

The Relationship Between Life Satisfaction and Healthcare Utilization: A Longitudinal Study

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Introduction: Studies have highlighted the importance of life satisfaction or, more generally, happiness, on health. However, there are few studies that have prospectively assessed the relationship between life satisfaction and healthcare utilization and costs.

Methods: Participants were from three national survey cycles conducted between 2005 and 2010 to future healthcare utilization up to 2015. Analysis was conducted in 2016–2017. Annual per person costs were calculated and individuals ranked. Adjusted multinomial logistic regression models were used to quantify the association between life satisfaction and being in the top 5% or top 6%–50%, compared to the bottom 50%, during follow-up.

Results: After exclusions, the study population included 85,225 adults. Increasing life dissatisfaction was associated with higher healthcare utilization and costs. In the fully adjusted model, the odds for those with the lowest level of life satisfaction being in the top 5% of healthcare costs relative to the lowest 50% is 3.05 (95% CI=1.61, 5.80). Those with the lowest life satisfaction were also at increased odds of being in the middle utilization category (6%–50%) with a significant OR=2.24 (95% CI=1.60, 3.14). All trends for increasing dissatisfaction were significant ($p < 0.001$).

Conclusions: Life dissatisfaction was significantly associated with being a high-cost user in the future. This relationship persisted after adjustment for demographic factors, comorbidity, socioeconomic factors, and health behaviors. This study points to the importance of considering broader correlates of well-being with respect to future healthcare utilization and costs.

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INTRODUCTION

Life satisfaction is a reliable dimension of quality of life, encompassing physical, mental, and social well-being.¹ Recent studies have highlighted the importance of life satisfaction, or more generally, happiness, on health.² The majority of research has been primarily focused on the mental health aspects of life satisfaction, but there is recent evidence suggesting that the health impacts of life satisfaction may be more widespread.³ A number of studies have emphasized the impact that life satisfaction has on healthy behaviors, risk of chronic disease, longevity, and a proactive approach to maintaining a healthy lifestyle.^{4,5} However, there are few population-based studies that have prospectively assessed the relationship between measures of life satisfaction and the impact on the healthcare system. The lack of literature in this area results from a paucity of

population-based data that links both information on life satisfaction and healthcare utilization in a longitudinal manner.

The relationship between health behaviors, chronic illness, and life satisfaction is likely bidirectional. Chronic illness and health-related risk factors have been demonstrated to have an independent association with life dissatisfaction, whereas optimism, life satisfaction, and

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social inclusion have revealed their protective properties in health respectively.⁶ People who are happy and satisfied with their life exhibit better self-rated health, absence of chronic and life-limiting conditions, as well as higher engagement with physical activity programs.⁷ Enrichment of life satisfaction through the use of psychological intervention has proven meaningful to enhancing subjective and psychological well-being.^{8,9} These factors may go on to affect the frequency of healthcare utilization and the necessity of healthcare services for existing disease management.

In healthcare systems worldwide, high-cost users (HCUs) disproportionately account for a majority of healthcare spending costs.¹⁰⁻¹² Previous research has identified important upstream determinants, as well as the impact that multimorbidity has on high healthcare utilization.^{13,14} In order to improve the sustainability of the healthcare system, an in-depth understanding of all risk factors and social characteristics that perpetuate concentrated healthcare spending in a small fraction of the population is necessary. Importantly, per-person healthcare costs reflect the combination of frequency, intensity, and complexity of healthcare utilization and thus are a meaningful and important metric of healthcare utilization.

The goal of this study is to investigate the impact of life satisfaction on patterns of future healthcare utilization by linking multiple cycles of a national population-based survey to subsequent health services utilization data from a single-payer system in Ontario, Canada.

