				Mean	0.83480			Mean	$28,713
				SD	0.08929				
				SE	0.03645				
				$t_{.025,5}$	2.571				
			Margin of Error of Mean		0.09372				
			Margin of Error of Prediction		0.24795				

Figure 16 shows how the third months' total claims compare to the claims processed after the first two months of processing. For example, how January's bills processed by the end of March compare to January's bills processed by the end of February. As with the claims that appear in the second month, the steps described above can be applied to estimating claims from the end of the 3 month from claims processed by the end of the second month.

Figure 16

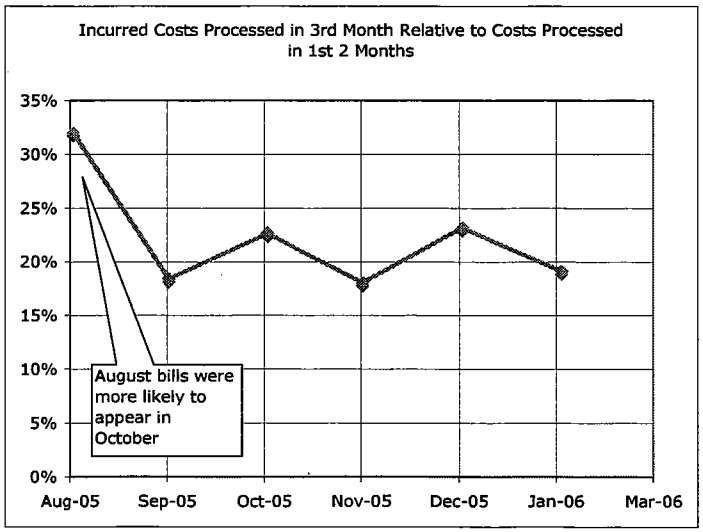


Table 18 shows the mean differences in logarithms and margins of error for estimating each cumulative total in the following month from the current month's cumulative total.

Table 18

Means & Margins of Errors for Predictions of Months' Totals Revealed in Following Month

Following Month (Same Month = 1)	Mean Logarithm	Margin of error
2	0.8348	0.2479
3	0.2050	0.1169
4	0.0488	0.0561
5	0.0271	0.0591
6	0.0116	0.0143
7	0.0065	0.0099
8	0.0052	0.0096
9	0.0031	0.0063
10	0.0031	0.0067
11	0.0033	0.0088
12	0.0019	0.0024
13	0.0015	0.0056
14	0.0005	0.0011
15	0.0008	0.0019
16	0.0008	0.0030
17	0.0001	0.0007

To allow for full comparisons of one month to another, this analysis estimates what the final total will be for each month. Imagine that one has only a single month of claims for a particular month. For example, imagine that one were working with June 2006 in July 2006. In this example, so far, only one month has been allowed for claims to come in. In that situation, one can estimate the cumulative total in the second month, by taking the logarithm of the claims that came in within the first month, adding .8348, and exponentiating. Then that estimate of what total will have accumulated by the end of the second month can be used to estimate the total by the end of the third month, by taking the logarithm, adding .2050, and exponentiating. That process can be continued through the 17 months to estimate the total that will appear eventually for June 2006.

Table 19 shows the sum of means and the margins of error necessary to extrapolate out to what each month's final total will be.

Table 19

Adjustments and Margins of Error After 1 to 16 Months of Claims Flow[3]

Months of Flow Reported	Adjustment to Log of Enrollments (Sum of Logs)	Margin of Error
1	1.1830	0.22217
2	0.3194	0.11203
3	0.1144	0.06605
4	0.0656	0.04973
5	0.0385	0.01914
6	0.0269	0.01561
7	0.0203	0.01358
8	0.0152	0.01137
9	0.0121	0.01029
10	0.0090	0.00888
11	0.0057	0.00559
12	0.0038	0.00531
13	0.0023	0.00286
14	0.0018	0.00279
15	0.0010	0.00247
16	0.0001	0.00059

So far, the King County Healthcare Database has medical data on claims processed up through May 2006. Claims data from June and later are not yet available. That means that the log of the December total must be increased by .0269 (ME=.01561), the November total must be increased by .0203 and so on to February's adjustment, .0001. Table 20 shows the calculations to estimate the final total that will be paid for 2005 medical care, based on claims that had been processed by the end of May 2006.

Table 20

Month of Service	Total of Paid Processed by End of May 06	Log of Paid	Forecasting Adjustment	Margin of Error	Bottom of Prediction Interval	Estimate	Top of Prediction Interval
Jan-05	$5,029,758	15.431	0	0	5,029,758	5,029,758	5,029,758
Feb-05	$5,428,487	15.507	0.0001	0.00059	5,425,827	5,429,029	5,432,233
Mar-05	$5,769,002	15.568	0.001	0.00247	5,760,528	5,774,774	5,789,055
Apr-05	$5,175,301	15.459	0.0018	0.00279	5,170,180	5,184,625	5,199,110
May-05	$6,271,290	15.651	0.0023	0.00286	6,267,779	6,285,730	6,303,733
Jun-05	$6,025,360	15.611	0.0038	0.00531	6,016,269	6,048,300	6,080,502
Jul-05	$6,217,144	15.643	0.0057	0.00559	6,217,828	6,252,683	6,287,733
Aug-05	$6,108,750	15.625	0.009	0.00888	6,109,484	6,163,977	6,218,957
Sep-05	$6,442,050	15.678	0.0121	0.01029	6,453,721	6,520,472	6,587,915
Oct-05	$6,668,855	15.713	0.0152	0.01137	6,694,446	6,770,996	6,848,422
Nov-05	$6,001,984	15.608	0.0203	0.01358	6,042,453	6,125,069	6,208,815
Dec-05	$5,951,387	15.599	0.0269	0.01561	6,018,959	6,113,652	6,209,835
Totals:	$71,089,368				71,207,230	71,699,066	72,196,068
			Ratio to Processed Total		100.2%	100.9%	101.6%

[3] To calculate the margins of error in table 13, the standard deviations of each mean log difference are squared to obtain the variance, the variances are summed, the standard deviation is calculated by taking the square root, and the margin of error is calculated using a t-distribution, making appropriate adjustments for the change in degrees of freedom. (The degrees of freedom of means are summed to find the degrees of freedom of the sum of the means.)

The total billed claims for King County employees' medical care in 2005 processed by the end of May 2006 is $127,609,148. If that total is increased by the 0.9% needed to forecast paid claims, it becomes 128,703,589 (95% confidence prediction interval: $127,820,717 to $129,595,734).

Table 21 shows calculations to transform the 2005 estimates into PEPM statistics.

Table 21

Transforming Estimated 2005 Totals to Per Employee Per Month

	Claims Processed by the End of February, 2006	Bottom of 95% Confidence Interval	Estimated 2005 Billed claims	Top of 2005 Confidence Interval
Total	127,609,147.9	127,820,717.3	128,703,588.8	129,595,733.5
PEPD	35.84	35.90	36.15	36.40
PEPM	1,090.99	1,092.80	1,100.35	1,107.98

Pharmacy

Claims flow is not a significant issue in pharmacy claims. Since 2003, almost all claims have been processed in the month they were incurred . Table 22 shows the portion of billed claims processed by the end of month 5 following the month prescriptions were filled in 2003 and 2004. These totals are very close to complete, because months in 2003 and 2004 have had over 12 months to complete their claims flows.

Table 22

Month	Percent of Claims Processed in Same Month as Prescription Filled	Percent Processed in Filling Month or Next Month	Percent Processed in Filling Month or Next 2	Percent Processed in Filling Month or Next 3	Percent Processed in Filling Month or Next 4	Percent Processed in Filling Month or Next 5
Jan-03	99.68	99.62	99.69	99.78	99.85	99.86
Feb-03	100.29	99.80	99.87	99.92	99.93	99.94
Mar-03	100.67	99.82	99.86	99.89	99.92	99.92
Apr-03	100.31	99.79	99.86	99.91	99.96	99.96
May-03	100.28	99.93	99.96	99.86	99.87	99.89
Jun-03	100.59	99.88	99.75	99.78	99.79	99.80
Jul-03	100.17	99.73	99.66	99.79	99.79	99.93
Aug-03	100.74	99.83	99.83	99.84	99.88	99.94
Sep-03	100.39	99.83	99.83	99.88	99.90	99.91
Oct-03	100.31	99.90	99.89	99.91	99.94	99.94
Nov-03	100.13	99.90	99.91	99.95	99.96	99.98
Dec-03	100.36	99.94	99.94	99.93	99.97	99.97
Jan-04	99.42	99.76	99.80	99.90	99.91	99.93
Feb-04	99.40	99.81	99.86	99.89	99.91	99.91
Mar-04	99.60	99.86	99.90	99.91	99.93	99.96
Apr-04	99.65	99.86	99.90	99.92	99.94	99.95
May-04	99.38	99.77	99.80	99.88	99.94	99.94
Jun-04	99.47	99.63	99.65	99.68	99.71	99.75
Jul-04	99.46	99.79	99.84	99.87	99.90	99.92
Aug-04	99.36	99.79	99.83	99.86	99.89	99.97
Sep-04	99.74	99.88	99.90	99.91	99.91	99.93
Oct-04	99.52	99.76	99.80	99.83	99.86	99.94
Nov-04	99.32	99.82	99.87	99.88	99.95	99.97
Dec-04	100.46	99.89	99.89	99.98	99.99	100.00
Average	99.95	99.82	99.84	99.87	99.90	99.93
Minimum	99.32	99.62	99.65	99.68	99.71	99.75

In 2003, the initial total for a month was typically higher than the final total for that month. That occurred because some bills from each month were later reversed. Caremark reports that this reversal typically happens because drugs

were invoiced during preparation, but then not received by patients – either the patient didn't pick up the prescription, or mailed prescriptions were returned without delivery.

Table 23 shows the average percent processed in the 2003-2004 months, along with the inverse of that percent. To estimate each month's final total, the month's current total is multiplied by the inverse of that percentage.

Table 23

Months of Processing and Multiplicative Adjustment to Estimate Month's Final Total

Months Of Processing	Average Processed Percent of Final Total	Adjustment
12	100.00%	1.0000
11	99.99	1.0001
10	99.98	1.0002
9	99.97	1.0003
8	99.97	1.0004
7	99.95	1.0005
6	99.93	1.0007
5	99.90	1.0010
4	99.87	1.0013
3	99.84	1.0016
2	99.82	1.0018
1	99.95	1.0005

Currently, pharmacy claims processed by the end of April 2006 are available. These show processing of December 2005's invoices in December or during the next 4 months. Table 23 shows that the 2003-2004 experience indicates that December's claim total should be adjusted upwards by multiplying by 1.0010.

Table 24 shows billed totals by month, adjustments, and calculations of PEPM statistics.

