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Health locus of control in patients undergoing coronary artery surgery - changes and associated outcomes - a seven year cohort study (Pre-publication version 1)

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Abstract

Introduction: Health locus of control is a measure of an individual's beliefs in factors that are thought to determine health experiences. Scores are generated and form a graduated linear scale from external to internal control, with respect to their views on health causality. Health locus of control has been considered to be a relatively stable entity. However, it is not clear if this status changes in the advent of serious health challenges, such as coronary artery bypass graft surgery. The aim of this study is to explore the variability of health locus of control and its association with postoperative health in this context.

Methods: In a longitudinal cohort study of patients undergoing coronary artery bypass graft surgery, a purposive sample (n=215) were recruited from the waiting list and followed up postoperatively, at approximately one year and seven years later.

Results: Patients undergoing coronary artery bypass graft surgery demonstrated marked fluctuations in health locus of control in their peri-operative and rehabilitative phases. Mean health locus of control became more external (often associated with poorer outcomes) peri-operatively, and more internal (generally associated with better health outcomes) in the rehabilitative period.

Conclusions: Health locus of control scores were shown to be changeable during a major health care intervention, with possible consequences for patient outcomes and care needs. The significant health belief upheaval demonstrated in this cohort should be considered in assessing patients preoperatively, and managed as part of the patients' clinical journey by both acute and rehabilitation staff. It is likely to have particular importance in individualised assessment and management of future prevention advice for patients.

Background

Coronary artery bypass grafting is a surgical procedure to improve arterial blood flow and alleviate symptoms in individuals suffering from coronary artery disease (CAD).^{1, 2} Although certain physiological, psychological, and behavioural lifestyle risk factors for CAD are well documented by large population surveys such as EUROASPIRE³ and MONICA,⁴ strategies to fully eliminate them remain elusive.

An understanding of the psychological aspects of health relates to work carried out by Rotter in the 1950s⁵ that examined beliefs about susceptibility to ill-health, and the extent to which health and illness are beyond an individual's control. Rotter's work evolved into a global concept of 'health locus of control'; that is, the extent and range of activities that individuals believe they can employ to control events affecting them. Individuals are classed as either having a strong internal locus of control belief, meaning events that happen to them are considered mainly to be a result of their own life actions, or a strong external locus of control, attributing their life events to uncontrollable external factors, including chance or the actions of others.⁶

Locus of control (LoC) has been linked to ways of interpreting and influencing a range of situations in life, such as job satisfaction and exam performance.⁷ Health locus of control (HLoC) specifically supports an understanding of how a person's thinking influences their health, with studies noting that an individual's HLoC influences how they respond to events, including adopting healthy behaviours, seeking health advice and formulating health beliefs.⁸ The HLoC scale developed by Wallston *et al*⁹ arose from Rotter's observations⁵ that personality comprises an interaction between an individual and their environment, influenced by an expectation of gaining positive outcomes and avoiding negative outcomes. LoC describes the belief that the likelihood of a favourable outcome (or reward) depends upon their own actions (the locus is internal), or events that are outwith their control (the locus is external). As Rotter suggests that behaviour is led by a desire for rewards⁵, those with an internal LoC are more likely to strive to achieve the reward. Rotter developed and tested a tool (the LoC scale) that measure LoC on an internal-external continuum with high validity and reliability⁹. This tool was adapted to fit specific other circumstances, including use within a health environment (the HLoC scale⁹), tested for validity ($\alpha = 0.72$) within the new sphere^{9, 10}, and found to have greater internal consistency reliability and construct validity than other similar tools¹¹. Also most thirty years after developing the tool Wallston reviewed the literature¹² and found that the scale (and its derivatives) validly assess locus of control beliefs. HLoC continues to be a concept of interest to researchers understanding health behaviours and experience in a wide range of clinical settings.¹³⁻¹⁶

Internal locus has been associated with improved health outcomes, including increased health literacy, improved levels of healthy activity (weight loss, diet, smoking, etc), and improved survival following

surgery.¹⁷ Specific correlations between internal HLoC and improved cardiac health have also been demonstrated both in the laboratory, as a lower induced cardiovascular stress response,¹⁸ and in the clinical setting, with fewer adverse cardiac events for cardiac patients,¹⁹ and greater improvements in lifestyle following myocardial infarction.²⁰ By contrast, Brown²¹ demonstrated that patients who measure highly for ‘chance’ (high External HLoC) as a controlling factor in their lives were relatively more likely to perceive obstacles to undertaking healthy lifestyle changes during cardiac rehabilitation. Obstacles ranged from social (no one to attend classes with), physical (health was too poor to attend) and environmental (transport and financial barriers), suggesting a degree of passivity or hopelessness in managing their own care.