METHODS

Study Sample

The study design used was a population-based longitudinal study of adult Ontario Canadian Community Health Survey (CCHS) participants combining several cycles to increase sample size. Participants from CCHS cycles for years 2003, 2005, and 2007/2008 were linked to the Registered Persons Database, which allows for linkage to population-based health administrative databases for Ontario, Canada. That is, for each cycle, each individual has 6 years of follow-up from their baseline. The CCHS survey administered by Statistics Canada, representative of 98% of the Canadian population aged ≥ 12 years living in private dwellings. The CCHS is a main data source for health surveillance and population health research in Canada. Detailed survey methodology is available elsewhere.¹⁵

All permanent residents of Ontario are covered by a single-payer insurance system (Ontario Health Insurance Plan [OHIP]) and all related healthcare encounters are recorded in health administrative databases. Healthcare spending was calculated for all key sources of healthcare expenditure, including hospital admissions, same day surgery, emergency department visits, physician payments, rehabilitation, complex continuing care, and prescriptions filled for individuals eligible for the Ontario Drug

Benefit (seniors, individuals living in long-term care or special care homes, residents receiving social assistance, and those with high relative drug costs). Healthcare spending was calculated using a person-centered methodology developed for Ontario administrative data.^{12,16} Annual per person costs based on individual healthcare transactions were calculated for each of the 6 years following the interview and individuals were ranked according to percentiles of cost. HCUs were defined as those who ranked in the top 5% according to total annual spending for > 1 year during the follow-up period.

The study design received ethics approval from the Ethics Review Board of the University of Toronto (Protocol Reference: 32666).

Measures

The main exposure variable available in the cycles of the surveys used in this study is self-reported life satisfaction; respondents were invited to select from the following options: *How satisfied are you with your life in general?* Response options: *very satisfied, satisfied, neither satisfied or dissatisfied, dissatisfied, or very dissatisfied.* Very satisfied and satisfied were collapsed due to small sample sizes and minimal differences between the two categories in terms of impact on health. It should be noted that future cycles of the CCHS (not included in this study) score this question according to a 10- or 11-point scale, which is then converted to the aforementioned categories; however, those scorings were not used in the earlier cycles. This single question has been widely used to study life satisfaction and is established as reliable and valid.^{17,18} Previous research supports the stability of this measure over time.¹⁹⁻²²

Gradients of healthcare utilization costs were defined as a multicategory outcome with the three categories: the top 5%, who are considered HCUs, the top 6%–50%, and the bottom 50%.²³ Annual spending for healthcare utilization groups was tracked using the person-centered costing approach¹² for 6 years following interview. The outcome of interest was annual healthcare cost ranking for (top 5%, top 6%–50%, bottom 50%) categorized for each of the 6 years following CCHS interview.

Prior healthcare utilization was estimated from administrative data captured in the 2 years prior and aggregated diagnosis groups (ADGs)²⁴ scores, a measure of comorbidity, were calculated. ADGs have previously been validated for use in Ontario and have been shown to be reliable for morbidity adjustment.²⁵ All other important covariates were captured from interview questions, including demographics, socioeconomic, health status, and health behavioral indicators. These included age, sex, immigrant status, household education and income, smoking status, alcohol consumption, physical activity, and BMI derived from height and weight.

Statistical Analysis

Participants were further excluded for nonresponse on the life satisfaction measure or lost OHIP eligibility during follow-up. Any participants that were HCUs in the year prior to the survey were removed at baseline, representing only 121 individuals or $< 0.1\%$ of the sample (Figure 1).

The weighted distribution of demographic, socioeconomic, health status, and behavior characteristics were estimated