Table 24

Month Prescriptions Filled	Billed & Processed By the End of April	Adjustment	Adjusted Total	Employee Enrollment Count	Days in Month	Employee Days Covered	Pharmacy PEPD	Billed Pharmacy PEPM
Jan-05	1,642,796	1	1,642,796	9,879	31	306,249	5.36	163.27
Feb-05	1,499,835	1	1,499,835	9,735	28	272,580	5.50	167.48
Mar-05	1,785,119	1	1,785,119	9,730	31	301,630	5.92	180.14
Apr-05	1,628,265	1	1,628,265	9,726	30	291,780	5.58	169.86
May-05	1,732,802	1	1,732,802	9,737	31	301,847	5.74	174.73
Jun-05	1,724,540	1.0001	1,724,712	9,745	30	292,350	5.90	179.57
Jul-05	1,649,074	1.0002	1,649,403	9,746	31	302,126	5.46	166.17
Aug-05	1,743,730	1.0003	1,744,253	9,744	31	302,064	5.77	175.76
Sep-05	1,702,461	1.0004	1,703,142	9,749	30	292,470	5.82	177.25
Oct-05	1,721,716	1.0005	1,722,577	9,750	31	302,250	5.70	173.47
Nov-05	1,732,600	1.0007	1,733,813	9,756	30	292,680	5.92	180.31
Dec-05	1,798,545	1.001	1,800,343	9,746	31	302,126	5.96	181.37
Sum:	20,361,482		20,367,060			3,560,152	5.72	174.13
						Without Adjustment	5.72	174.08

The bottom row of table 24 includes PEPM calculations without any adjustment for flow, which shows that the adjustment for pharmacy claims flow makes little difference (4 cents PEPM).

Estimated 2005 Savings

Estimated Overall 2005 Medical Savings

Above, where 2005 claims are forecasted from the 2002-2004 average trend (9.7%), 2005 was forecasted to have PEPM medical billed claims of $1,077 (prediction interval $1,062 to $1,092). By the end of May 2006, enough claims had been processed to show medical billed claims PEPM of $1,091. If we estimate the 2005 claims that will appear over the next year, the prediction interval for 2005's PEPM claims is from $1,093 to $1,108, which is an increase of 12% +/- 2.4%.

Overall, when looking at medical claims, we see no evidence of savings. Instead, there is statistically significant evidence of acceleration in medical claims.

The analyses above do not include any attempt to examine catastrophic cases. It could be that the county saved $2M in billed claims in 2005, but had the bad luck of a $2M catastrophic case that wiped out the savings. If that were the case, random variations in catastrophic cases would mask any underlying savings. That is not a plausible interpretation of what happened in 2005, because 2004 is the year with the largest catastrophic claims.

Table 25 shows the top medical claims from 2002 through 2005. Each row in table 25 summarizes claims from a single employee. A steady 10% inflation was applied to adjust the claims to 2005 levels.

Table 25

Top Medical Claims 2002-2005

Employee	Year	Total Billed claims Rounded to $10,000	Total Billed claims Adjusted to 2005 Dollars By 10% Annual Inflation
Highest Total of Billed Claims in a Single Year	2004	1,720,000	1,890,000
2nd Highest	2005	1,500,000	1,500,000
3rd	2004	1,050,000	1,150,000
4th	2003	860,000	1,040,000
5th	2002	770,000	1,020,000
6th	2002	620,000	830,000
7th	2002	610,000	810,000
8th	2003	630,000	760,000
9th	2005	740,000	740,000
10th	2005	690,000	690,000
11th	2004	630,000	690,000
12th	2004	610,000	670,000
13th	2005	640,000	640,000

Table 25 shows that there have been five households with billed claims over $1M (adjusted to 2005 dollars). Three appeared in 2004, including the highest, $1.7M. When the highest claim is removed from the data, 2004's total drops by $1.7M, the 2003-2004 percent increase drops and the 2004-2005 percent increase rises. When lower cut-offs are used for catastrophic cases the analysis produces other results. Removing the employee with $1.5M in bills in 2005 reduces the 2004-2005 percent increase, but then removing 2004's $1M raises the 2004-2005 increase and drops the 2003-2004 increases further. Figure 17 shows the percent increases that are found by removing catastrophic cases in the $50,000 to $2M range. For the data in figure 17, the cutoffs for catastrophic cases were applied to totals adjusted to 2005 levels.

Figure 17

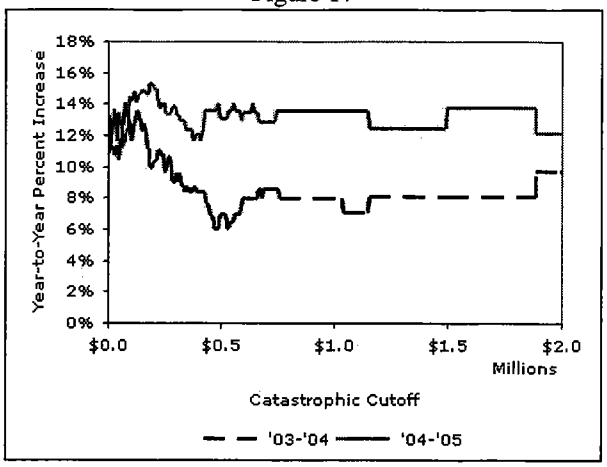


Figure 17 shows that without the employee with the highest bills, the 2004-2005 percent increase is higher than the 2003-2004 percent increase. This is the case for lower cutoffs down to $90,000. For cutoffs between $90,000 and $60,000, the pattern reverses and the 2003-2004 percent increase is higher than the 2004-2005 percent increase.

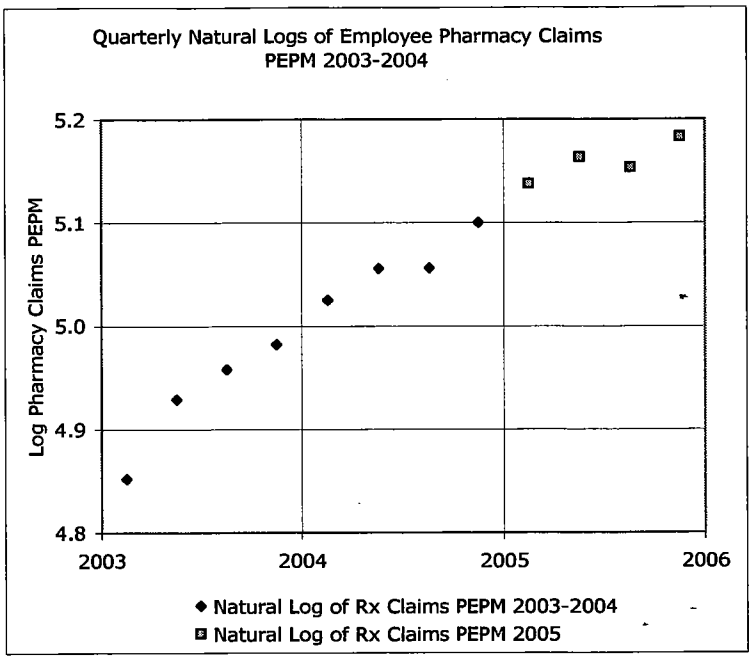
Pharmacy

Billed pharmacy claims PEPM in 2005 are estimated to be $174.13. That is a 10.52% increase over the PEPM statistic for 2004 ($157.55) and a savings of $4.92 compared to the $179.05 that was forecast for 2005 based on pharmacy billed claims in 2003 - 2004. The estimated savings of $4.92 PEPM would translate into a total savings in billed claims of $575,852 in 2005. It is unclear how much of the $575,852 in billed claims savings actually showed up as savings for KingCare. This reduction in billed claims may have produced a reduction in the rebates Caremark obtained for KingCare. Because King County's contract with Caremark did not include transparency in rebates, it is not possible to estimate what portion of a $575,852 savings in pharmacy billed claims would have ended up as paid savings for KingCare.

The 2005 pharmacy spending is within the 95% confidence prediction interval for 2005, which was from $159.53 to $198.57. Because of the uncertainty of what the underlying 2003-2004 trend was, a confidence interval for the 2005 pharmacy savings is from a savings of $24.44 PEPM to a loss of $14.60 PEPM, which is from a savings of $2.9M to a loss of $1.7M. Although the pharmacy savings in 2005 are not statistically significant, as more data become available in 2006, it may become possible to reject the hypothesis that there were no pharmacy savings. That is, the confidence interval describing what happened may include only savings.

Figure 17 shows what happened in pharmacy claims for employees and their dependents from 2003 through 2005.

Figure 17



The savings in 2005 appear to be due to a drop in pharmacy claims between Q2 and Q3. Q4 shows a resumption of the trend that has been seen, with interruptions, since 2003. Since 2005 savings appear to be limited to one quarter, the five pilot programs may not have been a factor, as they were in effect for all of 2005 This single-quarter deviation in claims seems likely to be due to some other factor, such as drug patents expiring.

Medical & Pharmacy Billed Claims Combined

The prediction interval for 2005's medical billed claims PEPM is from $1,093 to $1,108, and billed pharmacy claims PEPM in 2005 are estimated to be $174.13. The estimated range for 2005 total billed claims PEPM is $1,267.13 to $1,282.13. In 2004, total billed claims PEPM were $1,138.94 (10.20% over the total from 2003). The estimated total for 2005 is from 11.26% to 12.57% over the total from 2004. This deviation from the prior 10.20% increase is not evidence of savings in 2005.

2005 Savings Estimated from Risk Adjustment (Employee-Level Predictions of 2005 Claims)

If the five pilot programs had been provided in a randomized controlled experiment, a single analysis for each program would provide a reliable measure of each program's savings. Because the five programs were provided to all KingCare members simultaneously with no control groups, the analyses above are much more suspect than would be analyses of a controlled experiment. To improve the reliability of the results, analyses based on other approaches were done and are reported below.

Risk adjustment is an effort to use this year's data to forecast the claims that will appear for an individual in the coming year. (It is called "risk adjustment", because it was originally used in managed healthcare to set fees for patients after adjusting for the risks of high costs that some patients bring with them.) Any savings calculated from risk adjustment are like the savings calculated at the overall level in that a forecast is made and billed claims are compared to the forecast. For this appendix, the risk adjustment model was created from claims data from 2003 and 2004. The model is then used to forecast each employee's costs in 2005.

For the measurement and evaluation of the King County Health Reform Initiative, 3M graciously donated use of the 3M Clinical Risk Grouping Software. In published reports comparing the performance of risk adjustment software, 3M's Clinical Risk Grouping Software has shown to be one of the most accurate cost forecasters. Due to problems in data collection, 3M's software could not be used for this year's measurement and evaluation report. By the 2007 report, problems related to non-active employees and identifying dependents are expected to have been resolved. For that report, measurement and evaluation will be able to take advantage of 3M's generous donation.

The following pages describe how the risk adjustment cost forecasting system was developed. Figure 29, below, shows that the risk adjustment development went very well, and King County now has an employee-level claims forecasting system that is very accurate for groups of employees taken 100 at a time. Further below that, in a section headed, "2005 Claims Estimated from Risk Adjustment", the analysis continues based on the risk adjustment system. The description, immediately below, of how the risk adjustment model was created is a very technical section of this technical appendix. Reading and comprehending this part of this appendix requires a mastery of a course in multivariate linear modeling with transformations.

Population Limits

To simplify the risk adjustment task, the creation of the risk adjustment model was based only on employees covered by KingCare throughout the 24 months of 2003-2004. Also, tests based on the risk adjustment model only include employees covered by KingCare throughout the 24 months of 2004-2005.

This alters the data somewhat. For example, a patient who died mid-year and who had very high claims would be excluded from the analysis. Table 26 summarizes billed claims for employees and their dependents in 2003 and 2004 and shows how the employees in the risk adjustment data differed.