It has been thought that HLoC is a relatively stable component of an individual’s psychology,²²⁻²⁴ requiring time or persistent therapy to change, although in its early conception it was recognised that a ‘life crisis’ could cause significant changes in locus,²⁵ and hospitalization could cause a temporary increase in ‘Powerful Other’ HLoC,²⁶ particularly in those who were unfamiliar with the hospital environment. The term ‘powerful others’ arose from the original work by Rotter⁵ to acknowledge that external factors that affect outcomes could be either chance (or fate, or a supernatural being/God) or individuals who are regarded by the individual as having expertise, authority, or power, including doctors, teachers, and other authority figures (‘powerful others’). Generally HLoC tends to become slightly more external as part of the ageing process,²³ however, the notion that major changes can occur in HLoC through interventions has not been described in the literature, with the ‘chance’ component appearing to be least consistent of all three factors within an individual’s LoC.¹⁰

Introduction to this study

This study reports on the follow-up of a group of patients undergoing elective coronary artery bypass grafting (CABG) over a period of seven years. The purpose of the initial study was to explore the wider determinants of outcome following cardiac surgery, and to explore patients’ experiences of undergoing cardiac surgery.²⁷ The patients were assessed at three time point during a seven years period with recording of mortality data for a further five years. Physiological, lifestyle, and self-reported psychological factors (including HLoC and wellbeing) were recorded at three time points; pre-surgery, approximately one year after surgery, and seven years following surgery. Key results from initial follow up at sixteen months and seven years have been reported previously²⁸⁻³⁰ and demonstrated initial health improvements, but with increased mortality and morbidity associated with persistent smoking in the longer term follow-up.³¹

This paper addresses the research questions:

- Is HLoC a stable psychological component in patients undergoing cardiac surgery?
- Do HLoC internal (low) or external (high) scores relate to the outcome of cardiac surgery as measured by survival and well-being (SF36 scores)?
- Are HLoC scores related to health promoting behaviour, as measured by smoking, alcohol consumption, or attendance at cardiac rehabilitation?

Methods

Ethical approval was granted for a cohort study of patients awaiting coronary artery bypass surgery, with data gathered at the time of recruitment, at approximately one year and seven years after surgery, and finally, follow up of mortality for a further five years.

Patients awaiting CABG surgery were identified from the waiting list and a purposive sample (n=215) was recruited over a six month period according to the inclusion criteria of a single elective CABG procedure planned within the following four weeks (approximately), and resident within a 50 mile radius of the hospital.

Following informed consent for inclusion in the study data were collected at initial recruitment using a set of self-completion questionnaires, a clinical assessment record to document demographic details and clinical measurements, and a structured interview schedule. Data collected included demographic data (age, sex, socio-economic grouping), clinical data (including cardiac history, range and severity of symptoms, data related to surgery and post-operative recovery, co-morbidities, drug history, and specific physical [height, weight, waist circumference] and physiological [serum lipids, blood pressure] markers), pre and post operative lifestyle indicators (smoking, alcohol consumption, and attendance at cardiac rehabilitation classes), and measures of psychological health and wellbeing (HLoC³² and SF 36³³). The study reports on the output from completion by participants, of two validated assessment tools, measuring HLoC³² and health and well-being SF 36 form.³³ Recurrence and degree of severity of angina and breathlessness was reported using a seven-point self-completed likert type scale.^{28, 29, 34, 35} Data were entered into the statistical programme SSTS v22, and descriptive statistics, T-tests (paired sample and independent sample, as appropriate), Chi-square tests, and Pearson correlation coefficient (two tailed) were undertaken, and are reported below.

Self-complete Questionnaires

Locus of Control was measured using the HLoC scale^{32, 36} at each point in the study (HLoC-1, HLoC-2, and HLoC-3). The component parts of 'Health Locus of Control' (HLoC) have been

deconstructed and assembled into a scoring scale to measure an individual's degree of internal or external beliefs^{32, 36} (Figure 4). The scale consists of eleven questions, each scored on a four point scale where the higher the score the more external control beliefs are held, with the lower scores associated with more internally focussed health beliefs. There are five questions exploring 'internal' health beliefs and six questions 'external' beliefs.

