

# Excess healthcare costs associated with excess health risks in the diseased and non-diseased

## A study of health risk appraisal participants in an Australian private health insurance population

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### Introduction

Disease management programs, especially in the US, have typically focused on disease compliance measures among high-risk patients<sup>1</sup>. These programs have shown

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improvements in compliance of disease measures and quality of life, as well as cost savings in the number of hospitalisations and emergency room visits for diabetes mellitus<sup>2-5</sup>, congestive heart disease<sup>6,7</sup>, asthma<sup>8,9</sup>, chronic obstructive pulmonary disease<sup>10</sup> and hypertension<sup>11</sup>.

Less attention has been given to changing behavioural health risks unless those risks are directly related to the specific disease, e.g. smoking and asthma or weight and Type 2 diabetes. Increased healthcare costs have been associated with additional health risks for patients with coronary heart disease (CHD). In a recent cross-sectional study,

expenditures were higher for patients with CHD who also reported being depressed (42.1%) or had high glucose levels (37.4%), high stress (27.1%), current tobacco use (26.4%), obesity (22.7%) or a sedentary lifestyle (16.1%)<sup>12</sup>.

Maintaining a favourable cardiovascular risk profile from middle age through older age was shown in a longitudinal study to result in lower healthcare costs for both men and women. Average annual healthcare charges were much lower for persons at low-risk - the total charges for men were less than two thirds of the charges for the men not at low-risk, and for women at low risk, the charges were less than one half of those

for women not at low-risk. Charges related to cardiovascular disease and cancer were also lower for low-risk groups of men and women compared to those not at low-risk<sup>13</sup>.

The basic relationship between behavioural health risks and healthcare costs has been established in the scientific literature, both in the US and Australia. Those individuals with more health risks have been associated with higher costs compared to those at low-risk<sup>14-19</sup>. As importantly, those who improve their lifestyle behaviours have been shown to reduce their costs<sup>14,17-19</sup>.

Excess health risks in a population have been shown to result in excess healthcare costs - with excess costs defined as the difference between the costs of the lowest risk individuals and other higher risk groups<sup>14,20</sup>. This risk/cost relationship has also been evaluated among those with and without chronic primary diseases. Excess health risks were associated with increased healthcare costs in both subgroups (19.2% excess costs among those with diagnosed disease; 9.1% excess costs among those with no disease)<sup>21</sup>. These data indicated that additional health risks contributed to the healthcare costs associated with specific medical conditions.

The Australian Health Management Group has been offering Health Risk and Disease Management programs to its members since 1995. It was of interest to test the concept of excess healthcare costs associated with excess health risks among those with and without chronic diseases in the private Australian healthcare environment. The purpose of this study was to:

1. establish that high-risk individuals (with or without disease) will have higher costs than low-risk individuals;
2. evaluate the magnitude of excess healthcare costs associated with excess health risks, given a self-reported chronic disease; and
3. apply the knowledge gained from this study to the design of the current suite of telephonic programs offered.

## Methods

The selected study group was the 27,786 Australian Health Management Group (AHMG) current members who completed a Health Risk Appraisal (HRA) questionnaire during 2001. The completion of the HRA qualified them for possible participation in the telephonic disease and health risk manage-

ment program delivered by the health management division of the Group, *CareLink*.

### Health risk appraisals

The HRA, offered annually, was used as a measurement tool for individual health risks and to assign health risk levels. Twelve individual health risks were selected to establish health risk levels: smoking, lack of physical activity, excessive alcohol use, high blood pressure, high cholesterol, low HDL-cholesterol, overweight, presence of medical conditions, absence due to illness, high stress, poor perception of health and presence of mental health conditions. High-risk criteria for each of the health risks are given in *Table 1*.

Health risk levels were determined by counting the number of individual health risks for each person. Overall health risk levels were defined as fol-

lows: low-risk (0-1 risk), medium-risk (2-3 risks) and high-risk (4 or more risks).

Individuals were categorised as being "with disease" if they self-reported on the HRA one or more of the following diseases: heart disease, cancer, diabetes mellitus, emphysema or previous stroke. Those categorised as without disease self-reported as not having any of the above diseases. Individuals were also categorised by the presence of a single disease, having multiple diseases or having none of the above diseases.