Table 26
Total 1-Year Billed Claims by Year for All Employees and their dependents and in the Two Modeling Sets
(With no adjustment for claims flow)

Results	Median	Mean	Maximum	SD	N
2003 All Employees	4,744	11,450	859,468	27,614	10,499
2003 Employees Covered throughout 2003-2004	5,320	11,460	531,100	23,991	8,224
2004 All Employees	5,472	12,692	1,724,969	33,805	10,515
2004 Employees Covered throughout 2003-2004	6,244	13,730	1,724,969	36,218	8,224
2004 Employees Covered throughout 2004-2005	6,034	13,140	1,724,969	33,277	8,327
2005 All Employees	5,891	13,967	1,495,444	33,867	10,594
2005 Employees Covered throughout 2004-2005	6,851	14,890	743,100	31,572	8,327

Table 26 shows that there were 10,499 employees covered by KingCare in 2003. Of those, 8,224 (78%) were employed throughout 2003 and 2004. About 20% of employees in a year are not employed for a full 24 months, and so are not included in the risk adjustment analysis.

The 2005 statistics in table 26 reflect the claims that have arrived at King County by the end of April 2006. No adjustment is made for claims flow and coming claims.

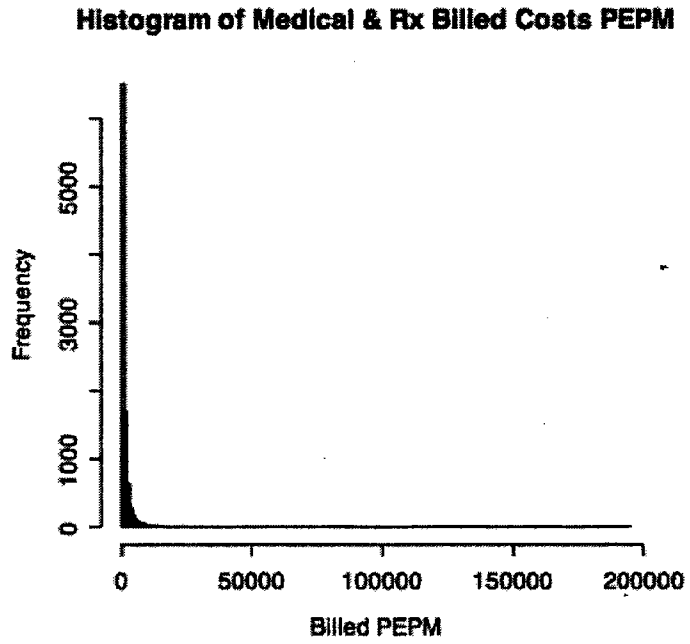
An important difference between all employees and the set included in the modeling is the loss of maximums in 2003 and in 2005.[4]

The Distribution of Claims

The technology underlying risk adjustment is a multivariate predictive model. There are methods to create models without assuming normally distributed individual deviations from the model, but they are currently not as developed as so-called "parametric" modeling methods. Figure 18 shows the distribution of billed medical and pharmacy claims per employee per month of employment in 2005.

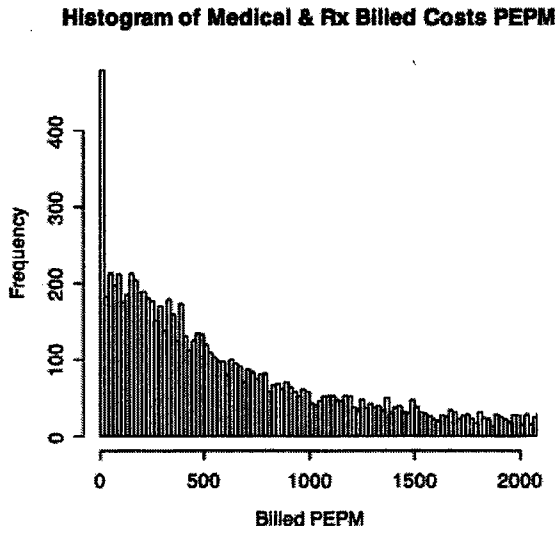
[4] The importance of losing maximums is diminished when billed claims are transformed by taking logarithms.

Figure 18



Like most currency statistics, billed amounts are right skewed (skewness=23.87). For 3% (286) of the employees, 2005 billed claims were zero. Figure 19 provides an image of the lower end of the distribution of 2005 billed claims shown in figure 18, showing the spike at zero.

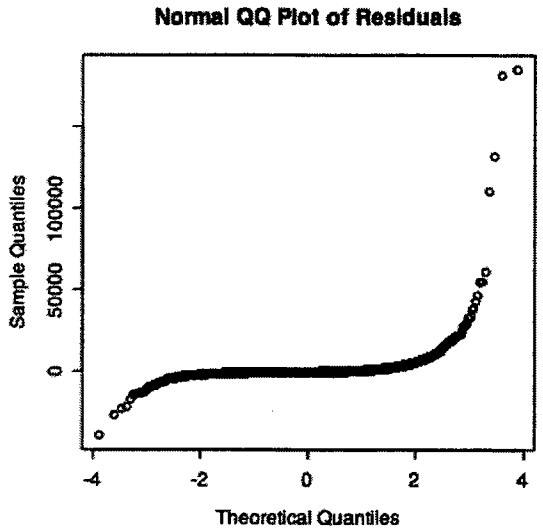
Figure 19



The Distribution of Residuals in a Linear Multivariate Model

The lack of normality in 2005's billed claims leads to lack of normality in the residuals of a linear model. The residuals of that regression have a skewness of 25.38. Figure 20 shows a normal quantile-quantile plot of the residuals of regressing 2005 billed claims onto 2004 billed claims.

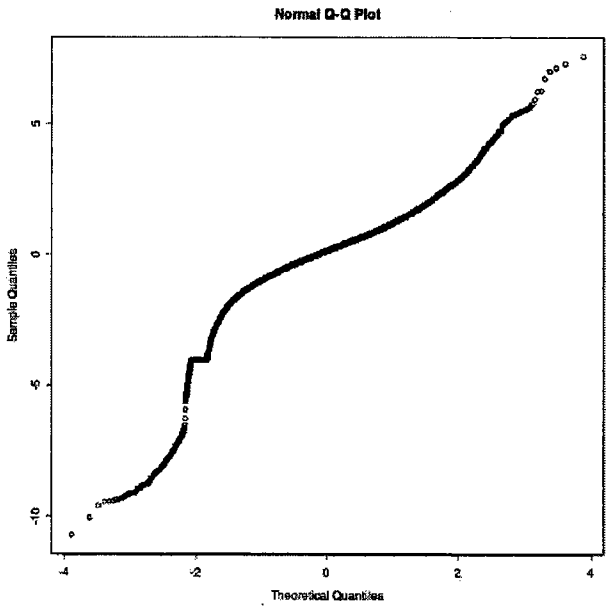
Figure 20



In a normal quantile-quantile plot, if the data are normally distributed, the plot's curve is a straight diagonal line. In this case, the residuals (reflecting the individual deviations from the regression model) are not normally distributed.

The right skewness of billed claims is typical of currency data, which tend to be log-normal. The usual transformation to compensate for this non-normality is to take logs of the observations. Logs can only be taken of values over zero, so the billed claims have to be bottom coded before logs can be taken. Figure 21 shows a normal quantile-quantile plot of the residuals of a regression model estimating 2005 claims from 2004 claims after the claims have been bottom coded at $1 and logs have been taken.

Figure 21

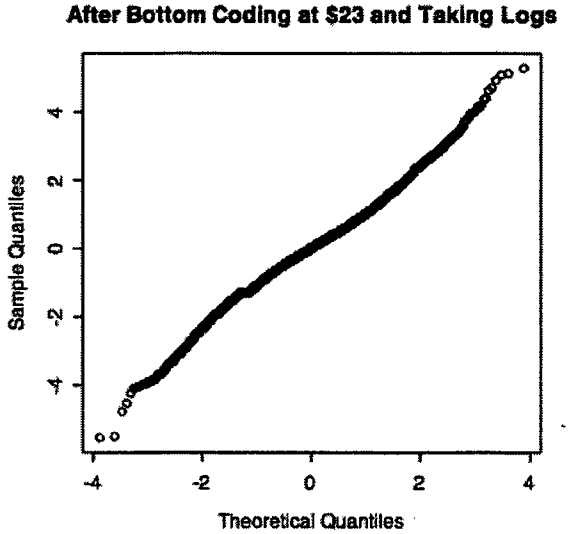


The QQ plot in figure 21 shows much improvement over the QQ plot of residuals from raw claims. There is a curve and a notch to the line in figure 21. That curve and notch is due to the bottom coding at $1. $1 is an outlier.

Bottom coding at $1 does not produce a residual distribution that is as normally distributed as one based on a higher bottom code. Iterative tests of potential bottom codes, using the Kolmogorov-Smirnov test of normality revealed that the ideal bottom code was $23. Figure 22 shows the QQ plot for residuals after bottom coding at $23 and taking logs.

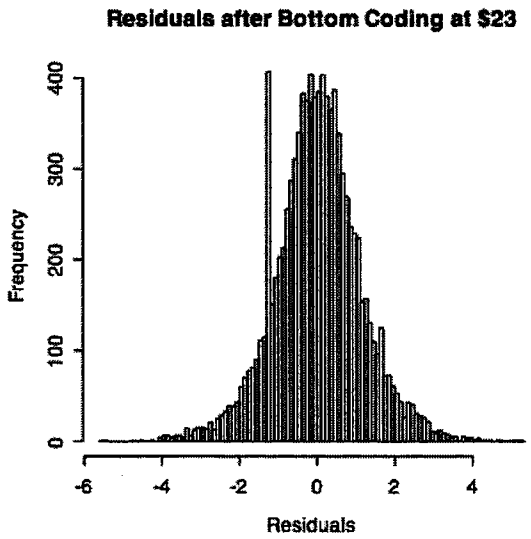
Figure 22

Normal QQ Plot of Residuals



The residuals in figure 22 are symmetrical and roughly normal (skewness=0.016, kurtosis=1.023, median=0.0066). The distribution still contains an anomaly related to the zero claim observations. Figure 23 shows a histogram of the residuals. The spike in figure 23 is the observations that were bottom coded before taking logs.

Figure 23



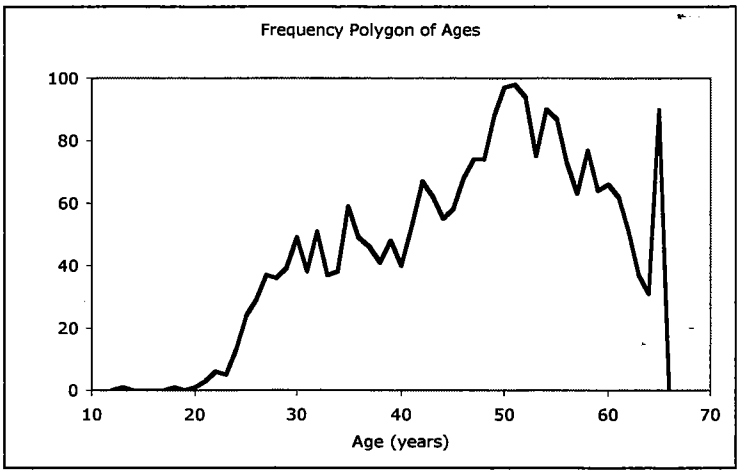
The deviation from normality shown in figure 23 will not produce significant problems for parametric modeling, which is mostly susceptible to skewness and heavy tails.

Bottom coding does artificially inflate billed claims. 5.25% (512) of the billed claims in 2005 were below $23. Before bottom coding, the average billed claim was $1,389.20 (SD=$4,442.59). After bottom coding, the average was lifted to $1,390.15 (SD=$4,442.29).