Results

Initially data were collected from 208 patients, and 128 patients were followed up seven years after surgery. The causes of this attrition are detailed in Table 1.

Demographics

Demographics (age and deprivation category) of the study sample were collected together with similar data from larger population databases. The study sample comprised 170 males (79.1%) aged between 40 years and 80 years (mean age 58.2 years, sd 7.7 years) and 52.4% with DEPCAT scores between 5 to 7 inclusive (Table 2). Deprivation was classified by Scottish DEPCAT scores,³⁷ ranging from 1 (least deprived) to 7 (most deprived).

The study sample had a greater number of men, and greater levels of deprivation than the Health Board area population (51.2% males,³⁸ and 31.1% with DEPCAT scores 5-7).³⁹ The sample was therefore dissimilar from the population (Table 2), and the MONICA (a large cardiac study drawn from the same population) sample (Table 3) in terms of age and gender. These differences may be explained by the uneven distribution of coronary artery disease within the population, as the sample in this study comprised individuals with established coronary artery disease. High levels of socio-economic deprivation are recognised as a contributing factor to increased morbidity and mortality from cardio-vascular disease.⁴⁰

Survival

Forty-four patients died, with ten dying in the peri-operative period (30-day mortality = 4.65%). HLoC showed no association with survival (HLoC-1 and survival, $t(166) = -0.63$, $p=0.53$, HLoC-2 and survival, $t(93) = -0.33$, $p=0.74$). Within the participants in the study there was no evidence for increased mortality among those who were more deprived, chi-square for trend (1, $N=208$) = 0.05, $p=0.82$.

Health Locus of Control

In terms of scores, the mean HLoC score was similar to that of the large sample of individuals from different countries, assessed in the MONICA project⁴ (Table 3).

Across the period of study there were variations in HLoC that were statistically significant. Between the pre-operative and post-operative periods (Figure 1) sample mean HLoC increased by 0.87 (range -7 to 11, SD=3.91) (that is, Locus became more 'external'), $t(84) = 2.06, p = 0.043$. However, for the approximately two-thirds of the participants who attended cardiac rehabilitation (Figure 2) HLoC became more 'internal', with a mean change of -1.42 (range -11 to 7, SD=3.57), $t(57) = -3.03, p = 0.004$. It appears that the sample mean for HLoC after seven years (HLoC-3) reverts to a figure that is close to the pre-operative value (Figure 3) (mean change -0.88 (range -19 to 9, SD=4.26), $t(89) = -1.97, p = 0.052$).

Data were not collected from each patient at all three time points – and comparisons between time points are given for paired data points. Correlation between pre-operative (HLoC-1) and post-operative (HLoC-2) scores was statistically significant ($r(85) = 0.46, p < 0.01$) as was the correlation between HLoC-2 and HLoC-3 ($r(58) = 0.41, p < 0.01$). However, HLoC-1 and HLoC-3 were more weakly correlated ($r(90) = 0.21, p = 0.051$). A paired t-test on $n = 85$ patients indicated that the means of HLoC-1 (27.62) and HLoC-2 (28.49) were increased ($p = 0.043$), meaning individuals became more externally focussed. The mean of HLoC-3 (26.99) was lower than HLoC-1 (28.41) ($p = 0.004$). Mean HLoC-1 score (27.71) was found to be higher ($p = 0.050$) than the mean HLoC-3 score (26.83), suggesting that patients surviving to the 7-year follow up had a statistically significantly lower (more internal) HLoC score than they had pre-operatively.

Correlations between HLoC and symptoms

A relationship between HLoC and angina symptoms could not be demonstrated pre-operatively ($r = 0.061; p = 0.429 (n = 172)$) or post-operatively (one year) ($r = 0.118; p = 0.248 (n = 97)$), but those who have angina pain at seven years showed greater external HLoC ($r = 0.234; p = 0.016 (n = 106)$).

