

THE IMPACT OF WELLNESS ACTIVITIES ON HOSPITAL CLAIMS EXPERIENCE

ABSTRACT

This paper presents an analysis of the in-hospital claims experience of adult beneficiaries of South African medical schemes according to their level of participation in an incentivised wellness programme. The analysis considers the participation level alongside other covariates such as age, gender and chronic status in terms of the explanatory power with respect to differences in observed claims experience, with particular reference to hospital admission rates.

KEY WORDS

Medical scheme, beneficiary, wellness programme, fitness

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1. INTRODUCTION

This paper presents the results of an analysis of the hospital claims experience of a South African insured population with respect to their level of engagement in lifestyle related activities including fitness and preventative screenings.

The overview presents a discussion on various studies in the area of wellness programmes and identifies that these are mainly worksite related whereas the study presented in this paper relates to an insured population assessment. The data used for the study is then described including the method for classifying beneficiaries according to their level of engagement. The analysis of the claims experience is presented in terms of the level of engagement in an incentivised wellness programme in general and, more specifically, in terms of the level of engagement in fitness-related activities. The fitness analysis is presented separately since these results could be considered to be more generic since the level of engagement is measured in terms of fitness activities rather than being related to the points earned in respect of the incentivised wellness programme. The claims experience assessed relates to hospital admissions in aggregate and according to diagnosis categories. The paper closes with a discussion of the results.

It is important to note at this point that the project aimed to investigate the significance of the differences in the claims experience of the groups identified. It did not aim to attribute cause and effect to any differences identified. It is intended that this project will be followed by further research to address this issue. This includes longitudinal analyses and analysis focused on beneficiaries with chronic medical conditions.

2. WELLNESS PROGRAMMES

In developing the methodology for the study presented in this paper, a number of studies relating to programmes aimed at promoting preventative care activities, with particular focus on physical activity, were reviewed. It was found that most of the studies published to date appear to have considered employer-based programmes.

It is apparent that promoting physical activity can have a significant impact on health care costs. The World Health Organisation (WHO) estimates that 3.3% of the total disease burden in developed countries is due to physical inactivity. In studies by Bouchard (2001) and Haskell (2001), the authors assert that switching from a sedentary to a moderately active lifestyle has the greatest effect on reducing the prevalence of chronic diseases in men and women. Furthermore, Lambert and Kolbe-Alexander (2006) state that as physical activity levels increase, greater health benefits accrue. They state that a mere thirty minutes of daily exercise can offer protection from many chronic diseases. Farrell et al. (1998) supports this view and attempts to quantify the health benefits that accrue from this over time. They assert that physical inactivity increases the risk of diseases like ischaemic heart disease, diabetes mellitus and hypertension by 1.5 to 2 times.

A number of studies have focussed on worksite programmes aimed at encouraging employees to make better personal health risk choices. Edington et al. (1997) note that numerous worksite health promotion studies have reported that health behaviours relate significantly to medical claims costs. Their study investigated the relationship between baseline health risks and the subsequent three-year costs and focussed on modifiable personal health practices. The findings included a consistent relationship between higher risk and higher costs.

Lee et al (1998) demonstrated that higher levels of cardiorespiratory fitness can reduce the relative risk of cardiovascular disease mortality and all-cause mortality within weight groups. They found that fit but overweight men have lower risk of all-cause mortality than unfit and normal weight men, indicating that being physically fit can offset the adverse health effects of overweight and obese status.

Pronk et al (1999) reported a dose effect of physical activity with 4.7% lower health care charges per active day per week (they did not consider body weight).

Ozminkowski et al. (2002) found that for a worksite-based wellness programme, savings increased substantially in years 3 and 4 after programme implementation. The study presented by Pronk et al. (1999) examined the impact of modifiable health risks (physical inactivity, obesity and smoking status) on health care charges controlling for age, race, sex and chronic conditions and found that adverse health risks translated into significantly higher health charges within 18 months.

Shephard (1991) notes the difficulties of isolating the economic impacts of work-site fitness programmes and demonstrates how a cost-effectiveness analysis can be employed for this purpose. The author concludes the work-site fitness programmes appear to yield corporate benefits that more than match programme costs although this finding could be strengthened by more controlled experiments. Proper et al.

(2003) conducted a review of literature with respect to the effectiveness of worksite physical activity programmes and noted that there was strong evidence for a positive effect of such programmes on levels of physical activity and musculoskeletal disorders but suggested the need for more randomised controlled trials.

3. THE VITALITY PROGRAMME

This paper presents some results from a cross sectional study conducted on the adult beneficiaries of South African medical schemes¹. The medical schemes offer an incentivised wellness programme called Vitality. This programme has established partnerships with health and lifestyle brands to enable members to enjoy a healthy lifestyle at lower cost. Members are offered incentives for using these facilities and points are earned for participating in health and fitness related activities. These points are accumulated towards tiers from Blue through to Bronze, Silver and Gold. With each tier, members have access to increased lifestyle and leisure rewards such as discounts on airfare, accommodations and shopping vouchers.

The intention behind the Vitality programme is to offer more immediate rewards for healthy lifestyle choices since the natural rewards for these choices in terms of health improvement only accrue over a longer period².

In terms of the Vitality programme, the tools that members have access to in order to assist them in improving their health are³:

- Physical activity: points are awarded for gym and other workouts and participation in sports events;
- Health checks: points are awarded for preventative activities such as cholesterol and blood pressure checks;
- Knowledge: points are awarded for completing an on-line risk assessment questionnaire, doing a CPR course or participating in an antenatal programme;
- Healthy choices: points are awarded for lifestyle changes such as reaching a goal weight or giving up smoking.

Vitality is able to offer benefits to members who may not necessarily have higher healthcare claims costs since the benefits or rewards are associated with wellness rather than illness. It therefore differentiates the Discovery products by offering benefits for being healthy as well as for when a member is sick. This can also lead to positive selection, in terms of lower risk lives being encouraged to purchase the product.

Further, by offering rewards for healthy lifestyle choices, the Vitality programme aims to encourage members to change their behaviour and thereby improve their health.

¹ Administered by Discovery Health in 2005 and 2006.

² Conference presentation by Adrian Gore, CEO of Discovery, 14 May 2007

³ From the Discovery website www.discovery.co.za

The Vitality programme was introduced in 1998 and so a significant volume of data has been accumulated. This lends itself to analysis in order to investigate whether Vitality is effective in translating healthy behaviour to lower medical claims costs.

The research project included a cross-sectional analysis of members of medical schemes administered by Discovery Health during 2005 and 2006. The two years were assessed independently as an attempt to identify consistency in the results and the 2006 results are presented in this paper. The project aimed to assess the experience of members who are not on the Vitality programme compared with those who belong to the Vitality programme. The project also considered the experience of those who are actively participating in the programme (termed “engaged”) compared to those who belong to the programme but have not accumulated a significant number of points.

This study differs from some of those described in the preceding section in that the Vitality programme is offered by the medical scheme rather than the employer. Participation in the programme can therefore be considered to be voluntary, however for the majority of the members, medical scheme membership is a condition of employment. Members of medical schemes administered by Discovery Health are eligible to join the Vitality programme⁴ and the fee for participating in the Vitality programme is often subsidised by the employer.