A first pass at risk adjustment would use age, gender, months of employment in 2004, and claims PEPM in 2004. How to reflect age and gender for an employee and dependents is not immediately clear. Before addressing that difficulty, a model is created for employees without dependents. The results of that modeling will inform decisions about how to use age and gender to predict future claims.

There are 2,445 employees who were employed in both 2004 and 2005 and never covered dependents. Of those, 91% have only a single birth year recorded in King County's records, but 9% (215) have inconsistent records of birth years. For each of those 215, there is one birth year that is recorded most often, and that birth year was used to calculate ages. Figure 24 shows the distribution of ages in this group.

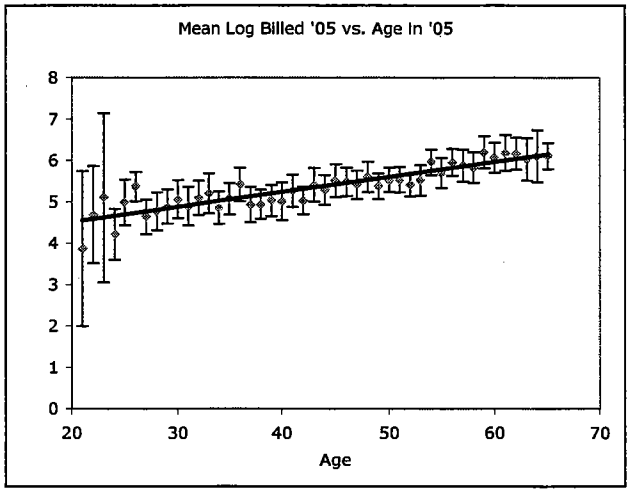
Figure 24



For reasons of privacy, employee ages are top-coded at 65 before claims data are delivered to King County.

Figure 25 shows the relationship between ages and log billed claims.

Figure 25



It appears that the relationship between age and log billed claims is linear.

The model predicting 2005 claims from 2004 claims and age is

$$\text{Log 2005 Billed claims} = 1.454 + 0.625 * \text{Log 2004 Billed claims} + 0.015 * \text{Age}$$

There is no evidence of an interaction between age and 2004 log claims.

Risk Adjustment Model

On the assumption that independence and linearity would work well in general, a risk adjustment model was created to estimate a coming year's claims from the following data from the previous year. The risk adjustment model was fit to data including billed claims in 2004 and predictors in 2003. Only employees employed for the 24 months in 2003 and 2004 were included in the model creation.

The predictors included:

- Billed and paid claims in 2003
- Age of employee
- Gender of employee
- Age of eldest 3 dependents (zero for no dependent)
- Gender of eldest 3 dependents
- Whether employees' claims included diagnoses for:
    - Type 1 diabetes
    - Type 2 diabetes
    - Coronary Artery Disease
    - Congestive Heart Disease
    - Other Heart Disease
- Whether employees' claims included specific ICD9 diagnosis codes truncated to the first two digits (for example, "V70.0" and "V73.2" were grouped into a "V7" group; one binary code indicated whether a "V7" ICD9 code appeared in a household's 2003 claims)

Before modeling, logs were taken of billed and paid claims from both years. Modeling was backwards stepwise linear multiple regression, repeated with randomly selected halves of the '03-'04 data until a set of predictors was obtained in which all reliably provided statistically significant contributions to the model across random subsets. Because tests of diabetes and heart disease were going to be tested along with the predictions of the model, variables reflecting diabetes and heart disease were added to the set of variables. Coefficients for these predictors were then obtained by fitting to the entire '03-'04 dataset. Table 26 shows the model and some statistics regarding the model.

Table 26

Listing of Final Modeling on '03-'04

```
                            Estimate Std. Error t value Pr(>|t|)
(Intercept)                3.520e+00  7.620e-02  46.193  < 2e-16 ***
Ln Billed '03              5.753e-01  4.579e-02  12.565  < 2e-16 ***
Ln Rx '03                  1.734e-01  1.264e-02  13.719  < 2e-16 ***
Ln Medical '03            -1.840e-01  3.960e-02  -4.647 3.42e-06 ***
Employee Gender
(female=1, male=0)         7.676e-02  2.691e-02   2.852 0.004354 **
Eldest Dependent's Age     7.696e-03  6.614e-04  11.637  < 2e-16 ***
Paid for CAD '03          -2.551e-05  6.628e-06  -3.849 0.000120 ***
ICD 30                     1.491e-01  3.181e-02   4.687 2.81e-06 ***
ICD 36                     1.219e-01  4.151e-02   2.937 0.003322 **
ICD 46                     1.304e-01  2.846e-02   4.584 4.63e-06 ***
ICD 54                    -7.529e-01  1.985e-01  -3.793 0.000150 ***
ICD 58                     3.907e-01  1.356e-01   2.881 0.003973 **
ICD 62                     1.060e-01  3.147e-02   3.369 0.000758 ***
ICD 64                     4.125e-01  9.959e-02   4.142 3.48e-05 ***
ICD 66                    -7.386e-01  1.287e-01  -5.738 9.91e-09 ***
ICD 73                     1.618e-01  3.270e-02   4.948 7.64e-07 ***
ICD 78                     1.353e-01  3.266e-02   4.142 3.47e-05 ***
ICD 83                     1.509e-01  3.736e-02   4.039 5.41e-05 ***
ICD V2                     1.671e-01  3.356e-02   4.978 6.57e-07 ***
Diabetes type 1            1.557e-01  9.934e-02   1.567 0.117053
Diabetes type 2            3.973e-02  5.153e-02   0.771 0.440658
Congestive Heart Disease   1.033e-01  1.586e-01   0.651 0.514931
CAD                        9.509e-02  8.147e-02   1.167 0.243132
Other Heart Disease        5.392e-02  3.244e-02   1.662 0.096521
---
Significance codes: p<.0005 '***' p<0.001 '**' p<0.01 '*' p<0.05

Residual standard error: 1.183 on 8197 degrees of freedom
Multiple R-Squared: 0.473, Adjusted R-squared: 0.4716
F-statistic: 319.9 on 23 and 8,197 DF,  p-value: < 2.2e-16
```

Table 27 explains the predictive variables.

Table 27

Predictive Variable	Notes
Ln Billed '03	Natural log of each employee's total medical and pharmacy billed claims in 2003
Ln Rx '03	Natural log of each employee's total pharmacy billed claims in 2003
Employee gender	Binary code indicating female (1) or male (0). The positive coefficient for this variable in the model indicates that bills for female employees will be higher than what would have been predicted from the rest of the predictors.
Eldest dependent's age	Reflects age and presence of age of eldest dependent; set to zero if employee has no dependents.
Paid for CAD '03	Total paid by KingCare for Coronary Artery Disease for employee's family. The negative coefficient in the model indicates that, after using the rest of the predictors to estimate the coming year's claims, some additional cost has to be removed if a much of this year's claims

	were for coronary artery disease.
ICD 30	Binary code indicating whether any ICD9 diagnosis code in 2003 began with "30" for any of employee's family's care. "30" ICD9 codes indicate a variety of psychological disorders.
ICD 36	Binary code indicating the presence of an ICD9 code beginning with "36". This includes some eye disorders.
ICD 46	Includes respiratory disorders
ICD 54	Appendicitis. Negative coefficient indicates that, after using claims etc. to predict next year's claims, if part of this year's claims were appendicitis related, next year's estimate should be brought down somewhat. That is roughly that high claims this year predict high claims next year, but not for appendicitis.
ICD 58	Nephrosis
ICD 62	Disorders of female genital and reproductive organs
ICD 64	Complications of pregnancy
ICD 66	Complications of Labor & Delivery
ICD 73	Osteopathies, Chondropathies, and Acquired Musculoskeletal Deformities (includes chiropractic)
ICD 78	Symptoms not related to diagnosis
ICD 83	Dislocation
ICD V2	Related to Reproduction and Development
Diabetes type 1	Binary code indicating the presence of diabetes type 1 in employee's family; ICD9 digits 1-3: "250", digit 6: "1" or "3"
Diabetes type 2	Presence of type 2 diabetes; ICD9 digits 1-3: "250", digit 6: "0" or "2"
Congestive heart disease	Presence of congestive heart disease; ICD9 digits 1-3: "428" OR ICD9 "398.91"
CAD	Presence of coronary artery disease; ICD9 digits 1-3: "414"
Other Heart Disease	Presence of heart disease other than congestive and CAD; ICD9 digit 1-3 between "390" and "429", except for the CAD and congestive codes described above

Figure 26 shows a quantile-quantile plot of the residuals from the modeling, showing approximate normality.

Figure 26

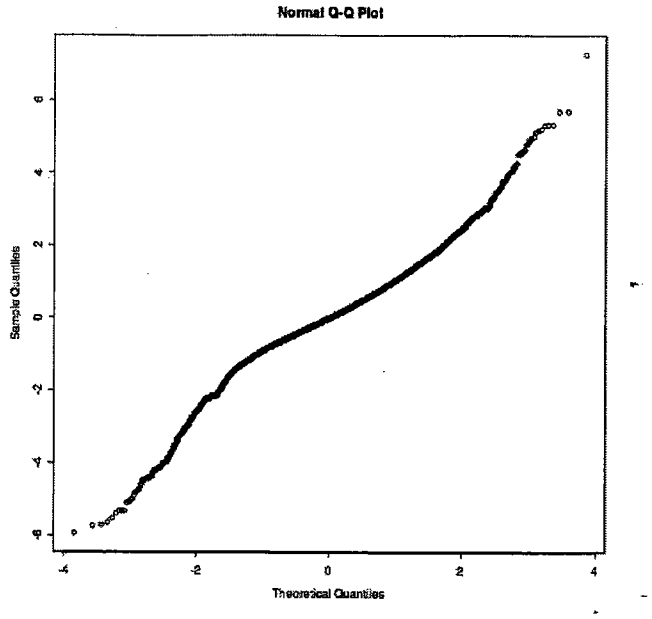


Figure 27 shows the dependent variable (log of billed claims in 2004) plotted against the model's estimates.