### Healthcare cost ratios

Average annual 1998 to 2001 healthcare costs (all hospital and ancillary claims excluding dental) were calculated for each HRA participant adjusting for the number of years of membership in the fund. Healthcare cost measures included total healthcare costs

**Table 1.**  
**Health Risk Criteria**

Selected Measures	High Risk Criteria
<b>Lifestyle Risks</b>	
Smoking	Current cigarette smoker (number of cigarettes per day > 0)
Physical activity	Less than or one day per week or missing
Alcohol use	Heavy drinker (>14 drinks/week)
<b>Health/Biological Risks</b>	
Blood pressure	<ul style="list-style-type: none"> <li>&gt; Systolic blood pressure greater than 139 mmHg <u>or</u></li> <li>&gt; Diastolic blood pressure greater than 89 mmHg <u>or</u></li> <li>&gt; Taking blood pressure medication</li> </ul>
Cholesterol	Greater than 6.64 mmoles
HDL-Cholesterol	Less than 0.97 mmoles
Body Weight (BMI)	Greater than or equal to 27.5 [weight (kg) / height (m) squared]
Medical conditions	Heart condition, cancer, diabetes, emphysema, or stroke
Absence due to illness	Three or more days for a 6 month time period
<b>Psychological Risks</b>	
Personal stress	Quite a bit or a great deal
Perception of health	Greater than or equal to 50% towards poor health
Mental health conditions	Most or all the time during the past four weeks or missing
<b>Overall Risk Levels</b>	
Low risk	0-1 high risks
Medium risk	2-3 high risks
High risk	4 or more high risks

(episode plus ancillary), episode costs only and ancillary costs only. Costs were paid amounts adjusted to 2001 dollars using medical inflation rates.

Healthcare cost ratios were then calculated using the low-risk, no disease group as the reference group for each of the cost measures. The ratios were calculated using this reference group for each of the respective higher risk and disease status subgroups. Ratios were used to simplify cost comparisons and to facilitate extrapolations to other healthcare provider organisations.

**Excess cost calculations**

Excess costs were defined as the difference in healthcare cost ratios between the low-risk group and the other respective risk groups (medium-risk and high-risk) multiplied by the respective number of individuals within each risk group. The percentage of healthcare costs attributable to excess health risks was then calculated as a percentage of the total healthcare costs incurred by those with and without disease using the respective low-risk group as the baseline (i.e. low-risk, no disease for those without disease; low-risk, with disease for those with disease). Excess healthcare costs were also calculated for each healthcare cost measure across each of three defined age groups for those with and without disease.

The impact of health status on members with co-morbidities was also evaluated by considering the following disease categories: presence of any one disease, multiple diseases or having none of these diseases. The percentage of excess costs associated with excess risks was calculated for each of these disease categories.

Differences were statistically tested (SAS Version 6.12) using the chi-square test for categorical variables and the ANOVA procedure for continuous variables.

**Results**

Among the 27,786 HRA participants, 8.8% (N=2,436) had at least one of the self-reported primary diseases: 2.0% with heart disease, 2.9% with cancer, 3.6% with diabetes, 0.4% with emphysema and 0.8% with previous stroke. The remaining participants (N=25,350) did not report any of these diseases. Those with disease were more likely to be male (58.2% vs. 44.4%) and older (60.0 years vs. 50.7 years) (Tables 2a and 2b). High-risk participants, with and without disease, were more likely to be

**Table 2a. Demographics for 2001 HRA by Risk Status Among Those Without Disease**

Demographics	Overall (N=25,350)	Low Risk (N=15,758)	Medium Risk (N=8,000)	High Risk (N=1,592)
Gender*				
Male	44.4%	43.0%	46.8%	46.1%
Female	55.6%	57.0%	53.2%	53.9%
Age Group*				
<45	32.6%	34.4%	29.5%	30.1%
45-64	52.6%	51.9%	53.6%	55.3%
65+	14.8%	13.7%	16.9%	14.6%
Average Age**	50.7 years	50.1 years	51.9 years	51.0 years

\*chi-square<.001.

\*\*anova, p<.01: low-risk younger than medium, high-risk.

Note: The overall percentages of low, medium and high-risk members without disease are: 62.2% low-risk; 31.6% medium-risk, and 6.4% high-risk.