4. DATA

4.1 CRITERIA

The data to be analysed was defined as beneficiaries that met the following criteria:

- Principal and spouse beneficiaries;
- Participating in benefit options where members may opt to participate in the Vitality programme (described in section 3);
- Covered for the full 12 months of either 2005, 2006 or both years; and
- Either on or off Vitality for the full 12 months in each year.

The study was restricted to principal and spouse beneficiaries since they are primarily eligible for earning points on the Vitality programme. Note that the analysis is conducted at the beneficiary (individual life) level rather than at the level of the member family where dependants are grouped with the principal member and hence may blur the results.

The exclusion of beneficiaries with partial exposure is intended to reduce the need for additional assumptions (particularly regarding the uniform or otherwise accumulation of points and incidence of claims over the 12 month period of each calendar year).

The data criteria resulted in total exposure of 897 859 beneficiaries in 2005 and 948 974 beneficiaries in 2006.

⁴ Although some individual benefit options within these schemes are not eligible but this affects under 5% of the total membership base.

4.2 ENGAGED STATUS

For the purposes of the research project, beneficiaries were analysed according to:

- Vitality status⁵ – defined in terms of the points earned on the Vitality programme; and
- Fitness status – defined according to levels of reported physical activity.

4.2.1 VITALITY STATUS

The Vitality statuses were defined according to Vitality points⁶, since this study aims to assess the Vitality programme rather than to revise it. The points were categorised according to:

- Fitness;
- Preventative;
- Healthy choices;
- Knowledge; and
- Other.

The ‘Other’ category was excluded from the analysis as these points do not relate to health-related activities (for example, they include points earned for receiving statements electronically and points rolled over from previous years).

The analysis of the distribution of beneficiaries according to cumulative points earned in each category showed a fairly smooth and continuous distribution for Fitness and Preventative while the other two categories were found to be quite discontinuous and “lumpy” as a result of individual activities (such as non-smoker declarations) having a large points allocation. The analysis of beneficiaries with in excess of different threshold levels of aggregated points showed that Fitness and Preventative were the major contributors. This was deemed to be desirable as the research project aimed to assess the impact of physical activity and screenings on claims expenses.

It should be noted that beneficiaries will earn preventative points for screening activities (such as cholesterol or blood pressure checks) whether these are for preventative or management purposes (as would be the case for chronic patients) and the points are not differentiated on this basis.

The threshold for the highly engaged status was determined with reference to the fairly arbitrary level of 15% of Vitality beneficiaries that had been used in previous Vitality programme studies⁷.

⁵ Note that this is different from the Vitality tier status used for determining the reward levels in the programme since it is based on the points accumulated for the individual beneficiary rather than for the family group.

⁶ Points are earned for a variety of wellness-related and other activities. Further detail can be viewed at www.discovery.co.za.

⁷ Milliman Consultants and Actuaries conducted a Vitality Project Evaluation in 2005 (unpublished).

For Vitality status, the following groups have been defined:

- a. Not on Vitality Programme (Not)
- b. On Vitality Program but No Points Earned (NPE): on Vitality but with zero points in the Fitness, Healthy choices, Knowledge and Preventive categories
- c. Vitality Engaged (VE): on Vitality with non-zero points in the categories noted in (b) above but not meeting the total engaged criteria; and
- d. Vitality Highly Engaged (VHE): as defined above.

The distribution of beneficiaries between these groups is as follows:

Table 1: Distribution of beneficiaries

	2005			2006		
	Beneficiaries	% of total beneficiaries	% of Vitality beneficiaries	Beneficiaries	% of total beneficiaries	% of Vitality beneficiaries
Not	328,287	36.60%	n/a	357,840	37.70%	n/a
NPE	208,439	23.20%	36.60%	207,728	21.90%	35.14%
VE	276,363	30.80%	48.52%	293,208	30.90%	49.60%
VHE	84,770	9.40%	14.88%	90,198	9.50%	15.26%
Total	897,859			948,974		

The percentage allocations per category are reasonably consistent across the two years. Note that the 15% engaged criterion for the highly engaged status is based on Vitality beneficiaries rather than total beneficiaries.

The profile of the beneficiaries per category is shown below. There is reasonable stability between the two years.

Table 2: Profile of beneficiaries

	Not	NPE	VE	VHE	Total
2005					
% male	45.7%	51.5%	46.2%	54.6%	48.0%
Average age	51.1	41.8	42.6	40.6	45.4
% Chronic	28.5%	9.4%	18.2%	12.9%	19.4%
% Comprehensive	43.9%	41.7%	60.8%	54.1%	49.6%
2006					
% male	45.5%	52.4%	45.9%	54.2%	48.0%
Average age	51.0	41.8	42.7	41.2	45.5
% Chronic	28.9%	8.9%	18.4%	14.3%	19.9%
% Comprehensive	40.9%	38.2%	57.2%	52.9%	46.5%

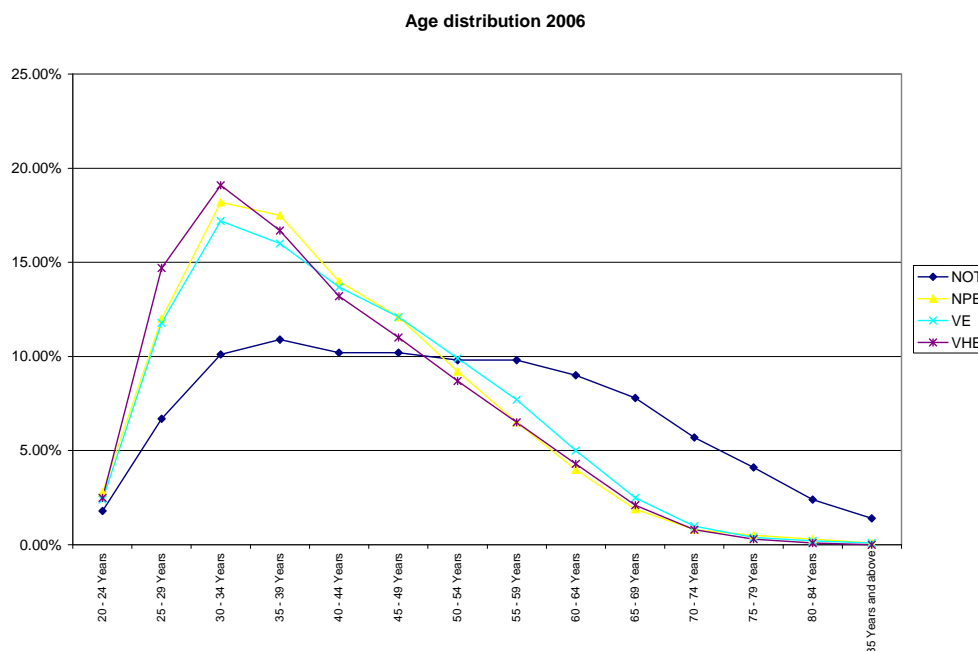
% Chronic is the percentage registered for a chronic medical condition

% Comprehensive is the percentage on benefit options that include an above threshold benefit for ambulatory care while the other options cover all these benefits via medical savings accounts

Graph 1 shows that the age distribution of the groups have a different shape for Not on Vitality and similar shapes for the Vitality groups. This suggests that there may be

some self selection in the way in which beneficiaries opt to participate in the programme and suggests a need for normalising the claims experience for the demographic differences when conducting the analysis.