Conversely, while there was no relationship between preoperative breathlessness and HLoC-1 ($r = 0.052; p = 0.496 (n = 171)$), those who continued to experience breathlessness after surgery showed statistically significant greater external HLoC-2 ($r = 0.219; p = 0.031 (n = 97)$). This relationship was not demonstrated at seven year HLoC-3, ($r = 0.107; p = 0.276 (n = 106)$).

SF36 Mental Health scores were compared pre-operatively (MH1), post-operatively (MH2) and at the 7-year follow up (MH3). The effect of surgery was to increase the average SF36 mental health score between pre-surgery ($M = 61.09, SD = 18.62$) and post-surgery ($M = 65.80, SD = 18.64$) and this difference was statistically significant ($t(168) = -2.87, p = 0.005$).⁴¹ The relationship between increased

mental health between pre-surgery (M=62.14, SD=19.37) and seven year follow up (M=65.65, SD=25.94) persisted, but was not statistically significant ($t(107)=-1.35, p=0.178$). Correlations between HLoC and mental health pre-operatively (MH1 vs HLoC-1, $p=0.08$), post-operatively (MH2 vs HLoC-2, $p=0.11$) and scores at the 7-year follow up (MH3 vs HLoC-3, $p=0.30$) were not statistically significant. There appeared to be no correlation between HLoC and change in mental health score peri-operatively ($r = 0.120; p=0.144 (n=151)$).

Correlations between HLoC and health improving activities

Alcohol consumption, tobacco smoking, and attendance at cardiac rehabilitation classes were considered markers for health improving activities. Alcohol consumption in those who survived (mean = 8.34 units per week, sd = 13.1) was greater than in those who died (mean = 5.43 units per week, sd = 8.0), but this difference was not statistically significant, $t(169) = 0.20, p=0.051$. Weekly alcohol consumption was grouped into three categorical variables; abstention (0 units/week), moderate alcohol consumption (≤ 13 units/week for women or ≤ 20 units/week for men), and heavy alcohol use (≥ 14 units/week for women or ≥ 21 units/week for men). There was no statistical difference in HLoC-1 ($p=0.055$) and HLoC-2 ($p=0.759$) between these three groups.

Self reported smoking status was recorded pre- and post- operatively. Of the smokers at the time of surgery who recorded subsequent smoking status, 31 continued to smoke, and 11 quit smoking. However, 15 patients who reported they had quit smoking pre or post-surgery reported smoking again at seven year follow up. There was no statistically significant association with pre and post-operative HLoC between these three groups.

Attendance at cardiac rehabilitation as a measure of engagement with health promoting behaviours was considered in three groupings; attendance for 50% or more of classes, attendance but for less than 50% of classes, or no attendance. Any attendance gave a statistically significant survival benefit with chi-square (1, N=182) = 3.56, $p=0.03$. HLoC scores did not correlate with attendance at cardiac rehabilitation (HLoC-1 and attendance, $t(151) = -1.05, p=0.30$).

Discussion

This study aimed to investigate correlations of health locus of control scores generated by patients before CABG, one year and seven years after CABG with survival, selected rehabilitation patterns and measures of well-being. In overview, the sample means for HLoC before and one year after

CABG are significantly different. This difference showed a change towards a belief systems that relied more on the influence of external factors on health but after seven years this was shown to revert to a figure that more closely resembled its pre-operative value, representing a more internally influenced health belief system. This trend was not statistically significant (Figure 3) (mean change -0.88 (range -19 to 9 , $SD=4.26$), $t(89) = -1.97$, $p=0.052$).

Linkage between HLoC and survival

Although internal HLoC has previously been shown to be related to better outcomes following major thoracic surgery^{17, 42} and reduced morbidity in patients undergoing cardiac interventions,⁴³ we did not demonstrate a similar relationship.

Linkage between HLoC and cardiac symptoms

Approximately half of the patients continued to experience some degree of angina or breathlessness although this was statistically significantly reduced by the first follow-up visit.²⁸ Continued breathlessness was associated with changes towards external control in HLoC-2 ($p=0.034$) although this trend was not observed for angina. However by seven years post-operation, angina persistence was positively correlated with greater external HLoC-3 ($r=0.234, p=0.016$). This could be explained by a worse than expected outcome following surgery leading to beliefs that health status was influenced by factors beyond the individual's power, while those who had symptomatic relief were more likely to have greater internal control beliefs.