**Table 2b. Demographics for 2001 HRA by Risk Status Among Those With Disease**

Demographics	Overall (N=2,436)	Low Risk (N=346)	Medium Risk (N=1,283)	High Risk (N=807)
Gender*				
Male	58.2%	54.9%	59.1%	58.1%
Female	41.8%	45.1%	40.8%	41.9%
Age Group*				
<45	6.5%	9.3%	6.2%	5.8%
45-64	49.8%	52.3%	47.7%	51.9%
65+	43.7%	38.4%	46.1%	42.3%
Average Age**	60.0 years	60.5 years	62.4 years	62.0 years

\*chi-square<.001.

\*\*anova, p<.001: low-risk younger than medium-risk.

Note: The overall percentages of low, medium and high-risk members with disease are: 14.2% low-risk; 52.7% medium-risk, and 33.1% high-risk.

**Table 3. Disease Profile by Age and Risk Status**

Age Group	Percent with Disease		
	Low Risk %	Medium Risk %	High Risk %
Less than 45 years* (N=8,422)	0.6% (N=5,457)	3.3% (N=2,439)	8.9% (N=526)
45-64 years* (N=14,552)	2.2% (N=8,353)	12.5% (N=4,900)	32.3% (N=1,299)
65 years and older* (N=4,812)	5.8% (N=2,294)	30.4% (N=1,944)	59.4% (N=574)
Total*	2.2% (N=16,104)	13.8% (N=9,283)	33.6% (N=2,399)

\*Chi-square; p<.001 (statistical comparisons test risk status\*disease status across age groups).

Note: The displayed N's are the number of members within each cell and the percentage is the incidence of disease within that cell, e.g., for low risk, less than 45 years, 0.6% of the total population of 5,457 members have a self-reported disease.

male and older.

Within each age group, the incidence of disease was higher in those groups with more health risks (Table 3). The lowest incidence of disease was among those participants less than 45 years who were at low-risk (0.6% with disease). The highest incidence of disease was among those 65 years and older who were at high-risk (59.4% with disease). As expected, within each risk level group, the incidence of disease increased with age.

Among those without disease, participants with more health risks had higher healthcare costs. Healthcare cost ratios using the low-risk group as the reference were: 1.00 (low-risk); 1.61 (medium-risk); 2.82 (high-risk); i.e. those at medium-risk cost 1.61 times those with low-risk (0-1 risk) and those at high-risk cost 2.82 times those at low-

risk (see Figure 1a). The percent of total annual excess healthcare costs for those with 2 or more health risks was 23.5% (see Figure 1a notes for calculations). This is the theoretical maximum savings in healthcare costs that could be achieved if all participants without disease changed to low-risk and costs followed those changes in health risks.

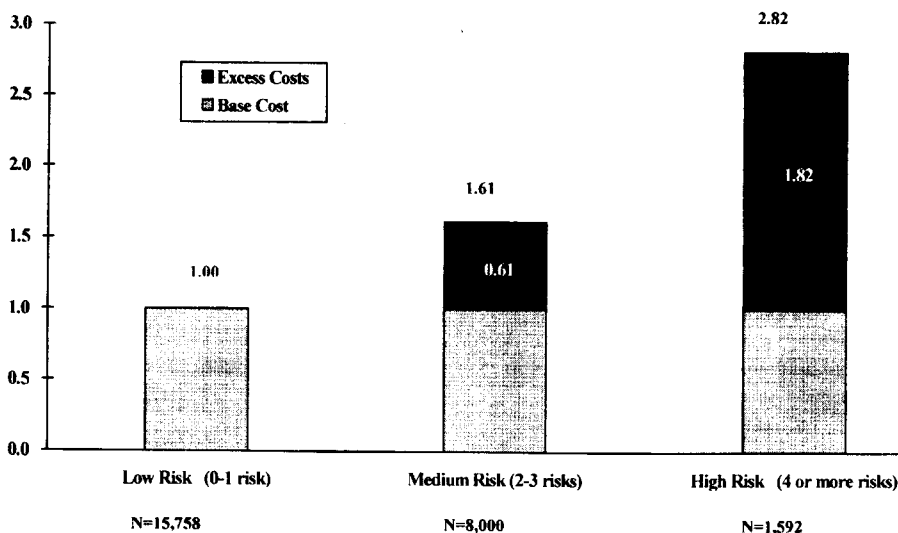
Those participants with disease had higher cost ratios for each of the respective risk groups compared to the low-risk, no disease reference group. Cost ratios for the respective risk groups were: 3.80 (low-risk); 4.24 (medium-risk); 5.86 (high-risk); i.e. those at medium risk cost 1.12 times (4.24/3.80) those with 1 risk and those at high-risk cost 1.54 times (5.86/3.80) those at low-risk (see Figure 1b). The percent of total annual excess healthcare costs for those with 2 or more health risks was 19.4%