Graph 1



4.2.2 FITNESS STATUS

For beneficiaries participating in the Vitality programme, a record of total gym visits (not capped according to Vitality points earned) was used to define fitness status. Reference was also made to points earned for participation in sports events such as road running races (which the beneficiaries register to participate in through a Vitality partner organisation called SA Active). The fitness status was defined as follows:

- Fitness engaged (FE): At least 5000 SA Active points or more than 48 gym visits per annum.
- Fitness medium active (FMA): 24 to 48 gym visits per annum
- Fitness low active (FLA): 4 to 24 gym visits per annum
- Fitness inactive (FIA): 3 or less gym visits per annum
- Not on Vitality Programme (Not)

It should be noted that the Fitness inactive category (and, to a lesser extent, the other Fitness categories) may include beneficiaries participating in fitness activities but this information has not been recorded on the Vitality programme, either because the beneficiaries have not submitted information and/or because the activity does not earn points in the programme.

The cross-tabulation of the Fitness status with the Vitality status used earlier in this paper is set out in table 3 (for 2006 and with columns summing to 100%).

Table 3: Cross tabulation of Fitness status and Vitality status

%	Not	FIA	FLA	FMA	FE
Not	100.0	0.0	0.0	0.0	0.0
NPE	0.0	49.6	0.0	0.0	0.0
VE	0.0	47.6	89.4	71.7	15.6
VHE	0.0	2.8	10.6	28.3	84.4
Total	100.0	100.0	100.0	100.0	100.0

There is a strong correlation between Fitness engaged and Vitality highly engaged status with 84% of those beneficiaries classified as Fitness engaged while the balance were previously classified as Fitness Not Engaged. Of the VHE beneficiaries, 65% are also classified as Fitness Engaged. This suggests that the balance of VHE beneficiaries achieved the Vitality Engaged status by earning points in areas other than fitness.

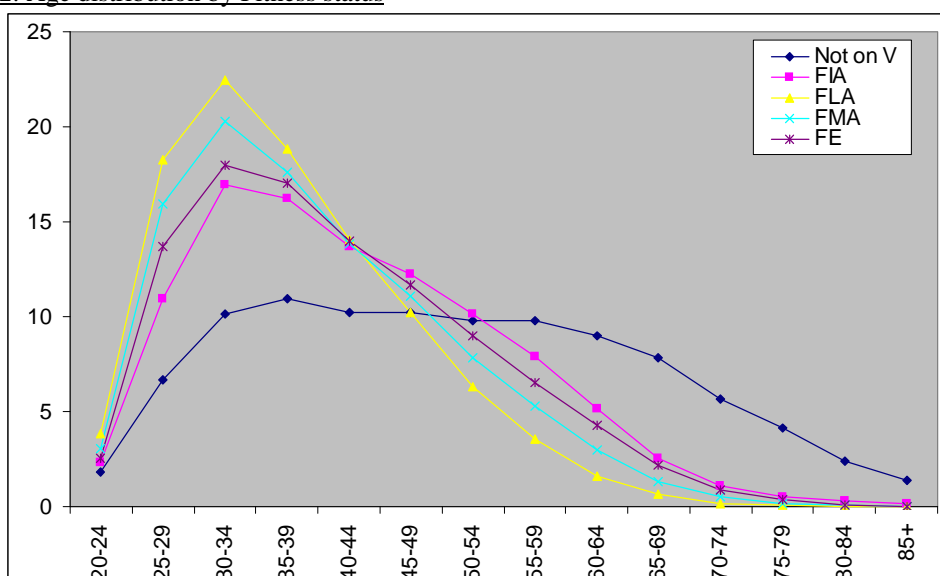
The demographic profile according to Fitness Status is set out in Table 4.

Table 4: Demographic profile according to Fitness Status

2006	Not	FIA	FLA	FMA	FE
Beneficiaries	357,840	419,187	52,713	49,633	69,601
% Beneficiaries	37.7	44.2	5.6	5.2	7.3
% male	45.5	48.0	48.1	49.8	58.9
Average age	50.5	42.5	37.5	39.3	41.1
% Chronic	28.9	15.4	10.4	12.5	13.1
% Comprehensive	40.9	50.3	49.0	48.5	49.1

It is notable that the Fitness Engaged group does not necessarily have the youngest average age. The age distributions (for 2006) are shown in Graph 2. As noted above, the Fitness inactive group can be considered to be a combination of inactive and non-reporting beneficiaries.

Graph 2: Age distribution by Fitness status



5. ANALYSIS

5.1 SELECTION OF COVARIATES

Factors which were likely to independently influence medical claims data, irrespective of participation in the wellness program, were pre-selected as covariates for the subsequent multivariate analysis. These included:

- age (in five year bands);
- gender (male, female);
- health plan options (Comprehensive, Saver or Core Plans);
- geographical area (grouped into Urban Inland, Urban Coastal, Rural Inland and Rural Coastal); and –
- chronic status (None, Single or Multiple).

A more detailed explanation of the factors is included in Annexure C.

A tree analysis was used to assess the relative importance of these covariates in differentiating the experience under each claim cost category. Each branch of the analysis was independent and so the relative importance of factors varied with each differentiation. The tree analysis was conducted separately with reference to the hospital admissions per beneficiary.

A tree analysis⁸ comprises a family of methods for hierarchically reducing a large dataset, consisting of a dependent variable Y and a number of categorical predictor variables, into relatively homogeneous (with respect to Y) subsets defined by different combinations of categories of the predictor variables. In the current context, Y is the claim cost and the predictors comprise the covariates and engaged status.

The results of the importance analysis for hospital admission claims showed remarkable consistency between the years. The order of the factors for 2006 is shown in Table 5. The tree analysis is shown graphically in Annexure D.

Table 5: Ranking of covariates

2006 Amount - All beneficiaries		
Order	Variable	Importance
1	Chronic Status	1.00
2	Age	0.45
3	Gender	0.25
4	Area	0.17
5	Vitality Engaged Status	0.14
6	Plan	0.13
7	Fitness Engaged Status	0.09

⁸ Kass (1975, 1980) initially proposed a method (CHAID) for successively splitting the dataset and deciding on when to stop, based on formal significance testing, using the Bonferroni approach to control the overall significance level. Subsequently, Breiman et al (1984) proposed an alternative approach (CART) for doing the same, based on cross-validation rather than on formal hypothesis testing. For the current exercise, the tree analysis implemented in SAS Enterprise Miner was used.

For hospital admissions, chronic status is found to be the first differentiating factor. For non-chronics the next factor is age with the break at age 55 and for those under 55, gender is the next differentiating factor. For females, the Vitality status is the next factor (although the Vitality status is grouped as VE vs. Not, NPE and VE) followed by Fitness status. For males the plan is the next differentiating factor with the Vitality and Fitness status not featuring significantly. For beneficiaries over 55, the area is a differentiating factor (Coastal vs. Inland) and Vitality status has a low level of significance.

For the chronic group, age, area and gender are differentiators. Plan features as a factor for those with a single chronic condition. The Vitality and Fitness status do not feature as significant differentiators for chronic beneficiaries.

With reference to this tree analysis, the following risk factors have been used as covariates in this analysis:

- Age;
- Gender;
- Area;
- Chronic status; and
- Plan type.