Figure 27
Log of 2004 Billed Claims Plotted Against Model's Predictions

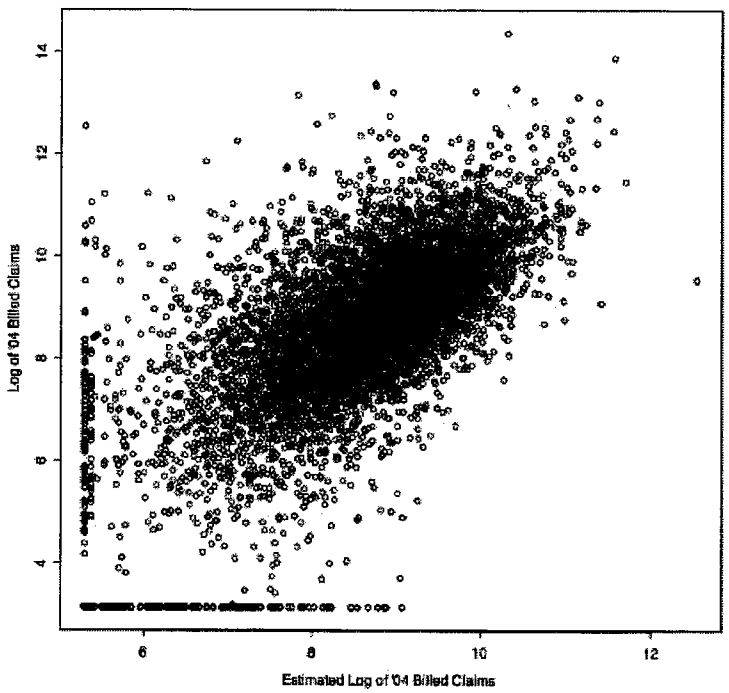
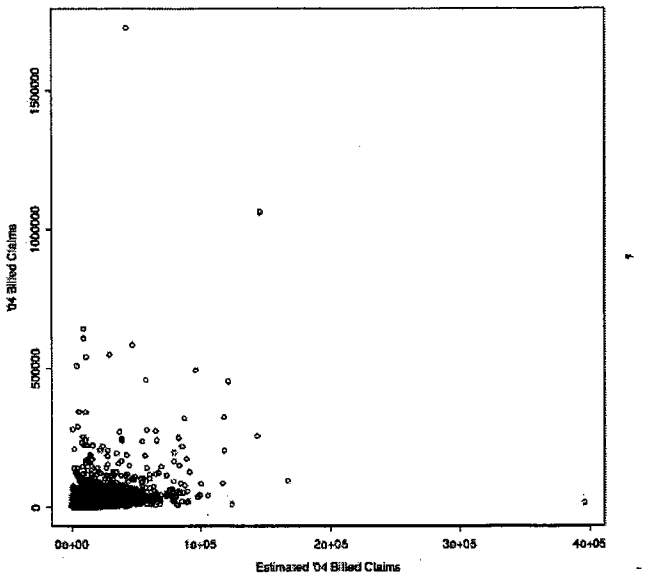


Figure 28 shows the same data as shown in figure 28 after exponentiating the two sets of values to return them to dollar amounts, and multiplying the estimates by an adjustment factor of 1.4.

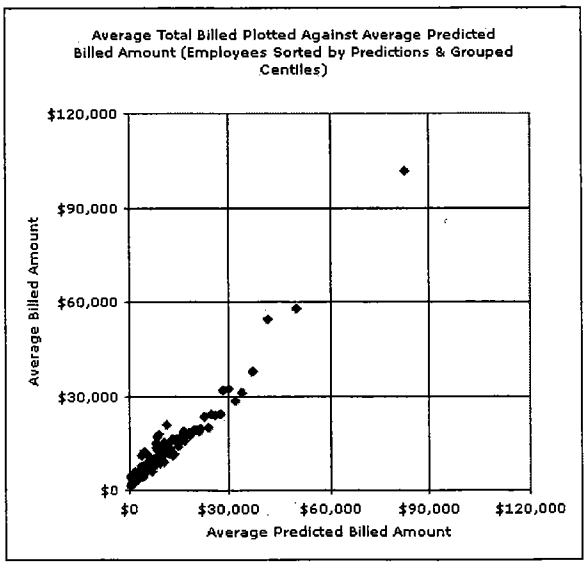
Figure 28



The Pearson correlation in figure 28 is .35. Part of how regression modeling works is that the average estimate equals the average of the estimated variable. This is true for the modeling set, which included logs of billed claims. After exponentiating, the mean estimated variable was 1.4 times the mean estimate. To adjust for this, the estimates were multiplied by 1.4.

Figure 29 shows the relationship between the estimates and the billed claims by aggregating the data after sorting it by estimate. In figure 29, each dot shows the average estimate (after multiplying by 1.4) and the average billed claims (not the log of either) for groups of employees. Each group includes 1% of the employees in the '03-'04 analysis set (82 or 83 employees each).

Figure 29



Risk Adjustment Accuracy Demonstrated in 2004-2005 Claims

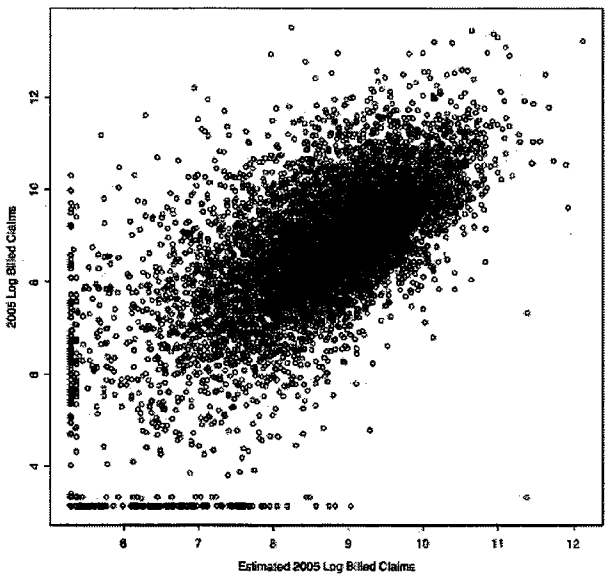
The risk-adjustment methodology for estimating savings is to use the risk adjustment model (the model used to create the estimates shown in figure 29) to predict from 2004 to 2005. Deviations from the model's estimates reflect ways in which the King County healthcare system has changed. Savings show up as billed claims below the model's predictions. The first step for these calculations is to use the model developed on '03-'04 to process '04 data and estimate claims in '05.

As with the '03-'04 data, this work is done only with employees who were employed at King County for the full 24 months from January 2004 through December 2005. Limiting the data set to only employees with 24 months of employment may have somewhat biased the results to find lower claims in 2005. The employee with the highest billed claims in 2005 ($1.5M) was not employed for the full 24 months. In contrast, the employee with the highest billed claims in 2004 ($1.7M) was employed throughout 2004 and 2005, and appears in the data for the risk adjustment tests.

Unlike analyses with totals, the case adjustment analyses cannot be sensibly adjusted for claims that will appear later. The reason for this is that it is not sensible to use a single adjustment factor for each employee, because the lag in bills varies from employee to employee, and there is some indication that it is greater for the employees with the highest bills. The result is that the analyses reported here will underestimate 2005 claims. When these analyses are redone in 2007, the complete data on 2005 will show higher claims than the data used here.

Figure 30 shows the fit between the model's predictions of log billed claims for 2005 and the logs of the recorded billed claims from 2005.

Figure 30



The risk adjustment model predicted 2005 log billed claims essentially as well as it fit the '03-'04 data. The Pearson correlation in figure 30 is .687. In the '030-'04 data, the correlation was .688. The average 2005 log billed claims was 8.67 (Median=8.83, SD=1.59, N=8,323). The average prediction from the risk adjustment was 8.62 (Median 8.76, SD=1.13, N=8,221). The mean 2005 log billed claims was statistically significantly higher then the mean risk adjustment prediction (t(8222)=3.68, p=.0002).

2005 Claims Estimated from Risk Adjustment

After exponentiating and multiplying by the 1.4 adjustment, the risk adjustment model's prediction, the average predicted 2005 billed claims per employee per month was $1,067 (Median=$744, SD=$1138, N=8323, Margin of Error=$24.46).

Estimated 2005 Savings

In the data used for the risk adjustment analyses, the average 2005 billed claims per employee per month was $1,241 (Median=$570, SD=$2632, N=8323, Margin of Error=$56.54). This indicates that claims came in higher than predicted by the risk adjustment model. In this analysis, there is no evidence of 2005 savings.

The risk-adjusted model will be used below to test for savings in targeted groups (employees with diabetes or heart disease).

Summary of Estimated 2005 Savings

So far, there has been no evidence of the Health Reform Initiative five pilot programs producing savings in 2005.

Health Reform Initiative Program Costs in 2005

Table 30 lists the 2005 program claims for the five pilot programs. The claims in table 30 do not include costs for providing the pilot programs to non-employee patients, such as COBRA enrollees and retirees.

Table 30

Pilot Program Claims in 2005 for Active employees

Pilot Program	Claim PEPM	2005 Total for Employees
Provider Best Practices (Aetna's MedQuery)	$1.60	$187,269
Nurse Line (Aetna's Informed Health Line)	$0.86	$100,657
Case Management (Aetna's Enhanced Member Outreach)	$1.50	$175,565
Specialist Efficiency (Aetna's Aexcel Network)	$1.50	$175,565
Disease Management (Aetna's Healthy Outlook Program)	$1.71	$200,144
Total	$7.17	$839,198

Overall Five-Program Cost Benefit Analysis

There was no statistically significant impact of the five pilot programs on healthcare claims in 2005. Overall, healthcare claims rose more in 2005 than they had in recent years.

The impacts of the 2005 programs may be seen over the coming years. For example, teaching a patient who has recently developed type 2 diabetes to manage his diabetes produces savings throughout all of his future years employed at King County. So there will be a 2006 ROI for the 2005 expenditures, as well as a 2007 ROI. So far, we can only estimate the 2005 ROI of the pilot programs' work in 2005. In early 2007, the last of the healthcare claims from 2005 will have appeared at King County. At that point, there may be evidence of savings.

Overall Evaluation of Pilot Programs on a Paid Claims Basis

Because billed claims are several steps removed from the bottom line for King County, it may be helpful to consider the 2005 experience in light of paid claims. Table A below shows KingCare's paid claims experience for active employees and their dependents from 2002 through 2005.

Table A

Claims Paid by KingCare for Active Employees and Their Dependents

By the Year the Claims Were Incurred for 2002-2005

Year Claims Incurred	Paid by KingCare	Employee Days	KingCare Paid Claims Per Employee Per Month	Percent Increase
2002	38,217,732	2,555,511	$455.19	
2003	55,138,471	3,540,370	$474.04	4.14%
2004	61,526,554	3,566,459	$525.09	10.77%
2005 Recorded	67,304,333	3,560,152	$575.418	9.58%
Adjusted For Claims Flow	67,881,568	3,560,152	$580.35	10.52%

The Per Employee Per Month statistics in table A are created by calculating a per employee per day statistic and multiplying by the number of days in an average month. As of June 1, 2006, $67.3M claims have been reported paid for active employees in 2005. Using the same adjustment used elsewhere to adjust for coming claims, that statistic indicates that ultimately claims data will show that $67.9M was paid for active employees and their dependents.

The 2004-2005 percent increase, 10.52%, is not statistically significantly different from the 2003-2004 percent increase.

From 2002 to 2003, there was an unusually low increase in the claims paid by KingCare. This is due to the changes in the KingCare plan that increased the employee's healthcare expenses. Because the 2002-2003 percent increase did not indicate an overall trend, but rather a negotiated savings, it is not sensible to summarize the 2002-2004 trend from these percent increases. Table B shows the combination of KingCare and employee expenditures to cover healthcare claims incurred in 2002-2005.

Table B

Claims Paid by KingCare and Active Employees for Active Employees and Their Dependents

By the Year the Claims Were Incurred for 2002-2005

Year Claims Incurred	Employees Paid	KingCare Paid	KingCare & Employee Paid	Employee Days	Paid Claims Per Employee Per Month	Percent Increase
2002	3,651,759	38,217,732	41,869,492	2,555,511	$498.69	
2003	6,936,285	55,138,471	62,074,756	3,540,370	$533.67	7.02%
2004	7,273,029	61,526,554	68,799,582	3,566,459	$587.16	10.02%
					2002-2004 Average Increase	8.51%
2005 Recorded	7,589,507	67,304,333	74,893,840	3,560,152	$640.304	9.05%
Adjusted For Claims Flow	7,654,598	67,881,568	75,536,167	3,560,152	$645.80	9.99%

As is appropriate for percent increases, the percent increases in table B are averaged with a geometric mean. That is, 8.51% is the annual increase that would bring 2002's rate of $498.69 up to $587.16 by 2004. The margin of error for the underlying annual trend is 9 percentage points, so a 95% confidence interval for the underlying trend is from a drop in claims to 17.51%. Although the 2004-2005 percent increase is higher, it is not statistically significantly so.