(see Figure 1b notes for calculations). This is the theoretical maximum savings in healthcare costs that could be achieved if all participants with disease changed to low-risk and costs followed those changes in health risks.

The percent of total excess healthcare costs, episode only or ancillary only across the three age groups showed the impact of excess health risks on healthcare costs. For those less than 45, those with disease had a greater percentage of excess costs (episode, ancillary and total healthcare costs) associated with excess health risks compared to those in the same age group without disease. For those 45 years and older, those without disease had a greater percentage of excess costs for episode and total healthcare costs. Ancillary costs seemed to plateau at a high level among those with disease and showed no further impact of additional health risks. The impact of excess health risks was greatest among those in age group less than 45 with disease (54.6% excess costs) (see Tables 4a and 4b, page 24).

The impact of more health risks among those with a single disease, multiple diseases or no disease was also examined. In this population, among the 2,436 (8.8%) with disease, 89.9% had only one disease and 10.1% had multiple diseases. Among those 247 individuals with multiple diseases, 92.7% had 2 diseases, 6.5% had 3 diseases and 0.8% had 4 diseases. Across each of the disease status categories, excess health risks contributed to excess healthcare costs. Those members with co-morbidities had excess costs almost 60% higher than those members with only one disease (22.7% vs. 14.3% excess costs) (see Table 5).

**Fig. 1a. Excess Healthcare Cost Ratios due to Excess Risks Among Those Without Disease**



This chart shows that participants without a self-reported disease with more health risks have higher costs. Those with 2-3 risks cost 1.61 times those with 0-1 risk. High-risk individuals cost 2.82 times those at low risk.

The total annual medical cost of HRA participants was:  
 $(1.0 \times 15758) + (1.61 \times 8000) + (2.82 \times 1592) = 33,127.44$

The total annual excess medical cost for medium- and high-risk participants was:  
 $(0.61 \times 8000) + (1.82 \times 1592) = 7,777.44$

The percent of total costs attributable to excess risks is:  
 $7,777.44 / 33,127.44 = 23.5\%$

This is the theoretical maximum savings in healthcare costs that could be achieved if all participants changed to low risk and costs followed those changes in health risks.

## Discussion

Consistent with previous studies within the AHMG health fund, those individuals with higher numbers of health risks incurred higher healthcare costs<sup>14,15</sup>. The impact of additional health risks on healthcare costs was greater among those without disease, resulting in a larger percentage of excess costs (23.5%) compared to those with a diagnosed disease (19.4%). In a similar study in the US, those with disease averaged 19.2% excess costs compared to those without disease who averaged 9.1% excess costs<sup>21</sup>.

The percentage of excess costs among those with disease is similar to that in the US study but the percentage

of excess costs among those without disease is much higher in the Australian system. This may be explained by the difference in the health care funding structures between Australia and the US. In the US, the calculation of medical costs includes both primary care and inpatient services as the employer (the major funder of health care) covers both. In Australia, private health insurance covers only inpatient services along with some ancillary services. As much of the cost of the day to day management of disease lies in primary care, it would seem reasonable to expect that the cost impact of increased risk factors for a private health insurer would be less.

Generally in Australia little attention is being given to the management of risk factors in the non-diseased segment of the private health insurance population. These data highlight the importance of managing health risks in this segment, not only to enhance quality of life but also to reduce future claims costs. High-risk members are more than two and a half times more expensive than low-risk members. In this population, this amounted to \$610 per annum (\$945 v. \$335 respectively).