5.2 AGGREGATE ADMISSION ANALYSIS

Claims analysis was initially performed at the aggregate level. The first step in the analysis process is the calculation of adjusted means that take into account the impacts of the above covariates in each group. In other words, the mean calculated as if the distribution by covariate was the same across all groups (for example, if all the groups had the same age profile and gender split). This intends to isolate the impact of Vitality or Fitness status as opposed to the impact of the covariates.

The claims have been analysed for hospital admissions as follows:

- Events per beneficiary (admission rate)
- Cost per beneficiary
- Cost per patient (where a patient is a beneficiary with at least one hospital event)
- Days per patient
- Events per patient
- Length of stay
- Cost per event

5.2.1 VITALITY STATUS

The adjusted means are normalized for the covariates identified above. The adjusted means should therefore not be interpreted in absolute terms but rather relative to the adjusted means in the other groups. This is because the adjusted mean is based on a hypothetical standard membership distribution across all the groups. The table below shows the relative adjusted means and the associated 95% confidence intervals.

These statistics are calculated across all beneficiaries with at least one hospital admission during the period.

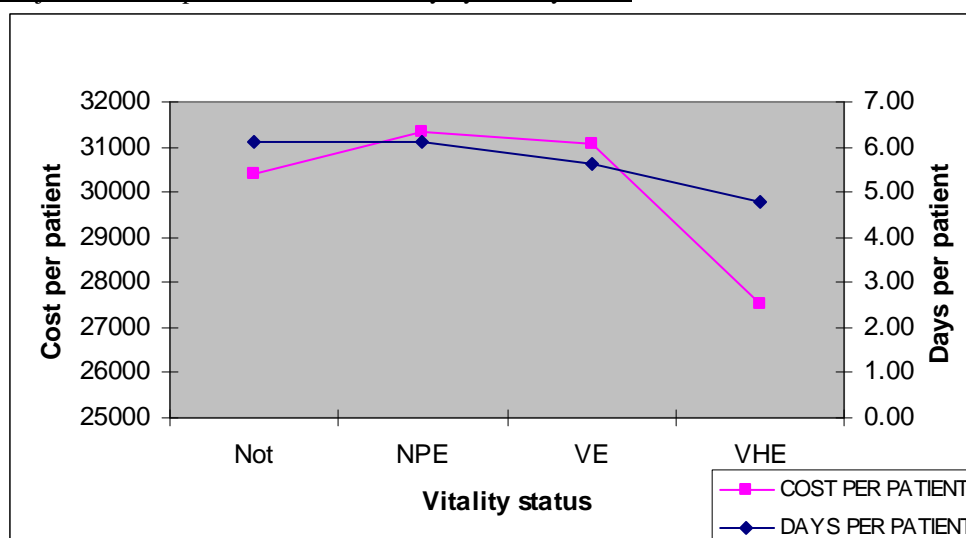
Table 6: Adjusted means per admitted beneficiary by Vitality Status

ADJUSTED MEANS 2006	Cost Per Patient Rands	Days Per Patient	Admissions Per Patient	Cost Per Event Rands	Length Of Stay Days
Not	30420 (30018 - 30822)	6.10 (6.03 - 6.17)	1.56 (1.56 - 1.57)	18494 (18281 - 18707)	3.61 (3.58 - 3.64)
NPE	31332 (30743 - 31920)	6.12 (6.02 - 6.22)	1.57 (1.55 - 1.58)	19044 (18732 - 19356)	3.60 (3.56 - 3.64)
VE	31078 (30592 - 31564)	5.62 (5.54 - 5.70)	1.56 (1.55 - 1.57)	19189 (18931 - 19446)	3.32 (3.29 - 3.36)
VHE	27538 (26754 - 28322)	4.77 (4.64 - 4.91)	1.46 (1.44 - 1.47)	18011 (17596 - 18426)	2.97 (2.91 - 3.03)

While the VHE group exhibits the lowest adjusted means across all the measured statistics, it appears that the frequency factors (admissions per patient and length of stay) are the key differentiators rather than the cost. The advantage of using these statistics is that it facilitates making comparisons over time since there is no need to account for inflation.

A graphical representation (Graph 3) of the cost per patient and the days per patient illustrates the lower experience for the VHE group with the other groups being less discernable from each other.

Graph 3: Adjusted means per admitted beneficiary by Vitality status



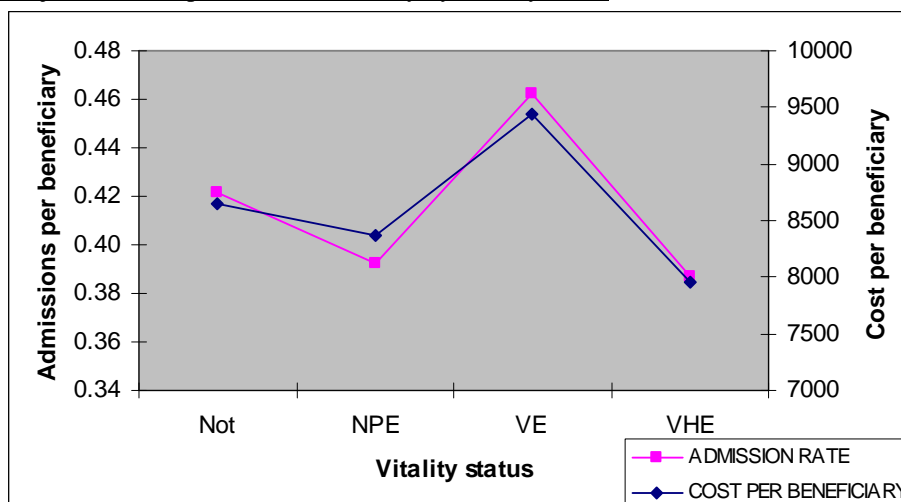
The adjusted means for the statistics calculated across all beneficiaries (including those with no hospital admissions) are as follows:

Table 7: Adjusted means per (total) beneficiary by Vitality status

	Cost Per Beneficiary Rands	Days Per beneficiary	Admissions Per beneficiary
Not on V	8645 (8547 - 8744)	1.71 (1.6975 - 1.7316)	0.42 (0.4185 - 0.4248)
VNPE	8375 (8246 - 8504)	1.62 (1.5983 - 1.6429)	0.39 (0.3881 - 0.3963)
VNE	9436 (9318 - 9555)	1.74 (1.7189 - 1.76)	0.46 (0.4589 - 0.4664)
VE	7955 (7785 - 8125)	1.43 (1.4023 - 1.461)	0.39 (0.3817 - 0.3925)

The graphical representation (Graph 4) of these statistics shows a “blip” for the VE group. This may be attributable to the chronic beneficiaries earning preventative Vitality points for activities associated with their chronic management programme and the normalising not being adequate in accounting for this difference. It certainly appears that there is some self selection in operation.