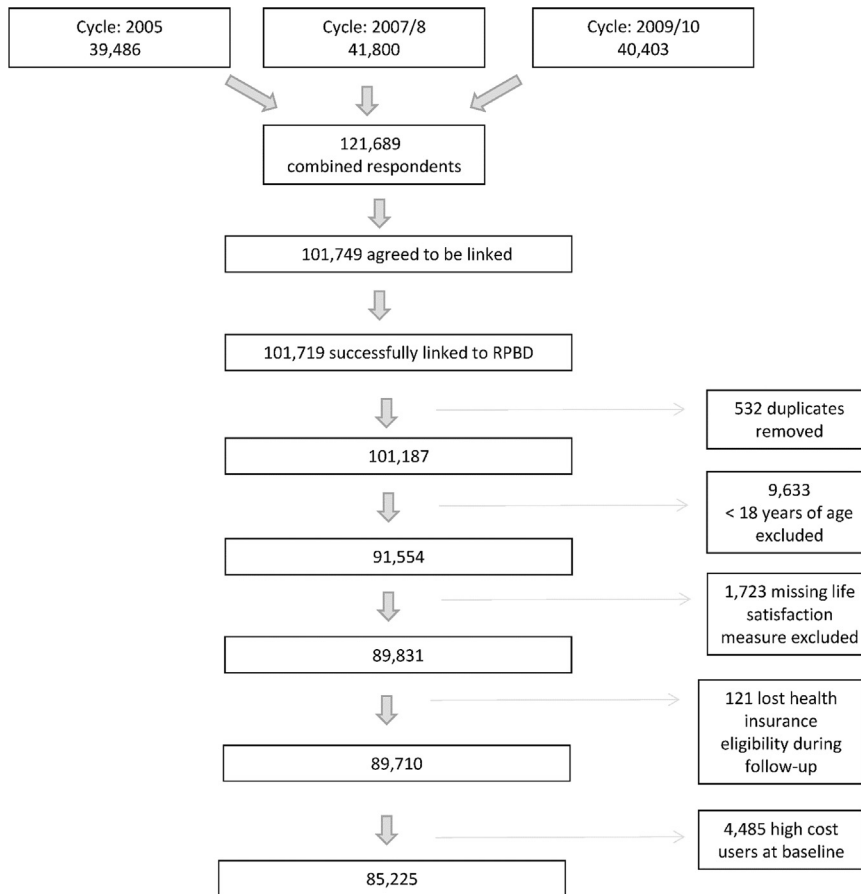


Figure 1. Flow chart of study participants from combined Canadian Community Health Care cycles linked to health administrative data through the Registered Persons Database (RPDB).

according to healthcare utilization ranking and life satisfaction. By excluding baseline HCUs, this allowed for investigation of the upstream determinants of HCUs (i.e., the factors associated with future HCUs among a cohort that did not comprise HCUs). Unadjusted; age- and sex-adjusted, age-, sex-, and ADG-adjusted; and age-, sex-, ADG-, and social and lifestyle risk factor-adjusted multinomial logistic regression models were used to quantify the association between life satisfaction and the odds of being in the top 5% or top 6%–50% compared to the bottom 50% in the 6 years following interview. The minimally adjusted model included age, sex, and ADG comorbidity score. The fully adjusted model included age, sex, and adjusted diagnostic ADG comorbidity score; smoking, alcohol consumption; physical activity level; immigrant status; household income; and survey cycle. A linear test for trend was assessed across gradients of life satisfaction on utilization categories.

Bootstrap sampling weights, as provided by Statistics Canada were applied, using balanced repeated replication, to all analyses to adjust for the complex survey design of the CCHS and to produce population-based estimates.²⁶ Weighted 95% CIs were calculated for all estimates. All statistical analyses were performed in 2016 using SAS, version 9.3.

Because both age and prior comorbidity are important confounders that could take on various functional forms, a range of analyses were conducted to test the robustness of the findings,

including modeling continuous and quadratic forms of age and the comorbidity score as well as quartiles. In addition, a binomial logistic regression model was run comparing the HCUs (top 5%) to the bottom 95% to compare to the multinomial model.