When health status by age groups was considered, the incidence of disease increased within each age group as the numbers of health risks increased. Among those less than 45 years old who were also at high-risk, 8.9% had a diagnosed disease compared with those at low-risk where only 0.6% reported disease. Among those 65 years and older who were also at high-risk, 59.4% had a diagnosed disease compared with those at low-risk where only 5.8% reported disease. The association of low-risk status with a low incidence of disease across each age group is clearly demonstrated.

The highest percentage of excess costs associated with excess health risks was calculated among those less than 45 years. Although the numbers of individuals with disease in this age group were comparatively small, additional health risks apparently exacerbate their specific disease conditions. Using major diagnostic codes from episode claims, those categories in this age group that were significantly impacted by health risks included neoplasms and factors influencing health status (includes other undefined diagnoses) ( $p < .05$ ). Symptoms, signs and ill-defined conditions (includes abnormal laboratory results or other investigative procedures for which

no diagnosis classification is recorded) and injury and poisoning categories were also borderline statistically significant ( $p < .10$ ). Another contributing factor could be that younger members have higher excess costs due to the acute effects of the disease while older members are more stable, assuming that they are further from the acute impact of the disease.

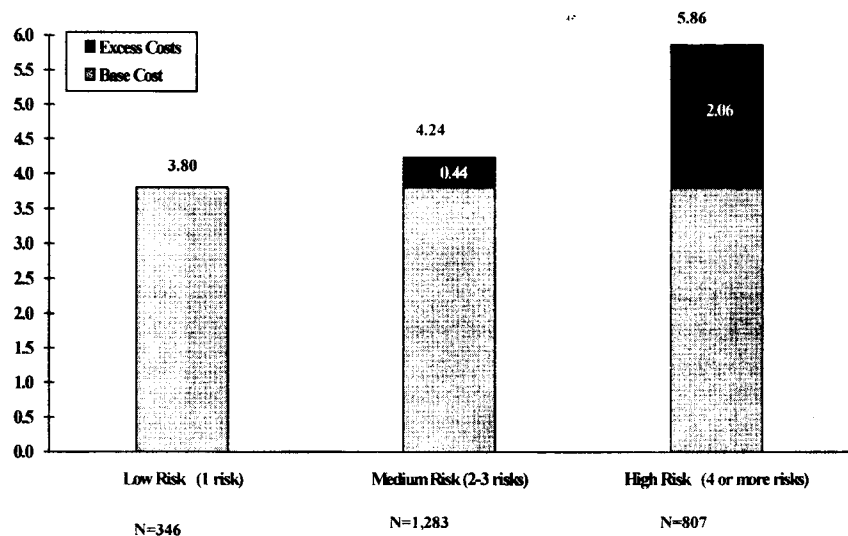
The impact of health status on those members with co-morbidities was demonstrated with calculated excess costs almost 60% higher compared to those with only one disease condition. Members can benefit from improved health status regardless of their disease status: one disease, with co-morbidities or with no current disease.

Most disease management programs are focused on improving the individual's compliance with disease

compliance measures with less emphasis on modifying lifestyle behaviours. The current results confirm the impact of additional health risks on the disease conditions and suggest that for disease management programs to be most effective, attention must be given to the overall health status of the individual.

As with previous studies, one of the major aims of the study was to provide input into the design of *CareLink's* telephonic programs in order to maximise outcomes. While the treating doctor is the care manager, and co-ordinators work closely with the doctor, all disease management programs are now delivered by multidisciplinary teams which include nurses, dietitians and exercise physiologists to ensure participants get access to the most appropriate clinical information to assist with the management of lifestyle issues relevant to man-

**Fig. 1b. Excess Healthcare Cost Ratios due to Excess Risks**



This chart shows that participants with a self-reported disease (8.8% of the population) with more health risks have higher costs. Those with 2-3 risks cost 1.12 (4.24/3.80) times those with 1 risk. High-risk individuals cost 1.54 (5.86/3.80) times those at low risk.

The total annual medical cost of HRA participants was:  
 $(3.80 \times 346) + (4.24 \times 1283) + (5.86 \times 807) = 11,483.74$

The total annual excess medical cost for medium- and high-risk participants was:  
 $(0.44 \times 1283) + (2.06 \times 807) = 2,226.94$

The percent of total costs attributable to excess risks is:  
 $2,226.94 / 11,483.74 = 19.4\%$

This is the theoretical maximum savings in healthcare costs that could be achieved if all participants changed to low risk and costs followed those changes in health risks.