Graph 4: Adjusted means per (total) beneficiary by Vitality status



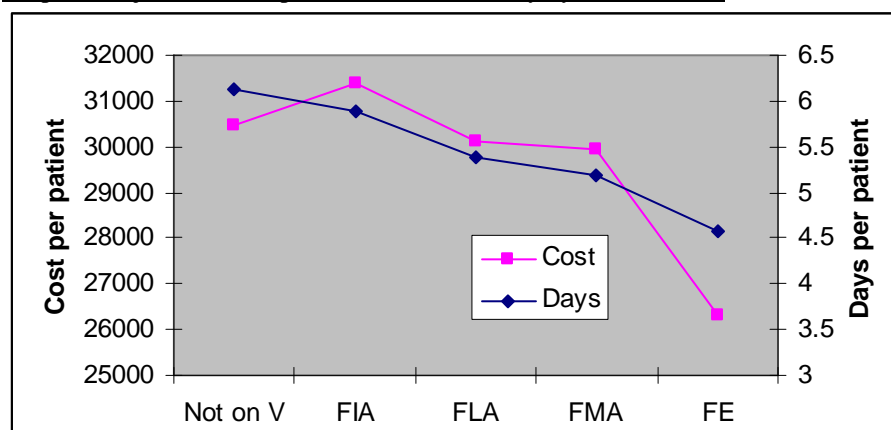
5.2.2 FITNESS STATUS

The adjusted means were similarly calculated for the Fitness status groups. Note that for this analysis the Vitality status was not used as a covariate so that the two sets of analyses can be considered independently.

Table 8: Adjusted means per admitted beneficiary by Fitness status

	Cost Per Patient Rands	Days Per Patient	Admissions Per Patient	Cost Per Event Rands	Length Of Stay Days
Not on V	30455 (30054 - 30856)	6.12 (6.06 - 6.19)	1.57 (1.56 - 1.57)	18497 (18284 - 18709)	3.62 (3.59 - 3.65)
FIA	31373 (30924 - 31822)	5.88 (5.8 - 5.96)	1.57 (1.56 - 1.58)	19164 (18927 - 19402)	3.45 (3.42 - 3.48)
FLA	30112 (29168 - 31057)	5.38 (5.22 - 5.54)	1.52 (1.5 - 1.54)	18955 (18455 - 19456)	3.24 (3.17 - 3.31)
FMA	29958 (28978 - 30937)	5.19 (5.02 - 5.35)	1.49 (1.47 - 1.52)	19159 (18639 - 19678)	3.19 (3.12 - 3.27)
FE	26321 (25396 - 27247)	4.57 (4.41 - 4.73)	1.42 (1.4 - 1.44)	17478 (16988 - 17969)	2.88 (2.82 - 2.95)

Graph 5: Adjusted means per admitted beneficiary by Fitness status



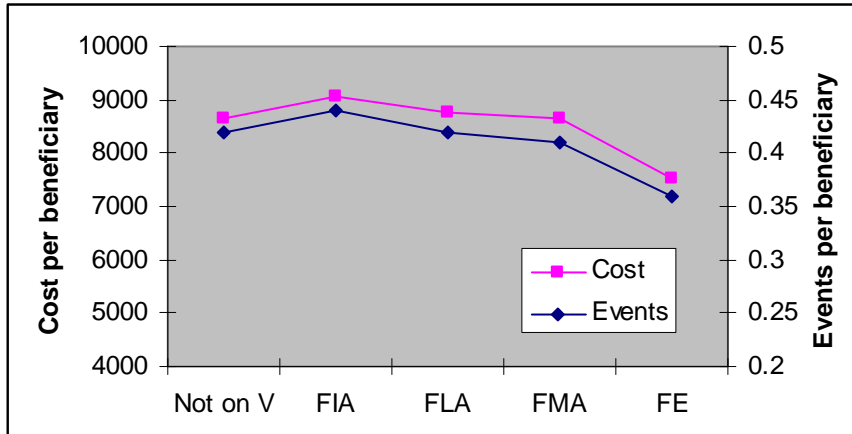
The adjusted means for the statistics calculated across all beneficiaries (including those with no hospital admissions) are as follows:

Table 9: Adjusted means per (total) beneficiary by Fitness status

	Cost Per beneficiary Rands	Admissions Per beneficiary	Days per beneficiary
Not on V	8,644 (8545 - 8743)	0.42 (0.418 - 0.425)	1.72 (1.7 - 1.73)
	FIA	9,075 (8966 - 9184)	0.44 (0.435 - 0.442)
FLA	8,770 (8560 - 8980)	0.42 (0.416 - 0.43)	1.6 (1.57 - 1.64)
	FMA	8,642 (8428 - 8856)	0.41 (0.403 - 0.416)
FE	7,540 (7354 - 7727)	0.36 (0.356 - 0.368)	1.36 (1.32 - 1.39)

The risk-adjusted mean admission rate and mean cost per beneficiary show a monotonically decreasing pattern with increasing Fitness status. This is shown graphically in Graph 6.

Graph 6: Adjusted means per (total) beneficiary by Fitness status



5.3 SUB-GROUP ANALYSIS

The next step was to conduct analysis at subgroups within each claim cost category. This was done by working with the clinical team at Discovery to identify appropriate subgroupings (using the ICD10⁹ diagnosis codes associated with each admission). The criteria used for the definition of the subgroupings were:

- the groupings needed to include diagnoses or medication that were logically related (for example, relating to the same body system); and
- the clinical team separated out those diagnoses within each group which they expected to be more affected by Vitality engaged status.

While the second criteria above could be viewed as a subjective influence on the analysis, all data was analysed in order to test the hypothesis that the “direct” subgroupings contained the more significantly affected diagnoses. In this way, it is intended that the analysis drives the results rather than the groupings. The listing of the groupings used and the associated distribution of costs and events is set out in Annexure B.

From a share of cost perspective, the most significant groups relate to the Cardiovascular System, the Digestive System, the Musculoskeletal System and Maternity. These four categories account for 47% of admissions and 50% of cost in the 2006 data. The results for a subset of groupings that make up 66% of events are set out below. The most significant category that has not been included below is the Maternity category since there is a self selection process associated with Vitality status (as beneficiaries earn additional points for pregnancy related activities) and beneficiaries are less likely to participate in fitness activities during the year of their confinement.

⁹ International Classification of Diseases version 10

A key finding at this stage is that the differences in claims experience, where they exist, are primarily driven by differences in the admission rates. The cost per event exhibits no significant differences between the categories (with Maternity-related costs being the only exception). The differences in the cost per event at the aggregate level are therefore driven by differences in the mix of events in each Vitality status population rather than by actual differences in the cost per event.

5.3.1 VITALITY STATUS

The comparison in the adjusted mean admission rates per admission category are set out in Table 10. The categories indicated as “direct” are where the Discovery clinical team split the diagnosis codes into those that are more likely to be impacted by lifestyle modification (such as physical activity, changes to diet and screening) and the balance (“other”). It is notable that the levels of significance in the differences, particularly for the comparison to the VHE group (highlighted) for the “direct” groups exceed the levels of significance for the “other” groups.

Table 10: Adjusted mean admission rates per category by Vitality status

Admission category	Not	NPE	VE	VHE
Cardiovascular (direct)	0.0741	0.0724	0.0773	0.0694
Cardiovascular (other)	0.0031	0.0030	0.0034	0.0030
Digestive	0.0544	0.0497	0.0578	0.0514
Nervous and Musculoskeletal System	0.0183	0.0180	0.0185	0.0154
Nervous (other)	0.0148	0.0157	0.0161	0.0129
Musculoskeletal (other)	0.0399	0.0407	0.0429	0.0421
Cancer	0.0102	0.0057	0.0143	0.0092
Kidney and Urinary Tract	0.0263	0.0241	0.0271	0.0217
Respiratory (direct)	0.0078	0.0078	0.0067	0.0058
Respiratory (other)	0.0240	0.0233	0.0219	0.0181
Mental (direct)	0.0095	0.0092	0.0086	0.0057
Mental (other)	0.0020	0.0019	0.0020	0.0015
Endocrine, Nutritional and Metabolic (direct)	0.0063	0.0056	0.0057	0.0047
Endocrine, Nutritional and Metabolic (other)	0.0050	0.0049	0.0051	0.0043

For each subgrouping a p-value for the level of significance in the difference in the admission rates for each pairing of statuses was calculated (using SAS) and coded as set out in Table 11.