RESULTS

After combining the three cycles of data linked to the Registered Persons Database and excluding those aged <18 years, duplicates, those who were missing life satisfaction or lost OHIP eligibility during the follow-up period, resulted in 89,710 individuals remaining. Those who were already HCUs at baseline were further excluded ($n=4,485$) in order to examine the impact of life satisfaction on future HCU status and reduce the possibility of reverse association with life satisfaction (Figure 1). In the case of duplicate respondents across surveys ($n=532$), only the first survey response was used. Each respondent was followed for 6 years, after which 2,778 or 5% were deemed as being in the highest category of cost and 37,592 in the middle utilization category (top 6%–50%). The top 5% incurred Can\$27,636 average

Table 1. Weighted^a Proportions (%) and Mean Characteristics According to Healthcare Utilization Status

Characteristic	Healthcare utilization ranking			
	Overall (N=85,225)	Top 5% (n=2,778)	Top 6%–50% (n=37,592)	Bottom 50% (n=44,855)
Life satisfaction				
Very satisfied or satisfied	90.8	85.7	89.4	91.8
Neither satisfied nor dissatisfied	6.1	7.50	6.50	5.70
Dissatisfied	2.7	5.70	3.50	2.10
Very dissatisfied	0.50	1.10	0.60	0.30
Sex				
Male	48.70	45.8	37.4	56.0
Female	51.30	54.2	62.6	44.0
Age group				
< 40 years	41.2	4.8	27.5	51.1
40–49 years	22.2	8.6	16.1	26.6
50–59 years	16.8	12.9	17.6	16.4
60–69 years	10.8	22.0	19.9	4.70
70–79 years	6.5	27.3	14.0	1.10
≥80 years	2.5	24.4	4.90	0.20
Immigrant				
No	67.7	66.2	65.6	69.2
Yes	32.0	32.7	34.1	30.6
Highest household education				
No post-secondary education	16.7	36.5	21.6	12.9
Post-secondary education	77.4	57.7	73.1	80.8
Household income quintile				
1	15.1	28.9	19.2	12.1
2	17.3	19.9	18.5	16.4
3	17.8	16.3	16.4	18.7
4	20.5	10.1	17.8	22.5
5	21.0	12.2	18.8	22.7
ADG comorbidity score, ^b M±SE	4.26±0.05	15.89±0.40	7.26±0.09	1.95±0.05
Smoking status				
Current smoker	22.8	17.9	19.9	24.8
Former smoker	23.0	37.3	28.2	19.2
Non-smoker	54.0	44.6	51.7	55.9
Alcohol consumption				
Current non-drinker; No alcohol consumption in the past 12 months	19.1	23.9	15.6	19.1
Occasional drinker; <1 drink the past month	16.6	19.0	15.00	16.6
Regular drinker	56.7	52.2	60.1	56.7
Binge drinker	7.2	4.50	9.10	7.20
Physical activity status				
Active	24.8	21.4	27.30	24.8
Moderate	24.9	24.6	25.30	24.9
Inactive	50.2	53.9	47.40	50.2
BMI				
Underweight, BMI <18.5	2.70	2.50	2.80	2.70
Normal weight, BMI 18.5–24.9	45.5	40.1	49.20	45.5
Overweight, BMI 25–29.9	33.4	34.0	32.80	33.4
Moderately obese, BMI 30–34.9	11.3	13.5	9.80	11.3
Very/severely obese BMI ≥35	7.10	9.90	5.30	7.10

^aWeighted using bootstrap weights provided by Statistics Canada; sampling weights were used to produce population estimates.

^bADG score is a weighted score based on an individual's ADGs. Austin's weighted ADG score has been described and validated elsewhere.²² ADG, aggregated diagnosis group.

annual healthcare costs, compared with Can\$3,393 and Can\$386 in the top 6%–50% and bottom 50%, respectively.

Women, the elderly, immigrants, those with less than post-secondary education, and those with lower income were among those more likely to become an HCU (Table 1). Pre-existing chronic conditions, or the presence of risk factors such as smoking, physical inactivity, or alcohol consumption, were independent predictors of becoming an HCU. Poor life satisfaction was associated with older age, immigrants, lower education and income, presence of chronic conditions at baseline, and chronic disease risk factors (Table 2).