Desire for control in healthcare outcomes, both in terms of making decisions and being able to undertake health related activities, has previously been considered a stable factor in individuals who are not threatened with disastrous health challenges,²² although Ai *et al.*⁴⁴ suggest that open-heart surgery is such an event, totally removing an individual's control, and providing additional conflict for those individuals whose HLoC is assessed as being internal. This can be understood in terms of the 'unknown', the uncertain change to a significant organ central to survival therefore removing to a great extent any previous 'terms of reference' or experiences that would be used to understand, explain and manage their health.

Linkage between HLoC and other symptoms

Although post-operative breathlessness was significantly positively correlated with external HLoC-2,

no correlation was found between Locus of Control and the reduction in breathlessness score or the reduction in angina score as outcomes of CABG. Mental Health and Physical Function were identified as the elements of SF36 most likely to be related to Locus of Control. At each time point no correlation was found between Locus of Control and Mental Health, and the significant increase in patient Mental Health scores as an outcome of CABG could not be explained through their pre-operative Locus of Control score.

HLoC and Cardiac Rehabilitation

HLoC showed no association with attendance at cardiac rehabilitation. The British Heart Foundation, a leading United Kingdom charity working in the area of cardiac health, has highlighted the association between, and lack of care provision for, psychological wellbeing and cardiac wellbeing.⁴⁵ This may include exploration of misconceptions about the various influencing factors in ‘keeping well’ and in limiting CHD progression. One of the key interventions offered to patients with heart disease to ameliorate physiological and psycho-social risk factors is cardiac rehabilitation, which should be offered to all patients who have undergone CABG surgery.^{46, 47} Reviews of cardiac rehabilitation studies have demonstrated short term beneficial effects on quality of life, physiological markers and adverse incidents such as myocardial infarction or death.⁴⁸⁻⁵⁰ Longer term survival benefit has also been demonstrated.⁵¹ However, there is also evidence that patients fail to continue with the rehabilitation measures once their initial recovery stage has passed,^{31, 52, 53} and this may be due in part to psychological factors including HLoC, perceived instrumentality (an expectation that there will be a direct health benefit following on from an action which may differ from advice from the professionals), and self-efficacy (the belief that an individual has the skills necessary to carry through on lifestyle advice).⁵⁴

Linkage between HLoC and alcohol consumption

Weekly alcohol consumption was grouped into three categorical variables, and showed no statistical association with pre or post-operative HLoC. Various levels of alcohol intake did not show a statistically significant link with survival, although the levels of units reported to be consumed were not excessively high. However, a well-recognised J-shaped relationship between alcohol intake levels and death has previously been reported in another study of patients undergoing CABG irrespective of HLoC status⁵¹ and in general population surveys.⁵⁵

Linkage between HLoC and smoking

Smoking status was grouped into three categorical variables, and showed no statistical association with pre or post-operative HLoC, although several ex-smokers started smoking again in the years following CABG.

Stability of HLoC

By contrast with the published literature on the development of the HLoC scales and the perceived stability of this concept, this study found major changes in HLoC scores over the time points of assessment for patients who have undergone CABG (see Figure 1, 2 & 3). This feature of HLoC has not previously been described. Traditionally, HLoC is regarded to be a stable psychological attribute that shows slow and slight changes over time.⁵⁶ In this study HLoC shows two fluctuations in patients undergoing CABG. The first change, with an overall movement towards external HLoC, occurs in the peri-operative phase. The second change towards internal HLoC occurs in the rehabilitative phase. Both of these changes showed statistical significance, and although the mean difference was small, individual variations were large. The changes noted in individual patients were masked by the overall stability of the sample mean, and it is possible that other studies have failed to identify these changes by aggregating data before analysis.

Pre-operatively, individuals were shown to have more internal HLoC (perhaps reflecting their conviction in their decision to undergo surgery) and had a similar status at seven years post surgery (responsibility for their well-being shifting again to their choice in engagement with HCPs as time passes and symptoms recur). However, in the interim period (one year post-op assessment) higher scores were reported *i.e.* more external HLoC (statistically significantly from both earlier and later assessments), perhaps indicating that they attributed their well-being to the efforts of others namely the surgeon and rehabilitation team.

As with the use of many quantitative scales to measure a more subtle and elusive concept the meaning to be taken from their responses can be difficult to interpret. However, HLoC appears to capture views or opinions that are unsubstantiated by rational thought, and covering all eventualities. The measurement of HLoC in this study uses the validated instrument included as Figure 4, and greater external HLoC has consistently been associated with poorer health outcomes.