Table B does not show all that was paid for medical care for active employees and their dependents in 2005. Another portion of costs were covered by healthcare coverage provided by spouses' employment outside of the county. Table C shows the total paid for claims incurred in 2005.

Table C

Total Claims Paid for Active Employees and Their Dependents

By the Year the Claims Were Incurred for 2002-2005

Year Claims Incurred	Paid by Employees	Paid by KingCare	Paid by Secondary Insurance	Total Paid	Employee Days	Total Paid Claims Per Employee Per Month	Percent Increase
2002	3,651,759	38,217,732	1,245,153	43,114,644	2,555,511	$513.52	
2003	6,936,285	55,138,471	2,653,755	64,728,511	3,540,370	$556.49	8.37%
2004	7,273,029	61,526,554	2,826,189	71,625,772	3,566,459	$611.28	9.85%
						2002-2004 Average Increase	9.10%
2005 Recorded	7,589,507	67,304,333	3,219,894	78,113,733	3,560,152	$667.83	9.25%
Adjusted For Claims Flow	7,654,598	67,881,568	3,247,509	78,783,676	3,560,152	$673.56	10.19%

As with table B, although the 2004-2005 percent increase is larger than the average increase in 2002-2004, it is well within the margin of error, and is not a statistically significant increase in paid claims.

Program-by-Program Analyses

Nurse Line

Nurse Line Components & Objectives

The Nurse Line provides KingCare enrollees and their dependents with 24-hour access to toll-free telephone consultations with nurses. According to materials posted on the Aetna website, the Aetna Informed Health Line nurses are registered nurses (RN's).

The Nurse Line's method of producing savings is through getting appropriate care to employees and their dependents. Problems that can be treated at home are not taken to an emergency room or physician. Critical problems are directed to immediate care, and do not grow into more expensive crises. In the Health Reform Initiative business case, a suggested measure of the Nurse Line savings is "changes in emergency room/urgent care utilization for conditions amenable to self-care."

Nurse Line Usage

Aetna reports on the Nurse Line include the following:

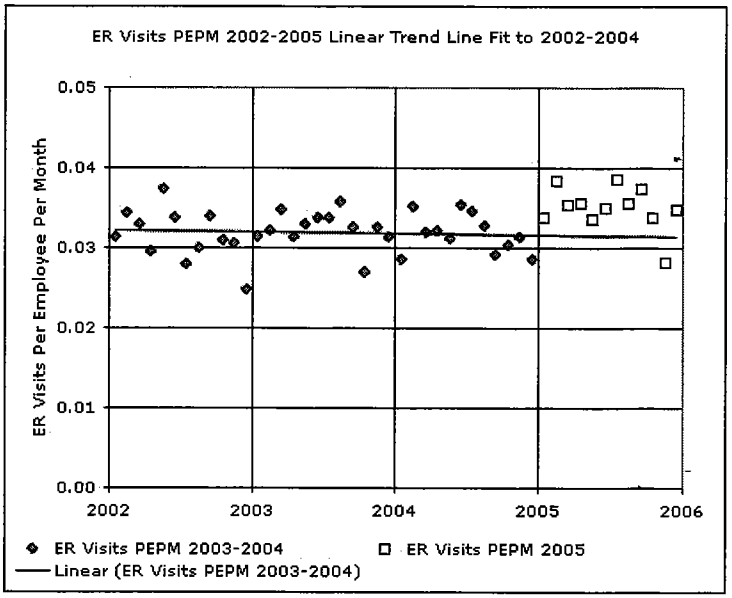
- In 2005, the Nurse Line was made available to 10,439 households. (In 2005, King County averaged 8,852 employees enrolled in KingCare each month. Because of turnover, the total number of employees in 2005 was higher: 10,594.)
- By the end of 2005, the Nurse Line had received 1,232 calls from 981 households (an average of 1.26 calls per calling household).
- In the second half of 2005, King County took advantage of the Nurse Line at rates that were twice what is typical at other organizations: There were 12.30 calls per 100 employees. At other organizations, Aetna finds an average of 5.6 calls per 100 employees. The Nurse Line per call cost to KingCare was half what it would have been had King County employees called at the rates seen elsewhere.
- Throughout the year, from 69 to 100 new households called the Nurse Line each month.

Emergency Room Usage

Aetna's online claims analysis tool reports monthly statistics for emergency room visits. Unlike statistics reported elsewhere in this report, this data includes visits by employees and their dependents as well as by non-employees

and their dependents (COBRA etc.). To calculate PEPM statistics, Aetna's emergency room visit counts were divided by Aetnas' enrollment counts. Before calculations, both emergency room visit counts and enrollment counts were estimated based on flow models as described above for billed claims. Figure 31 shows monthly emergency room visit counts PEPM incurred in 2002 through 2005.

Figure 31



The average number of emergency room visits from 2002 through 2004 PEPM is .032 (SD=.003, SE=.0004). In 2005, the average is 9.8% higher (which is statistically significantly higher, mean=.035, SD=.003, SE=.0008, $F(1,46)=12.54$, $p=.001$).[5] Rather than dropping, emergency room visits rose by roughly 30 emergency room visits per month. Given the number of calls to the Nurse Line (103 per month) for this increase to be due solely to the Nurse Line, 1/3rd of Nurse Line calls would have had to produce an emergency room visit.

The King County claims database cannot produce monthly statistics, but the increase in emergency room usage can be seen in annual billed claims in table 31.

Table 31

ER Billed Claims for Active employees and Their Dependents PEPM 2002-2005

Year	ER-Related Billed Claims PEPM	Year-to-Year Percent Increase
2002	$38	
2003	$44	17%
2004	$49	12%
2005	$60	23%

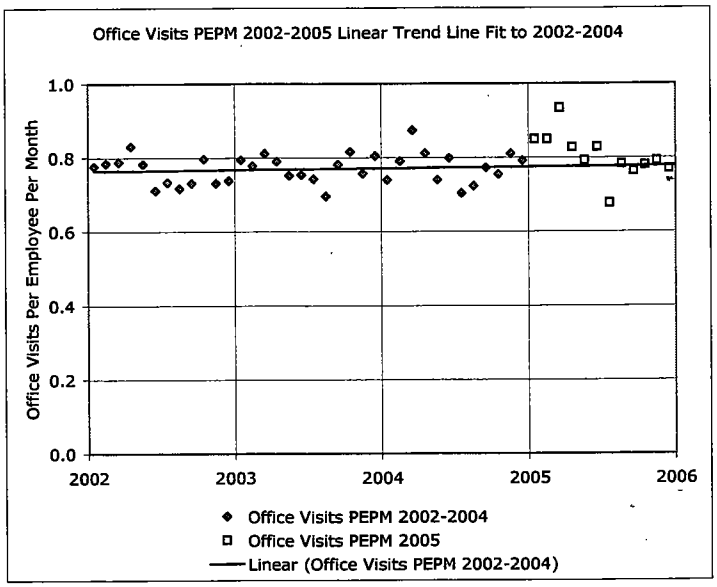
Whether the higher year-to-year percent increase in 2005 is due to the Nurse Line would be revealed by whether nurse-line callers are more likely to visit the emergency room than other employees. Such an analysis is not possible for this report, due to Aetna not providing Nurse Line participation data soon enough.

[5] These ER counts PEPM are a time series. Because the system appears to be stable, the observations appear to be independent pulls from a single system. From 2002 through 2004, there was no correlation between each observation and the following month's observation (for 2002-2004, r=.07, p=.67; in 2005, r=.09).

Office Visits

The online claims analysis tool also provides office visit counts. Figure 32 shows office visit data from the online claims analysis tool that has been flowed out to estimate final values.

Figure 32



From 2002 through 2004, the average number of office visits PEPM was .77 +/-.01 (SD=.039, SE=.0066). In 2005, the average was .80 +/-.04. The confidence intervals overlap, and an examination of figure 32 shows that, while office visits may have jumped in early 2005, they then dropped again. Unlike ER visits, office visits do show dependence (month-to-next-month r = .22), so a straight-forward ANOVA test of significance is not justified.

Estimated Nurse Line Costs

In 2005, the cost to KingCare for the Nurse Line was $0.86 PEPM. For employees, that is a total of $100,657 in 2005, or $81.70 per call. Total costs per call were higher, because this $81.70 statistic does not include Nurse Line costs that KingCare paid for non-employees (including COBRA and self-paying retirees).

Estimated Nurse Line Savings

In 2007, it will be possible to compare claims for Nurse Line users to claims for non-users. This report can review the emergency room data that had been proposed to show the Nurse Line savings. Emergency room billed claims for employees and their dependents showed a 23% ($11) rise PEPM from 2004 to 2005. About $6 of that rise was not anticipated by prior trends. At the same time, office visits did not rise. There is no evidence that the Nurse Line shifted medical care from the emergency room to office visits.

Nurse Line Cost Benefit Analysis

So far, there has been no evidence of savings from the Nurse Line.

Nurse Line Results Compared to Published Literature

The estimate that 1/3rd of calls to the nurse line result in emergency room visits that would not have otherwise occurred may be plausible. Baker et al. (1999) found that 21% of nurse line calls regarding pediatric patients with healthcare insurance were referred to an emergency room, but does not report how many of those emergency room visits would have happened otherwise.

Some studies have found that nurse lines reduce emergency room visit and provide a positive ROI. Bogdan et al. (2004) found nurse lines led to lower intensity care and an average savings of $16 per call. (To cover it's costs to KingCare, the Aetna nurse line would have to yield 10 times that savings in billed claims.) O'Connell et al. (2001)

report that emergency room usage dropped with the provision of a nurse line, and reported a nurse line ROI of 1.70, but it is unclear what Nurse Line price produced this ROI.

The most careful research does not indicate that a service like a Nurse Line reduces emergency room use. A 2005 review (Bunn et al.) of the most careful published tests of telephone consultations found six that provided physician telephone consultations and one that provided nurse consultations. In these seven studies, six demonstrated no change in emergency room use, and the seventh, the nurse line, showed an increase in emergency room use.

Disease Management

Disease Management Components & Objectives

The disease management program communicates with employees and their dependents with at least one of the target diseases: congestive heart failure, coronary artery disease, and diabetes. For 4% of those patients (57 in 2005), Aetna provided telephone consultations to improve their healthcare and ability to manage their diseases. For the rest of the patients who agreed to receive it, Aetna mailed a semi-annual newsletter about managing their diseases.

The greatest opportunity to produce savings is in the telephone consultations. In order to cover the $200,144 cost of the program, the 57 telephoned patients would have to show an average savings of $3,511 in 2005, which would be a drop of $7,000 in billed claims, or $583 PEPM. On average, after controlling for age and gender, employees whose families include someone with diabetes produce approximately $600 PEPM in billed claims over the average billed claims from families without diabetes. That is, families without diabetes or heart disease have average of $700 in billed claims PEPM. Families with someone with diabetes have an average of $1,300 in billed claims PEPM. Families that include someone with congestive heart failure produce approximately $7,500 in additional billed claims PEPM, and families with a patient with coronary artery disease produce an additional $1,500. So the savings to cover the programs claims would amount to approximately 20% of the additional claims due to the family having the disorders, assuming that the semi-annual newsletter had no impact. If the newsletter did have an impact, the savings needed to cover the program's costs would be less than 20%.