Life satisfaction had a strong unadjusted relationship with increasing levels of healthcare cost (Appendix Table 1, available online). Table 3 presents adjusted ORs for the relationship between life satisfaction and HCU for models that include age and sex, and then further adjusted for comorbidity level using the ADG score, and finally, a set of social and lifestyle factors. Although adjustment reduces the size of effect in the fully adjusted model, the odds of an individual with the lowest level of life satisfaction compared with those that reported being very satisfied or satisfied, becoming a highest 5% HCU relative to the lowest 50% is 3.05 (95% CI=1.61, 5.80). Those with the lowest life satisfaction, compared with those that reported being very satisfied or satisfied, were also at increased odds of being in the middle utilization category (6%–50%) with a significant OR of 2.24 (95% CI=1.60, 3.14). Interestingly, the effect sizes for being satisfied and dissatisfied were similar across models, suggesting minimal difference in these classifications. All models had a significant *p*-value for trend for the decreasing levels of life satisfaction (*p*<0.001).

A range of analyses were conducted to test the robustness of the findings, including modeling various continuous forms of age and the comorbidity score. None of these analyses meaningfully changed the results such that the effect size comparing the highest users to the bottom 50% ranged from 2.82 to 3.10 across model variations, which is similar to the fully adjusted result in the main model of 2.99 (Appendix Table 2, available online).

DISCUSSION

Life satisfaction is increasingly being recognized as an important determinant of overall health, but little is known about the impacts on healthcare utilization and costs to the healthcare system. This association was generated in a longitudinal design by linking individual survey respondents from a representative population-

based survey to healthcare records from a single-payer health system, and accounted for a wide range of demographic, socioeconomic, and clinical factors that could confound the association. Poor satisfaction in life was a strong and independent predictor of higher healthcare utilization with the lowest level of life satisfaction associated with three times higher odds of being in the highest cost category (top 5%) compared with those who are satisfied with their life, after accounting for confounders.

Previous studies have linked life satisfaction with health outcomes, such as cardiovascular disease²⁷ and mortality.² Life satisfaction has also been linked with a range of health behaviors. For example, being less satisfied with life may result in people being more likely to undertake risky behaviors, such as smoking or excess alcohol consumption.²⁸ Further, those that are dissatisfied in life may be living in poorer socioeconomic conditions, which is known to result in poor health outcomes and high healthcare utilization.^{13,14} Given the detailed survey variables, adjustments were possible for individual levels of SES and, although it did lessen the association, a strong relationship between reporting life dissatisfaction and being an HCU of health care persisted across all models. In addition to the detailed survey variables, all respondents were linked to all their healthcare utilization prior to the survey date and thus were able to ascertain objective measures of comorbidity and healthcare utilization and adjust for these in the analyses.

To the authors' knowledge, this is the first time that population-based health survey data linked with health administrative data has been used to investigate the association between life satisfaction and healthcare utilization; addressing an important gap in the literature that has relevance to health system sustainability. The design of this study is important because it allows capture of life satisfaction among people who were not high users of health care at baseline (i.e., not in the top 5% of healthcare costs). This overcomes a criticism of other studies looking at the impacts of life satisfaction where reverse causation may account for an observed relationship. Regardless of behavioral and clinical determinants of high healthcare utilization that may also affect life satisfaction, one explanation proposed for the relationship is the fact that increased life distress has physiologic impacts that have broad health effects that contribute to disease,²⁷ including complex chronic conditions, that would translate into high healthcare utilization. A recently published study using ecologic momentary assessment with a novel smartphone app showed that physical activity correlated with levels of happiness.²⁹ Therefore, people that are happier may engage in healthier behaviors, such as physical activity, which may suggest one

Table 2. Weighted Distribution of Characteristics in the Study Cohort According to Life Satisfaction