Limitations of the study.

This study is not able to explain if HLoC at seven years represents a state close to 'life-long' HLoC, with the pre-operative measures already indicating change from this base state, or if patients experience permanent changes to their HLoC as part of their illness pathway. Further study is needed

to establish if patients who develop a more external HLoC also experience the health risks and negative health behaviours of those individuals who naturally hold this psychological profile.

Conclusions

Patients undergoing coronary artery bypass surgery experience a change in their HLoC that can be dramatic, and is individually statistically significant. HLoC has previously been considered to be a stable characteristic, and these changes have not previously been described. Not only does CABG represent a substantial physical and psychological upheaval, but greater external HLoC has also been found to be associated with both poorer outcomes and less adherence to health promoting behaviours. Cardiac rehabilitation programmes offer an individualised approach to secondary prevention but perhaps could be enhanced further through inclusion of reflections on health belief systems and supporting strategies to ensure that they are credible, feasible and evidence-based.

Conflict of interest

None.

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CABG – Coronary Artery Bypass Grafting

HLoC – Health Locus of Control

DEPCAT – Deprivation Category

MONICA - Multinational **MONI**toring of trends and determinants in **C**ardiovascular disease

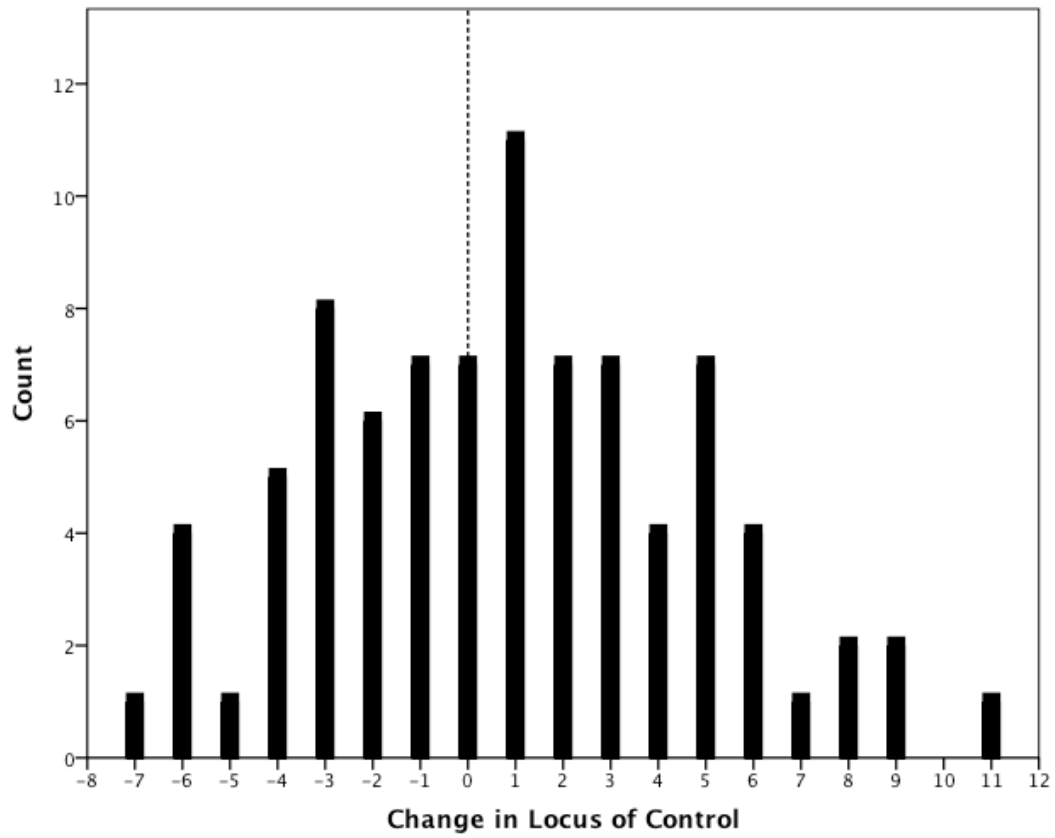
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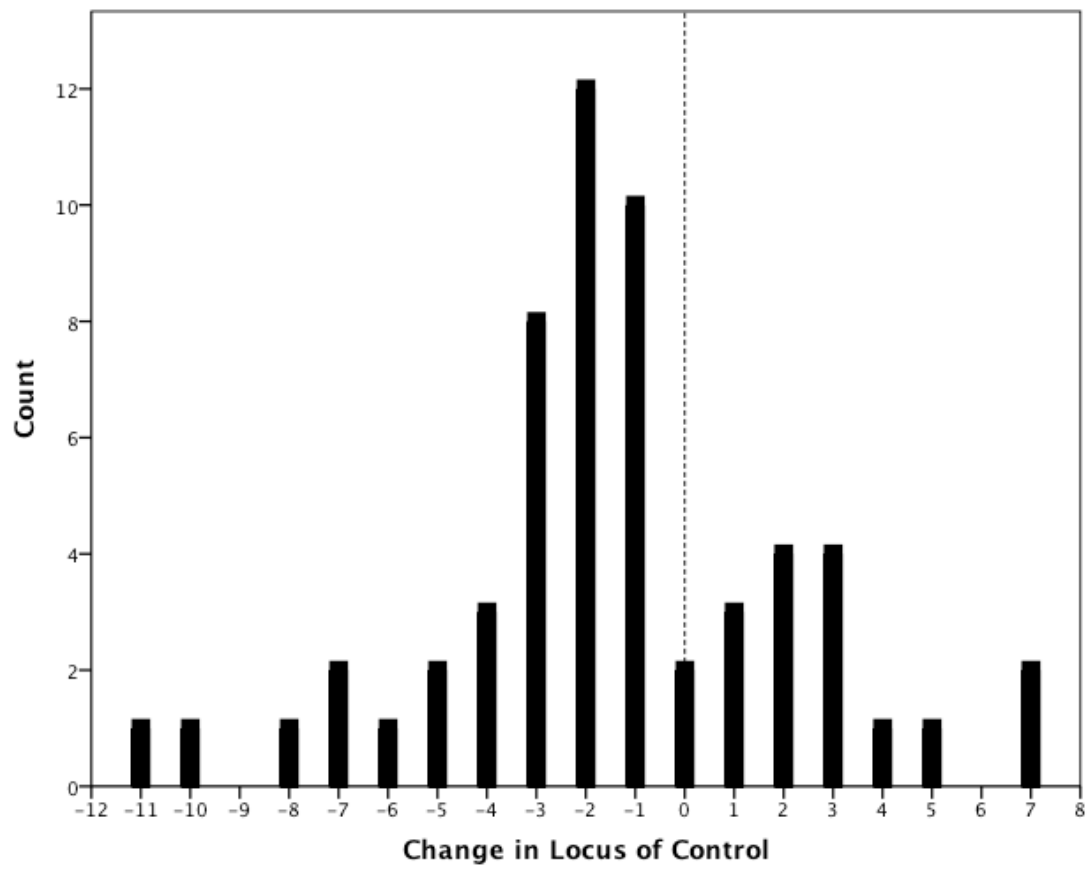
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Figure 1 - Individual changes in Health Locus of Control in the peri-operative period