Table 11: Levels of significance per category by Vitality status

Admission category	Not vs VHE	Not vs VE	NPE vs VHE	NPE vs VE	VE vs VHE
Cardiovascular (direct)	***	***	**	***	***
Cardiovascular (other)	Ns	ns	ns	**	Ns
Digestive	**	***	ns	***	***
Nervous and Musculoskeletal System	***	ns	***	ns	***
Nervous (other)	***	***	***	ns	***
Musculoskeletal (other)	*	***	ns	**	Ns
Cancer	Ns	***	***	***	***
Kidney and Urinary Tract	***	ns	**	***	***
Respiratory (direct)	***	***	***	***	*

Respiratory (other)	***	***	***	***	***
Mental (direct)	***	**	***	ns	***
Mental (other)	*	ns	ns	ns	**
Endocrine, Nutritional and Metabolic (direct)	***	***	***	ns	***
Endocrine, Nutritional and Metabolic (other)	**	ns	ns	ns	**

ns=not significant, *=p<.05, **=p<.01, ***=p<.001

For the cardiovascular direct grouping (i.e. cardiovascular diagnoses that were identified by the Clinical team as being likely to be expected to be more affected by Vitality engaged status) there was a significant reduction in admission rates as the level of Vitality engagement increased.

There are only two subcategories (both “other” categories) where there is no significant difference between the VHE and VE admission rates.

5.3.2 FITNESS STATUS

The comparison in the adjusted mean admission rates per admission category for Fitness status are set out in Table 12 and the levels of significance in the differences for each pair of statuses is set out in Table 13. The subgroups are the same as those used for the Vitality status analysis.

Table 12: Adjusted means per category by Fitness status

Admission category	Not on V	FIA	FLA	FMA	FE
Cardiovascular (direct)	0.0741	0.0756	0.0735	0.0719	0.0687
Cardiovascular (other)	0.0031	0.0032	0.0029	0.0033	0.0031
Digestive	0.0544	0.0548	0.0554	0.0533	0.0482
Nervous and Musculoskeletal System	0.0183	0.0182	0.0189	0.0175	0.0154
Nervous (other)	0.0149	0.0164	0.0148	0.0127	0.0123
Musculoskeletal (other)	0.0399	0.0415	0.0429	0.0452	0.0422
Cancer	0.0102	0.0109	0.0115	0.0103	0.0070
Kidney and Urinary Tract	0.0263	0.0262	0.0251	0.0234	0.0207
Respiratory (direct)	0.0078	0.0073	0.0066	0.0061	0.0059
Respiratory (other)	0.0241	0.0228	0.0212	0.0197	0.0178
Mental (direct)	0.0095	0.0089	0.0085	0.0076	0.0058
Mental (other)	0.0020	0.0019	0.0021	0.0023	0.0015
Endocrine, Nutritional and Metabolic (direct)	0.0063	0.0057	0.0055	0.0048	0.0047
Endocrine, Nutritional and Metabolic (other)	0.0050	0.0050	0.0048	0.0052	0.0042
Overall	0.4215	0.4388	0.4228	0.4096	0.3619

Table 13: Levels of significance per category by Fitness status

	FE Vs Not	FE Vs FIA	FE Vs FLA	FE Vs FMA	FIA Vs FLA	FIA Vs FMA	FIA Vs Not	FLA Vs FMA	FLA Vs Not	FMA Vs Not
Cardiovascular (direct)	***	***	***	ns	ns	***	*	ns	ns	ns
Cardiovascular (other)	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Digestive	***	***	***	**	ns	ns	ns	ns	ns	ns
Nervous and Musculoskeletal System	***	***	***	*	ns	ns	ns	ns	ns	ns
Nervous (other)	***	***	**	ns	ns	***	***	ns	ns	**
Musculoskeletal (other)	ns	ns	ns	ns	ns	***	**	ns	*	***
Cancer	***	***	***	***	ns	ns	ns	ns	ns	ns
Kidney and Urinary Tract	***	***	***	ns	ns	**	ns	ns	ns	**
Respiratory (direct)	***	***	ns	ns	ns	**	*	ns	**	***
Respiratory (other)	***	***	***	ns	*	***	***	ns	***	***
Mental (direct)	***	***	***	*	ns	ns	ns	ns	ns	**
Mental (other)	ns	ns	ns	*	ns	ns	ns	ns	ns	ns
Endocrine, Nutritional and Metabolic (direct)	***	***	*	ns	ns	***	***	ns	**	***
Endocrine, Nutritional and Metabolic (other)	*	*	ns	ns	ns	ns	ns	ns	ns	ns
Overall	***	***	***	***	***	***	***	*	ns	**

Ns=not significant, *= $p < .05$, **= $p < .01$, ***= $p < .001$

For the Fitness statuses there is a reduction in admission rates with increasing fitness engagement for all of the “direct” categories although in the case of Endocrine, Nutritional and Metabolic there is no significant difference between the FME and FE groups.

5.4 HIGHLY ENGAGED

The statistical analysis was used to develop confidence intervals for the differences in hospital admission rates between the VHE group and the balance of the beneficiaries and the FE group and the balance of the beneficiaries.

A summary of the confidence intervals at the overall level is presented as follows:

Table 14: Confidence intervals for the differences in hospital admission rates

2006	Lower	Upper	Estimate
VHE vs. Others	8.81%	11.09%	9.95%
FE vs. Others	14.61%	17.18%	15.90%

These results suggest that in 2006 the Vitality engaged beneficiaries had an admission rate 9.95% lower than the balance of the beneficiaries and that we can be 95% certain that this difference is in the range of 8.81% to 11.09%.

The results at a sub group level are set out in Tables 15 and 16 for the Vitality and Fitness statuses respectively. The tables show the mean differences, the level of significance and the 95% confidence interval in each case.