Characteristic	Life satisfaction			
	Very satisfied (n=77,558)	Neither satisfied or dissatisfied (n=4,765)	Dissatisfied (n=2,413)	Very dissatisfied (n=489)
Sex				
Male	48.9	46.4	49.3	45.4
Female	51.1	53.6	50.7	54.6
Age group				
< 40 years	41.2	45.5	32.2	29.3
40–49 years	22.1	21.2	28.5	24.8
50–59 years	16.6	16.9	21.0	27.2
60–69 years	10.9	9.40	10.4	8.8
70–79 years	6.70	4.70	5.2	6.6
≥80 years	2.50	2.3	2.6	3.3
Immigrant				
No	68.4	61.5	59.3	62.7
Yes	31.3	38.2	39.8	37.1
Highest household education				
No post-secondary education	16.3	18.6	24.3	26.5
Post-secondary education	78.0	73.5	68.7	65.3
Household income quintile				
1	13.9	24.8	32.4	36.8
2	17.0	21.1	18.2	18.4
3	17.9	18.1	13.4	13.0
4	21.1	14.0	14.5	13.2
5	21.8	12.9	12.6	8.8
ADG comorbidity score, ^b M±SE	4.12±0.05	5.00±0.25	6.49±0.37	8.34±0.70
Smoking status				
Current smoker	21.8	31.7	36.1	40.8
Former smoker	23.3	18.9	21.1	18.7
Non-smoker (former occasional smoker or never smoker)	54.8	49.3	41.9	40.5
Alcohol consumption				
Current non-drinker; no alcohol consumption in the past 12 months	18.6	22.6	28.1	31.8
Occasional drinker; < 1 drink the past month	16.1	21.1	21.8	27.8
Regular drinker	57.9	48.8	40.4	32.0
Binge drinker	7.2	7.3	8.6	7.8
Physical activity status				
Active	25.6	17.9	16.1	15.8
Moderate	25.4	21.1	18.7	16.4
Inactive	48.9	60.7	65.1	67.8
BMI				
Underweight, BMI < 18.5	2.6	3.6	3.8	3.9
Normal weight, BMI 18.5–24.9	45.8	43.9	40.7	39.6
Overweight, BMI 25–29.9	33.7	30.5	30.8	29.0
Moderately obese, BMI 30–34.9	11.2	11.9	13.5	17.6
Very/severely obese, BMI ≥35	6.8	10.0	11.2	10.0

Note: Values are unweighted percentages unless otherwise noted.

^aWeighted using bootstrap weights provided by Statistics Canada; Sampling weights were used to produce population estimates.

^bADG score is a weighted score based on an individual's ADGs. Austin's weighted ADG score has been described and validated elsewhere.²² ADG, aggregated diagnosis group.

Table 3. Multivariable AORs^a and 95% CIs From Multinomial Logistic Regression

Life satisfaction	Unadjusted			Age-sex adjusted			Minimally adjusted ^b			Fully adjusted ^c		
	Top 5%	Top 6%-50%	Top 5%	Top 5%	Top 6%-50%	Top 5%	Top 5%	Top 6%-50%	Top 5%	Top 6%-50%	Top 5%	Top 6%-50%
Very satisfied or satisfied	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Neither satisfied nor dissatisfied	71.40 (1.08, 1.82)**	1.17 (1.07, 1.29)**	1.95 (1.48, 2.54)**	1.33 (1.21, 1.47)**	1.77 (1.34, 2.33)**	1.33 (1.21, 1.47)**	1.27 (1.16, 1.40)**	1.37 (1.21, 2.31)*	1.17 (1.05, 1.30)**			
Dissatisfied	2.89 (2.05, 4.07)**	1.70 (1.44, 2.00)**	4.15 (2.85, 6.05)**	2.00 (2.00, 1.68)**	3.57 (2.44, 5.24)**	2.00 (2.00, 1.68)**	1.91 (1.59, 2.30)**	2.24 (1.60, 3.14)**	1.68 (1.38, 2.04)**			
Very dissatisfied	3.44 (1.33, 6.12)**	1.81 (1.32, 2.49)**	4.23 (2.23, 8.03)**	1.97 (1.35, 2.87)**	3.35 (1.79, 6.26)**	1.97 (1.35, 2.87)**	1.78 (1.23, 2.57)**	3.05 (1.61, 5.80)**	1.66 (1.12, 2.46)**			
p-Trend	**	**	**	**	**	**	**	**	**			