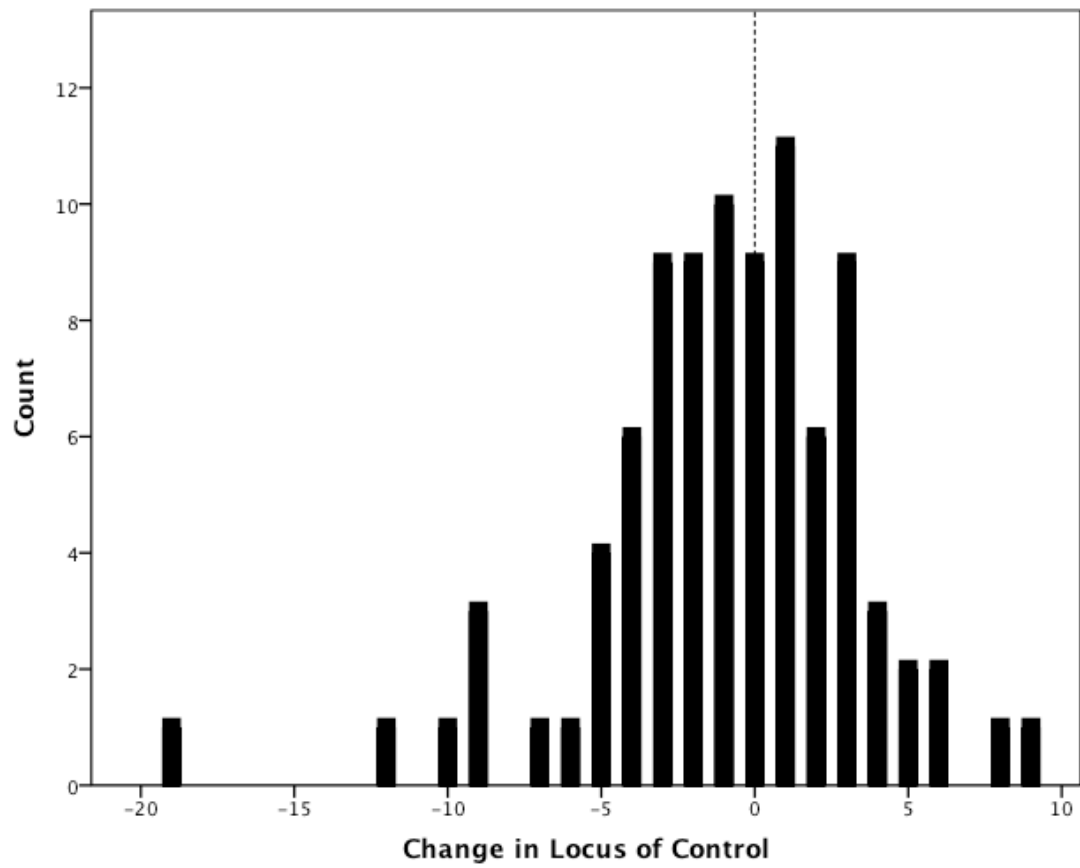
(negative scores denotes greater Internal Locus)

Figure 2 – Individual changes in Health Locus of Control in the rehabilitation period



(negative scores denote greater Internal Locus)

Figure 3 - Individual changes in Health Locus of Control over seven years



(negative scores denote greater Internal Locus)

Health Locus of Control: Please tick a single box to answer each questions

	Strongly agree	Agree	Disagree	Strongly disagree
I* 1. If I take care of myself, I can avoid illness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I 2. Whenever I get sick it is because of some-thing or not I've done	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E* 3. Good health is largely a matter of good fortune	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E 4. No matter what I do, if I am going to get sick, I will get sick	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E 5. Most people do not realise the extent to which their illnesses are controlled by accidental happenings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E 6. I can only do what my doctor tells me to do	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E 7. There are so many strange diseases around that you can never know how or when you might pick one up	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I 8. When I feel ill, I know it is because I have not been getting the proper exercise or eating right	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E 9. People who never get sick are just plain lucky	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I 10. People's ill health results from their own carelessness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I 11. I am directly responsible for my own health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

***I** is internally worded, **E** is externally worded. The scale is scored in the external direction, with each item scored from 1 (strongly disagree) to 4 (strongly agree) for the externally worded items and reverse scored for the internally worded items.

Reference: Wallston BS, Wallston KA, Kaplan GD, and Maides SA (1976) Development and validation of the Health Locus of Control (HLC) Scale. *Journal of Consulting and Clinical Psychology* 44:580-585

Figure 4 - Health Locus of Control Questionnaire

Table 1

Participant Attrition - From Initial Recruitment to Final Follow Up at Seven Years.

Reason	Number of Patients	Patients remaining
Initial recruitment	208	208
Died	44	164
Too ill for follow up	9	155
Declined follow up	18	137
Did not respond	9	128
Lost to follow up	1	127

Table 2

Sample Characteristics Compared to Population

Characteristic	Sample	Population
Male	79.4%	51.6%
Mean age	58.2 yrs	38.7 yrs
Socio-economically deprived	52.4%	31.1%

Table 3

Sample Characteristics Compared to MONICA Study Sample

Characteristic	Sample	MONICA
Total	214	1111
Male	170 (79.4%)	520 (46.8%)
Female	44 (20.6%)	591 (53.2%)
Mean age	58.1 yrs	45.5 yrs
Mean HLoC	27.8	26.5
Median HLoC	28	Not calculated

Note: HLoC = Health Locus of Control