Table 15: Difference in admission rates per beneficiary as a percentage for VHE vs. all others

Category	VHE vs. all others
	7.4% *** (5.5% - 9.3%)
Cardiovascular (direct)	
Cardiovascular (other)	Ns
Digestive	5.6% *** (2.6% - 8.6%)
Nervous and Musculoskeletal System	15.6% *** (10.7% - 20.6%)
Nervous (other)	17.0% *** (11.4% - 22.7%)
Musculoskeletal (other)	Ns
Cancer	13.2% ** (3.6% - 22.6%)
Kidney and Urinary Tract	16.6% *** (12.0% - 21.1%)
Respiratory (direct)	20.1% *** (13.4% - 27.0%)
Respiratory (other)	21.0% *** (17.4% - 24.5%)
Mental (direct)	36.2% *** (28.2% - 44.2%)
Mental (other)	21.8% ** (8.4% - 35.1%)
Endocrine, Nutritional and Metabolic (direct)	20.7% *** (14.8% - 26.5%)
Endocrine, Nutritional and Metabolic (other)	Ns
Overall	10.0% *** (8.8% - 11.1%)

Ns=not significant, *=p<.05, **=p<.01, ***=p<.001

Table 16: Difference in admission rates per beneficiary as a percentage for FE vs. all others

Category	FE vs. all others
Cardiovascular (direct)	8.0% *** (5.9% - 10.1%)
Cardiovascular (other)	Ns
Digestive	11.8% *** (8.4% - 15.1%)
Nervous and Musculoskeletal System	15.8 *** (10.3% - 21.3%)
Nervous (other)	20.9% *** (14.6% - 27.3%)
Musculoskeletal (other)	Ns
Cancer	35.4% *** (46.1% - 24.9%)
Kidney and Urinary Tract	20.3% *** (15.2% - 25.4%)
Respiratory (direct)	18.7% *** (11.1% - 26.3%)
Respiratory (other)	21.9% *** (17.9% - 25.8%)
Mental (direct)	34.6% *** (25.7% - 43.7%)
Mental (other)	21.4% ** (6.1% - 36.7%)
Endocrine, Nutritional and Metabolic (direct)	20.0% *** (13.4% - 26.5%)
Endocrine, Nutritional and Metabolic (other)	15.9% ** (6.2% - 25.7%)
Overall	15.9% *** (14.6% - 17.2%)

Ns=not significant, *=p<.05, **=p<.01, ***=p<.001

6. CONCLUSION

The results presented in this paper indicate that there does appear to be a lower claims experience associated with beneficiaries with a higher level of engagement in the Vitality programme, particularly in the subgroups of:

- cardiovascular;
- nervous and musculoskeletal;
- mental; and
- endocrine, nutritional and metabolic.

In particular, the categories identified by the clinical team as being likely to be affected by Vitality engaged status (indicated as “direct”) were found to have significant differences. These findings are also reflected in the analysis of subgroups by Fitness status.

The analysis by Fitness status indicated a clearer pattern of experience by increasing participation level with, at an overall level, lower admission rates being observed in beneficiaries with the highest level of engagement in fitness activities. Unlike in some of the cited studies (Wang (2004), Pronk (1999)), the largest differences were observed between the fitness engaged and the moderately engaged (as compared to findings that moderate changes from sedentary had a more significant impact on costs than from moderately active to highly active).

The analysis of hospital admissions indicated that while Vitality beneficiaries with no points earned and Vitality engaged beneficiaries tended to have lower admission rates than beneficiaries not participating in the Vitality programme. However, beneficiaries on Vitality but not engaged tended to exhibit higher admission rates than the other two categories of Vitality beneficiaries. This distortion could be attributable to points earned by chronic beneficiaries for their participation in activities related to their chronic treatment programme rather than for purely preventative purposes. The distortion may also be attributable to the relative weighting of points earned in different categories, particularly the fitness category relative to other categories.

There was no similar distortion in the Fitness analysis. This supports the supposition that the distortion may be caused by beneficiaries with chronic conditions being considered to be engaged as a result of points earned for tests associated with the management of their conditions rather than preventative behaviour. This is because the Fitness status considers only fitness activities while the Vitality status is based on the points earned for fitness activities (subject to an annual maximum), the points earned for preventative activities which include screenings and, less significantly, points earned for health choices and knowledge (as described in section 3).

The differences in the admission rates for the highly engaged groups compared to the balance of the beneficiaries show that overall, the difference for the FE (mean 15.9%) exceed the difference for the VHE (mean 10.0%). The main contributors to this higher difference are the cancer and cardiovascular (direct) groups. This finding raises the debate of cause and effect since it is likely that those beneficiaries suffering from cancer are less likely to be able to participate in fitness activities and thus their condition has driven their Fitness status rather than the other way around.

The hospital analysis indicates that the differences in cost per beneficiary are driven by admission rates rather than length of stay and cost per admission. The advantage of analysing admission rates is that results are more comparable over time (since no inflation adjustment is required) although they can be affected by changes in benefits.

As noted in the introduction to this report as well as Wang (2004) this cross-sectional study does not include a cause and effect analysis. A longitudinal analysis will provide a better indication of the effect of individuals moving between the statuses defined in this project. Further analysis of hospitalisation experience of chronic beneficiaries is also likely to give a better indication of the impact of the Vitality status on hospital utilisation by chronic beneficiaries.

This cross sectional analysis suggests that beneficiaries engaged in activities associated with a healthier lifestyle tend to have lower hospital admission rates. Attributing cause and effect will require further research.

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REFERENCES

- Aldana SG, Greenlaw RL, Diehl HA, Salberg A, Merrill RM, Ohmine S. (2005) *The effects of a worksite chronic disease prevention programme*. Journal of Occupational and Environmental Medicine 47:448-564
- Bouchard C. (2001) *Physical activity and health: introduction to the dose-response symposium*. Medicine and Science in Sports and Exercise 33 (6), S347-350
- Breiman, L, Friedman, J, Olshen, R and Stone, C (1984). Classification and Regression Trees, Wadsworth
- Edington DW, Yen L, Witting P. (1997) *The financial impact of changes in personal health practices*. Journal of Occupational and Environmental Medicine 39:1037-1046
- Farrell SW, Kampert JB, Kohl HW, Barlow CE, Macera CA, Paffenbarger RS, Gibbons LW, Blair SN. (1998) *Influences of cardiorespiratory fitness levels and other predictors on cardiovascular disease mortality in men*. Medicine and Science in Sports and Exercise 30 (6), 899-905
- Haskell WL, (2001) *What to look for in assessing responsiveness to exercise in a health context*. Medicine and Science in Sports and Exercise 33 (6), S454-458
- Kass, GV (1975). Significance testing in Automatic Interaction Detection. Appl. Statist, 24 (2), 178-189

- Kass, GV (1980). An exploratory Technique for Investigating Large Quantities of Categorical Data. *Appl. Statist*, 29 (2), 119-127
- Keeler EB, Manning WG, Newhouse JP, Sloss EM, Wasserman J. (1989) *The external costs of a sedentary lifestyle*. *American Journal of Public Health* Vol 79:975-981
- Kim K, Timm N (2007) *Univariate and Multivariate General Linear Models* Taylor & Francis Group, New York
- Lambert EV, Kolbe-Alexander T () *Physical activity and chronic diseases of lifestyle in South Africa*. South African Medical Research Council, Cape Town
- Lee CD, Jackson AS, Blair SN (1998) *US weight guidelines: is it also important to consider cardiorespiratory fitness?* *International Journal of Obesity* 22(suppl2) S2-S7
- Lynch WD, Golaszewski TJ, Clearie A, Vickery DM. (1989) *Characteristics of self-selected responders to a health risk appraisal: generalizability of corporate health assessments*. *American Journal of Public Health* 79:887-888
- Ozminkowski RJ, Ling D, Goetzel RZ, Bruno JA, Rutter KR, Isaac F, Wang S. (2002) *Long-term impact of Johnson & Johnson's health & wellness program on health care utilization and expenditure*. *Journal of Occupational and Environmental Medicine* 44:21-29
- Pronk N P, Goodman M J, O'Connor PJ, Martinson BC. (1999) *Relationship between modifiable health risks and short-term health care charges*. *Journal of Occupational and Environmental Medicine* 23:2235-2239
- Proper KI, Koning M, van der Beek AJ, Hildebrandt VH, Bosscher RJ, van Mechelen W. (2003) *The Effectiveness of Worksite Physical Activity Programs on Physical Activity, Physical Fitness and Health*. *Clinical Journal of Sport Medicine* 13(2): 106-117
- Reddy SP, Panday S, Swart D, Jinabhai CC Amosun SL, James S. (2003) *Umthenthe Uhlaba Usamila – The South African Youth Risk Behaviour Survey 2002*. South African Medical Research Council, Cape Town.
- Shephard RJ. (1991) *A critical analysis of work-site fitness programs and their postulated economic benefits*. *American College of Sports Medicine* 24 (3), 354-370
- Steyn K, Levitt NS, Hoffman M, Marais AD, Fourie JM, Lambert EV, Gaziano, TA Kepe L, Lombard CJ (2004). *The global cardiovascular diseases risk pattern in a peri-urban working-class community in South Africa. The Mamre study*. *Ethnicity and Disease* 14 (2), 233-242
- Wang F, McDonald T, Champagne LJ, Edington DW. (2004) *Relationship of body mass index and physical activity to health care costs among employees*. *Journal of Occupational and Environmental Medicine* 46:428-436
- World Health Organisation (2002) *Reducing risks, promoting health life*