Note: Values are multivariable AOR (95% CI). Boldface indicates statistical significance (* $p < 0.05$, ** $p < 0.01$).

^aMultivariable AORs comparing the highest cost users (top 5%) and the top 6%-50% to the bottom 50% according to life satisfaction.

^bMinimally adjusted model includes age, sex and adjusted diagnostic groups (ADG) comorbidity score.

^cFully adjusted model includes age, sex and ADG comorbidity score, smoking, alcohol consumption, physical activity level, immigrant status, survey cycle, and household income.

potential pathway for explaining the link between happiness and health outcomes. Indeed, the majority of high users are driven by noncommunicable diseases¹² and previous studies have demonstrated the impact of modifiable chronic disease risk factors, such as smoking, on becoming an HCU.^{13,14} The results supported the role of modifiable chronic disease risk factors, given the attenuation of the effect seen following adjustment for these factors.

One explanation for the observed findings may be that those that are dissatisfied with life may also be affected by depression. According to Diener et al.,³⁰ subjective well-being relates more to the amount of time one feels positive than with the intensity of positive feeling and, accordingly, the inverse correlation between life satisfaction and depression seems to go from moderate to strong.³¹ Previous studies show that depression affects quality of life and increases health service utilization.³² Direct measures of depression were not available in this study, although adjustments were made for stable and unstable psychosocial comorbidity through the ADGs. With further adjustment for clinically defined depression, a further attenuation in the relationship between life dissatisfaction and increased healthcare use may be observed.

Limitations

There are a number of important limitations to consider in this study. First, this is an observational study and thus drawing direct causal links should be done with caution. Importantly, this study controlled for a wide range of known confounders in both surveyed variables and through prior healthcare utilization and comorbidity assessment. Second, reported satisfaction with life is a subjective measure. Although it is used in many studies as a robust indicator of happiness, it reflects individual judgments of the survey respondents. Third, given that the health system does not cover drugs for those under the age of 65 years, those costs are not incorporated into resource calculations. This means that there may be those aged less than 65 years who would effectively be high users if out-of-pocket drug costs were considered. It is not anticipated that this misclassification would be related to life satisfaction and thus would not bias the relationship between life satisfaction and healthcare utilization. Finally, life satisfaction was only assessed at one point, the baseline of the cohort. It is possible that satisfaction changed during the study period, which may have affected the associations. Despite these limitations, this study contributes in important ways to the literature by providing the first longitudinal assessment of life satisfaction on healthcare utilization and costs in a nationally representative population-based cohort with

detailed accounting for self-reported and prior comorbidity and healthcare utilization.

CONCLUSIONS

This study demonstrates that life satisfaction is associated with future HCU healthcare status, even after accounting for health behaviors, socioeconomic determinants, and overall comorbidity. Studying the impact of life satisfaction in the context of healthcare utilization is important. Governments around the world are struggling to determine how to best manage future healthcare costs and improve population health. This study supports the view that factors outside the healthcare system, and even outside traditional health behaviors, may be important to consider. For example, rather than health interventions, perhaps social policy interventions that lead to improved life satisfaction should be considered as a means of addressing increasing healthcare utilization costs.

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VG and LR conceived the study, planned the analyses, and drafted the manuscript. AA contributed to the analytic plan and the literature review. LF ran all analyses. All authors reviewed and contributed to the final version of the manuscript.

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SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at <https://doi.org/10.1016/j.amepre.2018.04.004>.

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