**Table 4a. Excess Healthcare Cost Ratios Associated with Excess Health Risks By Age Group Among Those Without Disease**

Cost Measure	<45 Years				45-64 Years				65+ Years			
	Low Risk (N=5,425)	Medium Risk (N=2,359)	High Risk (N=479)	Excess Cost %	Low Risk (N=8,172)	Medium Risk (N=4,288)	High Risk (N=880)	Excess Cost %	Low Risk (N=2,161)	Medium Risk (N=1,353)	High Risk (N=233)	Excess Cost %
Episode	1.0	1.39	3.17	19.1%	1.02	1.87	3.87	31.0%	2.78	5.73	9.94	35.2%
Ancillary	1.0	1.09	1.30	4.2%	1.07	1.22	1.70	7.8%	1.45	1.70	2.49	9.7%
Total Health-care	1.0	1.27	2.39	13.6%	1.04	1.60	2.96	22.7%	2.22	4.05	6.82	29.8%

Notes: a) The relative percentages of low, medium and high-risk members among those without disease change across the different age groups: <45 years (66% low-risk; 29% medium-risk; 6% high-risk); 45-64 years (61% low-risk; 32% medium-risk; 7% high-risk) and 65+ years (58% low-risk; 36% medium-risk; 6% high-risk).

b) The reference group for the cost ratios is the low risk, no disease less than 45 years age group. The reference group for the excess cost calculations is the low-risk category for each cost measure within each age group.

**Table 4b. Excess Healthcare Cost Ratios Associated with Excess Health Risks By Age Group Among Those With Disease**

Cost Measure	<45 Years				45-64 Years				65+ Years			
	Low Risk (N=32)	Medium Risk (N=80)	High Risk (N=47)	Excess Cost %	Low Risk (N=181)	Medium Risk (N=612)	High Risk (N=419)	Excess Cost %	Low Risk (N=133)	Medium Risk (N=591)	High Risk (N=341)	Excess Cost %
Episode	1.26	2.42	6.47	62.9%	4.37	5.38	7.11	24.9%	8.63	8.92	13.01	15.4%
Ancillary	1.14	1.05	3.11	31.9%	2.52	2.27	2.50	-5.7%	3.73	3.14	4.53	-1.9%
Total Health-care	1.21	1.85	5.07	54.6%	3.60	4.08	5.18	17.9%	6.58	6.51	9.46	11.8%

Notes: a) The relative percentages of low, medium and high-risk members among those with disease change across the different age groups: <45 years (20% low-risk; 50% medium-risk; 30% high-risk); 45-64 years (15% low-risk; 51% medium-risk; 35% high-risk) and 65+ years (12% low-risk; 55% medium-risk; 32% high-risk).

b) The reference group for the cost ratios is the low risk, no disease, less than 45 age group in Table 4a. The reference group for the excess cost calculations is the low-risk category for each cost measure within each age group.

aging their disease and health risks.

The study also highlighted the importance of modifying behaviour in the management of disease. To this end, all CareLink co-ordinators are now trained to assist participants in achieving behaviour modification that will result in improved health status or at least prevent escalation of health risks.

A study has already begun to track health risks of those participants enrolled in the telephonic programs and results will be published as they come to hand.

**Table 5. Excess Healthcare Cost Ratios Associated with Excess Health Risks By Single or Multiple Diseases**

Disease	Low Risk	Medium Risk	High Risk	Excess Costs
No Disease (N=25,350)	1.00 (N=13,758)	1.61 (N=8,000)	2.82 (N=1,592)	23.5%
Any One Disease (N=2,189)	3.67 (N=331)	4.03 (N=1,158)	5.01 (N=700)	14.3%
Multiple Diseases (N=247)	6.55 (N=15)	6.21 (N=125)	11.40 (N=107)	22.7%

Notes:

a) Among those with multiple diseases: 92.7% had 2 diseases; 6.5% had 3 diseases; and 0.8% had 4 diseases.

b) The reference group for the ratios is the low risk, no disease group.

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