World Health Organisation (2005) *Preliminary results of the World Health Survey, 2002-2003; International Physical Activity Data, South African results*. World Health Organisation, Geneva

Wright D, Adams L, Beard MJ, Burton W, Hirschland D, McDonald T, Napier D, Galante S, Smith D, Edington DW. (2004) *Comparing excess costs across multiple corporate populations*. American College of Occupational and Environmental Medicine

ANNEXURE A: UNADJUSTED DATA

Data summaries used for checking purposes (totals):

Vitality Status:

Admissions	Not	NPE	VE	VHE	Total
2006					
Cost per event	17,826	15,575	15,889	14,636	17,826
Days per event	3.67	3.29	3.00	2.54	3.67
Cost per day	4,862	4,740	5,296	5,766	4,862
Beneficiaries with at least one admission per annum	20.9%	14.7%	22.4%	17.1%	20.9%
Cost per beneficiary per annum	5,958	3,376	5,924	3,382	5,958
Events per beneficiary per annum	0.3	0.2	0.3	0.2	0.3
Days per beneficiary per annum	1.1	0.7	0.9	0.6	1.1

Fitness Status:

Admissions	Not	FIA	FLA	FMA	FHA
2006					
Cost per event	17,826	15,929	14,527	15,338	14,548
Days per event	3.67	3.21	2.85	2.77	2.54
Cost per day	4,862	4,956	5,104	5,539	5,731
Beneficiaries with at least one admission per annum	20.9%	19.7%	18.9%	18.2%	14.7%
Cost per beneficiary per annum	5,958	4,698	3,801	3,850	2,840
Events per beneficiary per annum	0.3	0.3	0.3	0.2	0.2
Days per beneficiary per annum	1.1	0.9	0.7	0.7	0.4

ANNEXURE B: HOSPITAL ADMISSION CATEGORIES

Category	2006 Events	%	2006 Amount Rands	%	Cost/event Rands
Blood and Blood Forming Organs	2,614	1%	27,865,012	1%	10,659.91
Cancer	12,532	5%	237,427,516	5%	18,945.70
Cardiovascular (direct)	25,228	9%	720,580,677	15%	28,562.73
Cardiovascular (other)	1,811	1%	59,063,100	1%	32,613.53
Digestive	39,583	15%	472,005,705	10%	11,924.46
Ear, Nose, Mouth and Throat	9,177	3%	109,992,275	2%	11,985.65
Endocrine, Nutritional and Metabolic (direct)	2,018	1%	22,334,520	0%	11,067.65
Endocrine, Nutritional and Metabolic (other)	2,288	1%	34,907,154	1%	15,256.62
Eye	11,291	4%	131,463,555	3%	11,643.22
Female reproductive	8,769	3%	74,572,507	2%	8,504.11
Hepatobiliary system and Pancreas	4,496	2%	104,724,959	2%	23,292.92
HIV	6	0%	63,838	0%	10,639.59
Infectious, Parasitic and other unspecified diseases	1,934	1%	34,880,343	1%	18,035.34
Injuries, burns, poisoning and toxic effect of drugs	2,811	1%	32,341,711	1%	11,505.41
Kidney and Urinary Tract	16,067	6%	200,228,133	4%	12,462.07
Male Reproductive	6,846	3%	83,447,813	2%	12,189.28
Mental (direct)	6,299	2%	58,922,692	1%	9,354.29
Mental (other)	909	0%	10,056,475	0%	11,063.23
Multiple Trauma	692	0%	61,833,619	1%	89,354.94
Musculoskeletal (other)	28,403	11%	654,014,983	14%	23,026.26
Nervous (other)	9,782	4%	143,114,841	3%	14,630.43
Nervous and Musculoskeletal System	11,473	4%	351,208,861	7%	30,611.77
Newborns and other Neonates	71	0%	11,157,787	0%	157,151.92
Other	2,777	1%	161,325,689	3%	58,093.51
Pregnancy, Childbirth and Puerperium	32,757	12%	454,105,111	10%	13,862.84
Respiratory (direct)	2,719	1%	32,871,560	1%	12,089.58
Respiratory (other)	10,165	4%	165,894,860	4%	16,320.20
Skin, Subcutaneous Tissue and Breast	13,379	5%	145,867,221	3%	10,902.70
Unrelated procedures	2,799	1%	94,179,445	2%	33,647.53
	269,696		4,690,451,960		17,391.63

ANNEXURE C: DESCRIPTION OF CATEGORIES

Health Plan Options

For the purpose of this research, the benefit plans offered by Schemes administered by Discovery Health have been grouped as follows:

1. **Comprehensive plans:** Hospital related expenses and costs associated with the treatment and management of chronic conditions are covered through the insured risk portion of the cover while the balance of out-of-hospital expenses are covered by a medical savings account. Any unclaimed balance in the individual's medical savings account is carried over to the following year and cover is limited to the balance therein. The Comprehensive plans offer additional risk cover in respect of out-of-hospital expenses if these exceed a specified threshold in a calendar year. Out-of-hospital expenses in excess of the threshold are then covered through the insured risk portion of the cover.
2. **Saver plans:** Hospital related expenses and costs associated with the treatment and management of chronic conditions are covered through the insured risk portion of the cover while the balance of out-of-hospital expenses are covered by a medical savings account. There is no above threshold cover for out-of-hospital expenses.
3. **Core plans:** Hospital related expenses and costs associated with the treatment and management of chronic conditions are covered through the insured risk portion of the cover and there is no provision for other out-of-hospital expenses.

Geographical Area

Postal code data for each individual is used to allocate them into four geographical locations as follows (by province):

Urban Inland: Gauteng

Rural Inland: Mpumalanga, North West, Limpopo, Free State

Urban Coastal: Western Cape

Rural Coastal: Eastern Cape, Northern Cape, Kwazulu Natal

Chronic conditions

Members are required to register for their chronic condition benefits in order for them to be covered by the insured risk portion of the benefits (as described above). Members are grouped according to those with no chronic conditions (none), a single chronic condition (single) and multiple chronic conditions (multiple).

ANNEXURE D: TREE ANALYSIS