Disease Management Invitation & Usage Statistics

Table 32 shows counts that Aetna provided of KingCare members who have been flagged as having one of the target diseases along with participation statistics. Table 32's statistics include all members, including COBRA and self-paying retirees.

Table 32

Disease Management Participation Statistics

Condition	Invited Members with Condition	Members Participating in Disease Management Program	Members receiving "high touch" disease management (telephone consultations)	Members receiving "educational" disease management (mailed a semi-annual newsletter)	Members Who Have Not Yet Selected Participation Level (Receiving No Disease Management)	Percent of Invited Members who Have Chosen to Participate and Have Chosen Participation Level
Congestive Heart Failure	175	131	14	105	12	68%
Coronary Artery Disease	291	182	13	160	9	59%
Diabetes	1,182	1,078	30	1,032	16	90%
Total	1,649	1,391	57	1,297	37	82%

Aetna reports that King County participation in Disease Management has been approximately 6 percentage points higher than they have seen at other organizations.

Disease Management Savings Estimated from Risk Adjusted Model of Participant Claims

When 2005 billed claims are compared to 2005 billed claims projected by risk adjustment from 2003-2004 trends, the presence of any of the target diagnoses does not predict any deviation from the projections. That is, if the disease management program lowered costs, after estimating 2005 claims, one would have to take some additional savings off for the employees whose families include one of the target disorders. There is no statistically significant indication that any additional savings should be removed for those families.

Table 33 shows a listing of the results of a multiple regression model testing whether binary codes indicating the presence of the target diseases in 2004 provide any improvement in predicting logs of billed claims in 2005. If the disease management program reduced claims for these diseases in 2005, then the predictions for households with these diseases would be too high, and the model would have to take some additional billed claims off for those families.

Table 33
Listing of Multiple Regression Model Testing Whether
The Presence of the Target Diseases are Related to Lower Claims
By Regressing Billed Claims onto Risk Adjustment Claims Predictions & Binary Codes Indicating Target Diseases

```
Residuals:
     Min       1Q   Median       3Q      Max
-7.79902 -0.62084 -0.02063  0.63970  5.34479

Coefficients:
                            Estimate Std. Error t value Pr(>|t|)
(Intercept)                  0.33345    0.10082   3.308 0.000945 ***
Risk Adjustment Prediction   0.96620    0.01174  82.266  < 2e-16 ****
Diabetes Type 1             -0.10459    0.09900  -1.056 0.290798
Diabetes Type 2              0.02055    0.04582   0.449 0.653779
Congestive Heart Disease    -0.11295    0.13861  -0.815 0.415174
Coronary Artery Disease      0.14454    0.06974   2.073 0.038233 *
---
Significance codes: **** p<.0005; *** p<0.001; ** p<0.01; * p<0.05

Residual standard error: 1.154 on 8317 degrees of freedom
Multiple R-Squared: 0.4718,      Adjusted R-squared: 0.4715
F-statistic:  1486 on 5 and 8317 DF, p-value: < 2.2e-16
```

In this full model, coronary artery disease has a statistically significant positive impact on log billed claims. That is only because of the presence of the other diseases. When the 2005 log billed claims are regressed onto only the risk adjustment predictions and coronary artery disease, the coronary artery disease coefficient is still positive (.13), but its p-value rises to .051. Because the coefficient is positive, if the relationship were statistically significant, it would indicate that, after controlling for coronary artery disease claims that would have been expected from the 2003-2004 trends, there were new coronary artery disease claims in 2005. Altogether, this indicates no savings from the disease management program, and the possibility of some additional claims.

Disease Management Savings Estimated from Deviation from Trend in Target Disease Claims

Another approach to measuring an impact of the Disease Management program is to set aside risk adjustment and look at billed claims for each of the target diseases over the last four years. Table 34 shows the average costs of the target diseases PEPM. Table 34 shows that there have been variations in the claims related to the disease management target diseases, but the variations in trend have been within the margin of error of such claims.

Table 34

Billed Claims PEPM for Disease Management Target Diseases

	Diabetes			Congestive Heart Disease			Coronary Artery Disease		
Year	Billed Claims PEPM	Margin of Error	Percent Increase	Billed Claims PEPM	Margin of Error	Percent Increase	Billed Claims PEPM	Margin of Error	Percent Increase
2002	$17.22	$3.61		$6.78	$5.90		$22.46	$6.76	
2003	$18.84	$3.59	9.38%	$7.95	$4.26	17.21%	$24.62	$6.84	9.64%
2004	$26.05	$6.47	38.29%	$7.20	$5.22	-9.47%	$23.57	$6.64	-4.27%
2005	$27.62	$6.43	6.03%	$7.51	$5.22	4.33%	$33.66	$9.13	42.81%

Table 35 shows claims of the three diseases combined.

Table 35

Billed Claims for All Three Target Diseases

Year	Billed Claims PEPM	Margin of Error	Percent Increase
2002	$46.46	$10.26	
2003	$51.41	$10.17	10.65%
2004	$56.82	$11.14	10.52%
2005	$68.79	$13.23	21.07%

The large 2004-to-2005 percent increase in Coronary Artery Disease billed claims swamps the variations in the other disease's billed claims, but note that, in 2005, the margin of error for the average coronary artery disease paid claims was almost as large as the 2004-to-2005 percent increase. In fact, the 2005 PEPM average is not statistically significantly larger than the 2004 PEPM average.

Because of the large variation in these claims, none of their changes have reached statistical significance. Once two years of data are available, it may be possible to combine years and reach some statistically significant conclusions.

This difficulty with large variations is not limited to this methodology. The same large variation would also prevent the tests relying on risk adjustment to reveal new savings.

Summary of Estimated Disease Management Savings

Billed claims associated with the target diseases have not shown statistically significant impacts of the Disease Management programs. A clearer picture may become available after the Disease Management program has been run for two years. That will provide more data and smaller margins of error.

Disease Management Cost Benefit Analysis

So far, Disease Management has not been demonstrated to have produced savings.

Case Management

Case Management Components & Objectives

A standard part of the services that KingCare has purchased from our medical claims administrator since 2002 is a review of cases and interventions to avoid unnecessary claims. Part of the history behind this is that, years ago, it was common for hospitals to bill for extended hospital stays after patients had gone home. The original case management included visiting patients at hospitals daily to ensure that payments for hospital stays did not continue after patients were discharged. Since then, Case Management has grown to include a wide variety of interventions and communications (and daily hospital visits have been dropped).

Before 2005, Case Management interventions were limited to the cases that, in Aetna's judgment, were most likely to yield savings. By purchasing Aetna's Enhanced Member Outreach, KingCare contracted to have the Case Management interventions applied to more KingCare members. The hope here is that, while these new cases may be less likely to yield savings, they still promise some savings beyond the cost of the program.

The following text from Aetna helps describe Enhanced Member Outreach (the Case Management program KingCare bought in 2005):

> The Enhanced Member Outreach (EMO) program supplements and intensifies Aetna's standard case management program through the use of additional clinical resources for medical and pharmacy data and member outreach calls. The additional calls, based on predetermined triggers, result in increased case and disease management screenings and participation rates.

In 2005, the predetermined triggers for Enhanced Member Outreach were as follows. Where known, EMO actions are listed:

- Surgeries: Contacts were made Pre- and post-admissions/surgeries for all elective procedures except maternity
- Predicted to benefit from Disease Management (e.g., diagnosed with diabetes, coronary artery disease, or congestive heart disease): Patient referred to Disease Management.
- Pharmacy non-compliance (e.g., long-term prescription not refilled)
- In any 6-month period:
  - Incurred 3 or more ER visits
  - Visited one provider 30 times
  - Visited 10 or more specialists & 3 or more distinct providers
  - Visited primary care provider 10 or more times

The impact of Enhanced Member Outreach is through the increased actions of disease management and case management.

Case Management Invitation & Usage Statistics

In 2005, Enhanced Member Outreach referred 15 cases to Aetna's Case Management. Table 36 lists the number of cases referred and accepted by Aetna Case Management each year since 2002.

Table 36

Case Management Cases Referred and Accepted Each Year

Year	New Case Management Cases	Year-to-Year Percent Increase	Cases Declined Because Case Management Unable to Contact Patient	Cases Declined Because Patient Declined to participate
2002	66		0	0
2003	99	50%	7	13
2004	196	98%	0	2
2005	258	32%	116	21

Aetna reports on reasons for cases being declined are inconsistent. It is unclear that cases of inability to contact were recorded in 2004 and 2002. Nonetheless, it does seem that the big difference in Case Management activity in 2005 compared to previous years is a large jump in the number of patients whom Aetna attempted and failed to contact.

Case Management Savings Estimated from Deviation from Claims Trends

Target Diseases

Case management works with Disease Management to yield savings in the diseases that Disease Management targets. The analyses reported above regarding the Disease Management diseases revealed that changes in the target diseases were too small compared to the variation in such diseases for those changes to be statistically significant

(attributable to anything other than random variation). With additional years of data, it may become possible to see an impact of Case Management and Disease Management on these diseases.

Hospitalization Claims

Table 37 shows data on in-patient billed claims for KingCare for 2002 through 2005.

Table 37

In-Patient Billed Claims 2002-2005

Year	In-Patient Billed Claims PEPM	Year-to-Year Percent Increase
2002	$231	
2003	$251	8.96%
2004	$266	5.75%
2005	$286	7.43%

From 2002 through 2004, the overall annual trend in in-patient claims is 7.34%. 2005's 7.43% does not demonstrate a reduction in in-patient claims.[6]

Emergency Room Visits

Enhanced Member Outreach contacts patients who have visited emergency rooms frequently. These calls would produce savings by diminishing emergency room visits. As noted in section on the Nurse Line above, after holding steady for three years, emergency room visits rose in early 2005.

Provider Visits

Enhanced Member Outreach contacts patients who have visited providers with an unusually high frequency. Discouraging such patients from such visits would diminish physician visits. As noted in the Nurse Line section above, there was no drop in physician visits in 2005.

Summary of Estimated Case Management Savings

So far, there has been no evidence of savings due to Case Management (Aetna's Enhanced Member Outreach). This analysis is not based on all of the data that was hoped from Aetna. More experience and more complete data may reveal savings in the future.

Case Management Cost Benefit Analysis

So far, the Case Management program has not been demonstrated to have produced savings.

Provider Best Practices

Provider Best Practices Components & Objectives

The Provider Best Practices program (Aetna's MedQuery) reviewed medical and pharmacy claims to alert doctors to mistakes and oversights in care. Hospitals and large pharmacies contract with First Data Bank

[6] In 2005, it was reported that in-patient claims for KingCare had held steady from the first 6 months of 2004 through the first 6 months of 2005. This estimate had been made based on the assumption that the claims flows were constant from year to year. What was not then known was that in-patient claims flows in 2005 were substantially slower than claims flows in 2004, producing the apparent trend reduction. The way that claims flows are handled in this report is somewhat more reliable, because it is based on the assumption is that recent claims flows are similar to what was seen recently. For example, it assumes that the claims flow in February 2006 is close to the claims flow of January 2006. That has proven to be more accurate than assuming that claims flows in February 2006 match claims flows in February 2005. Future analysis may treat claims flows slightly differently, in that there may be some year-to-year similarities that the current method does not capture. For example, claims flows in December 2005 may have been similar to claims flows in December 2004 as administrators tried to catch up before the end of each year.

(www.FirstDataBank.com) to review prescriptions for such mistakes. The advantage of Aetna's MedQuery over the pre-existing First Data Bank service is that MedQuery reviews patients' full medical insurance claims of the last year as they search for such errors, while First Data Bank reviews each prescription individually.

Provider Best Practices Contact Statistics

Table 38 shows statistics on contacts by the MedQuery program and what has been documented about how physicians responded. The cases with possible compliance include cases in which the physician followed the advice, as well as cases in which the physician would have made the same change without prompting (either due to further consideration or patient complaints).

The data in table 38 is based on all KingCare members, including COBRA beneficiaries and self-paying retirees. Data specifically on employees is not available.

The documented-non-compliance rates in table 38 (column 3) are from the first 3 quarters of 2005. Fourth quarter non-compliance rates were not available for this report.

Table 38

MedQuery Contact and Physician Response Statistics

By Severity Level & Communication Method	Events	Documented Non-Compliance (Communication did not Change Care)	Events with Possible Compliance
Severity 1: Physician Telephone Call within 24 hours	62	44%	34
Severity 2: Nurse Telephone Call or Letter within 7 days	2,172	68%	689
Severity 3: Letter	979	76%	238
Total	3,213	70%	962
Type of Communication			
Stop A Drug	416	66%	141
Screening	384	60%	154
Monitoring	1,620	65%	567
Drug-Drug	35	59%	14
Add/Intensify Drug/RX	758	89%	86
Total	3,213	70%	962

Most (70%) of MedQuery communications can be documented to have not changed care by the physicians who received them.

To cover the MedQuery costs for employees, the MedQuery communications that may have produced compliance would have to have produced an average of $398 in billed claims savings per communication.

Physician Response to Contacts

Aetna reports that 70% of their doctor contacts can be conclusively determined to have been dismissed by the physician as unhelpful. It is unknown what proportion of the 30% were deemed helpful by the receiving physicians, because some of those contacts would include advice the physician was already planning to follow. Aetna has not provided MedQuery data that could be integrated with the King County Healthcare Database, so it is not possible to review specific cases that prompted MedQuery communications.

Savings Estimated from Trends in Poisonings by Medications and Adverse Reactions to Treatment

One anticipated benefit of the MedQuery program is that poisonings by prescribed medication would happen less often. Poisoning due to medications are coded with ICD9 codes 960 through 971, and so can be flagged in the KingCare claims data.

Recent trends in the prevalence and billed claims of such poisonings were unchanged in 2005. The proportion of employees whose families are poisoned by medicine each year from 2002 through 2004 ranged from 0.33% to 0.41% (margin of error=0.1%). In 2005, 0.39% were poisoned. Claims have ranged from $0.60 PEPM to $2.20. In 2005, they were $1.16 PEPM.

Table 39

Billed Claims for Adverse Drug Events (ADE) and Medication Errors

ICD9 Codes 960 through 971

Year	Average Billed Claims for ADE & Medication Errors PEPM	Margin of Error Of Average Billed Claims	Total Billed For ADE etc.	Number of Employee Families with ADE etc.	Percent of Employee Households With ADE etc.	Margin Of Error Of ADE Percent
2002	$2.21	$2.55	$201,886	31	0.41%	0.14%
2003	$0.60	$0.34	$75,439	35	0.33%	0.11%
2004	$0.90	$0.47	$113,413	42	0.40%	0.12%
2005	$1.16	$0.73	$147,614	41	0.39%	0.12%

Morimoto et al. (2004) provide a more complete list of ICD9 codes associated with adverse drug events and medication errors:

- 3-Digit ICD9 between 960 and 977
- or 3-digit ICD9 = 693, 708, 909, or 995
- or ICD9 = 357.6, 535.4, 583.9, 692.3, or 995.2

Using this broader definition of physician errors reveals a greater number of errors and higher claims, but no 2005 change in the 2003-2004 trend.

Table 40

Billed Claims for Adverse Drug Events (ADE) and Medication Errors

Using Diagnostic Categories from Morimoto et al. (2004)

Year	Average Billed Claims for ADE & Medication Errors PEPM	Margin of Error Of Average Billed Claims	Total Billed For ADE etc.	Number of Employee Families with ADE etc.	Percent of Employee Households With ADE etc.	Margin Of Error Of ADE Percent
2002	$6.53	$4.06	$595,506	594	7.82%	0.60%
2003	$3.48	$0.88	$438,275	769	7.32%	0.50%
2004	$5.31	$1.97	$670,389	761	7.24%	0.50%
2005	$6.83	$3.99	$868,586	796	7.51%	0.50%

By either the broad or narrow definition, physician errors revealed in ICD9 diagnostic codes have varied within a margin of error of a consistent rate from 2002 through 2005.

Healthcare claims show no evidence that the MedQuery program was able to provide protection beyond what was already provided through providers' subscriptions to First Data Bank.

KingCare Savings Estimated by Aetna Staff

As part of the MedQuery package, Aetna provides analysis of savings due to the MedQuery communications. These self-evaluative calculations begin by excluding all communications that can be proven by the healthcare claims record to have been dismissed by the physicians receiving the communications. MedQuery's analyses proceed by assuming the rest of the communications were effective in changing treatment. This is an optimistic assumption: some of those treatment programs would have changed without the communication. Finally, MedQuery's analysis uses the HCUP database that reports average billed charges associated with each adverse event that MedQuery takes

responsibility for making less likely. MedQuery then takes credit for the cost of that event multiplied by the change in the probability of that event due to MedQuery's communications. For example, imagine that research has suggested that the probability of an adverse event is 10% with a particular drug, and that the probability of that event without that drug is 2%. Let's say that the event produces $50,000 in billed claims. Now imagine that MedQuery emailed the doctor to ask that the drug be stopped, and the drug was then stopped. MedQuery would then consider 8% of the $50,000 ($3,500) as savings due to the communication. If following MedQuery's advice produces new costs, those costs are subtracted from MedQuery's estimates of their savings. For example, if MedQuery suggests prescribing a new drug for a patient, the cost of that drug is subtracted from MedQuery's estimated savings.

The HCUP database reports billed claims, rather than paid claims. If all of MedQuery's assumptions held, the savings for KingCare would be approximately one half of the savings MedQuery reports, because KingCare pays approximately a half of billed claims.

MedQuery's analysis indicates that KingCare savings from communications in 2005 were $16.08 PEPM, or $2M. MedQuery calculates savings that are expected to appear within one year. This biases their estimate downward, because it disregards savings that would appear in following years. The one-year timeframe also means that much of the savings from communications in 2005 will appear in 2006.

Summary of Estimated Provider Best Practices Savings

Evaluations of the savings due to Provider Best Practices are inconsistent. KingCare claims reveal no change in adverse events or medication errors, and overall claims show no change in trend. This indicates that MedQuery did not produce savings. MedQuery's own calculations suggest billed claims savings of $2M will appear by the end of 2006. It is unclear what portion of those savings should have been expected in 2005. A theory that would be consistent with all of these analyses is that almost all of the savings due to 2005 communications will appear in 2006.

Provider Best Practices Costs

In 2005, MedQuery cost King County $1.60 PEPM.

Provider Best Practices Cost Benefit Analysis

The theory described above, which is consistent with all tests, suggests that the first-year ROI of the MedQuery program is close to zero, and that the MedQuery program's 2005 communications will produce $1M in savings in paid claims in 2006, or $8.04 PEPM. With a cost of $1.60 PEPM and savings in paid claims of $8.04, the ROI of MedQuery would be 5.03. So far, none of this ROI has been documented in KingCare billed claims.

Specialist Efficiency

Specialist Efficiency Components & Objectives

The products that Specialist Efficiency provided were 1) a list of efficient doctors on an Aetna website, and 2) a project of having healthcare purchaser staff (including King County Benefits staff) collaborate with healthcare providers to improve provider efficiency.

The list of efficient doctors can be seen by following links from http://metrokc.gov/employees/health_matters/new_programs2.aspx. Unfortunately, this page appears to be in preparation and not part of the King County published network of web pages. An analysis of links in Google indicates that there are no pages that link to this page, and this is the only webpage that links to http://www.kingcare.com, where the list of efficient doctors is. If employees type "KingCare" into Google, they may find their way to the list of efficient doctors. It is unclear how they could find the list otherwise. It is not possible to find the list by following links from http://www.metrokc.gov/employees/benefits/ or http://www.metrokc.gov/employees/default.aspx. It is highly likely that no employee, other than a few Health Reform Initiative staff, saw this list all year.

Future Measurement through the Puget Sound Health Alliance Healthcare Claims Database

The Puget Sound Health Alliance is expected to have set up a healthcare claims database and to be providing evaluations of the efficiency of regional doctors in 2007. The Puget Sound Health Alliance is currently planning to use the same technology (Symmetry episode grouping) that Aetna's Aexcel Network program has used for the last

two years. This software was also relied on for the Boeing-Regence project to limit healthcare to efficient doctors that received much news attention in May 2006. This software will provide an efficiency score for each local practice. Aetna's experience with this software over the last two years has been disappointing. Top management in the Aexcel program reported that, on rescoring physicians after a year, Aetna found that the scores provided zero test-retest correlation. This indicates no test-retest reliability, and is an indicator of low or no validity. The Puget Sound Alliance expects that their experience will be better with the software, based on their being able to apply the software to claims from more patients. At this point, it is not clear how the Alliance's patient counts compare to Aetna's patient counts. As designed, scores from the Puget Sound Health Alliance may provide a clearer image of the value of the Aexcel Network scoring for the 2007 Measurement & Evaluation report.

Efficient Provider Network Usage Statistics 2003-2005

In the KingCare claims, 1,691 providers are flagged as having been scored by the Aexcel Network system. Of those, 1,084 (64%) are Aexcel designated as efficient. Table 41 shows how KingCare treatments have been spread across those 1,084 providers.

Table 41

Usage of Aexcel-Designated Physicians

Year	Sum of Billed Claims From Aexcel-Designated Physicians	Sum of Billed Claims From Physicians Not Aexcel Designated	Billed Portion From Aexcel Network Physicians
2002	$7,067,373	$1,982,520	78%-
2003	$11,140,674	$2,618,432	81%
2004	$12,367,456	$3,238,807	79%
2005	$13,532,840	$3,651,253	79%

Comparison of Claims In-Network versus Out-of-Network

In 2005, 3,667 KingCare households sought care from at least one of the physicians who have been Aexcel scored. (To discern the impact of visiting an Aexcel-designated physician, households that visited both Aexcel and non-Aexcel physicians were excluded from this analysis.) Of those 3,667, 3,160 (86%) sought care from Aexcel-designated physicians. To test for an effect of visiting Aexcel-designated physicians, log billed claims for households were regressed onto risk adjustment predicted log billed claims and a binary code indicating Aexcel versus non-Aexcel use. After controlling for risk adjustment predictions, use of Aexcel versus non-Aexcel was not statistically significantly related to billed claims. On the average, Aexcel Network users had higher billed claims, but this was not statistically significant ($t=-.55$, $p=.58$).

This is not evidence that encouraging KingCare members to use Aexcel-designated specialists would have reduced costs. This lack of significant relationship with billed claims is consistent with Aexcel's finding of no test-retest reliability.

Estimated Savings Due to Specialist Efficiency

At this point, there is no evidence of savings from Specialist Efficiency.

Specialist Efficiency Cost Benefit Analysis

So far, the Specialist Efficiency program has not been documented to have produced savings.

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