

WHICH HEALTH CONDITIONS CAUSE THE MOST UNHAPPINESS?

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SUMMARY

This paper assesses the effects of different health conditions on happiness. Based on new data for Latin America, we examine the effects of different conditions across age, gender, and income cohorts. Anxiety and pain have stronger effects than physical problems, likely because people adapt better to one-time shocks than to constant uncertainty. The negative effects of health conditions are very large when compared with the effects of income on happiness. And, while higher peer income typically elicits envy, better peer health provides positive signals for life and health satisfaction. Health norms vary widely across countries. Copyright © 2010 John Wiley & Sons, Ltd.

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1. INTRODUCTION

Do the health standards and conditions of those around you affect your life and health satisfaction? Should we attach more policy weight to particular diseases or conditions? To quality of life more generally? To mental or physical health, or preventive versus curative care? Do the old and the young – or the poor and the wealthy – rate health conditions the same way? Should the vote of patients and publics be weighted equally? There is substantial debate over how to make these decisions, not least because it is difficult to attach values to different health states. Novel methods for doing so can guide policymakers in decisions about how much to weigh investments in the treatment and prevention of various ailments and in their optimal allocation across cohorts.

Standard economic approaches rely on revealed preferences as proxies for welfare or utility. This is based on the assumption that what people say – as in survey data – has no consequence and therefore is not reliable data. Thus, economists traditionally relied on the information that comes from actual choices – such as consumption – and avoided survey data. Yet there are any number of questions – many of them pertaining to health – in which individuals do not have the agency to exercise an optimal choice, and thus revealed preferences provide limited if any information. The welfare effects of institutional arrangements that individuals are powerless to change, or behaviors that are driven by norms, addiction, or self-control problems, are prime examples. Survey data based on reports of happiness or reported well-being are very useful for shedding light in such instances, and are increasingly being used in economics research (Graham, 2008a).

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Survey data on reported well-being or ‘happiness’ are based on open-ended questions which are placed up front in the surveys, so as not to frame responses with prior questions. The questions are, typically, ‘generally speaking, how happy are you with your life’ or ‘how satisfied are you with your life’, with answers ranging from very unhappy/unsatisfied to very happy/satisfied on a 4 to 7-point scale. The definition of happiness or well-being is left up to the respondent, which avoids the imposition of cultural or country specific definitions of well-being on the respondents. There is remarkable consistency in the basic socio-economic determinants of the responses to these surveys in cultures and countries across the world, which both speaks to their validity and allows for the comparison of variance in the effects of these other factors – such as institutional arrangements, macroeconomic and/or health conditions, and the environment – on well-being.

Using revealed preferences for valuing health conditions, for example, results in gauging the relative weights of health conditions by how much individuals are willing to pay for particular treatments. Applying such approaches to health policy raises normative questions, not least as the poor typically under-report illness, under-invest in health, are less likely to demand better health care, and are surely willing to pay less, as they have less resources to begin with.¹

A number of scholars have developed alternative approaches to valuing health conditions (discussed below), all of which have contributed to our understanding of the relationship between health and well-being. Yet there are still many unanswered questions. Prominent among these is the variance in reported health which cannot be explained by objective differences, but rather is linked to norms, expectations, and other unobservable factors. For example, objective health indicators are better in the Netherlands than in the United States, yet reports of work-related disability are higher in the former.² Reports of conditions like diabetes and hypertension, meanwhile, are notoriously inaccurate, particularly in poor countries where awareness is low. Across all countries, they are mediated by income and education, among other factors.³

Our recent research⁴, as well as that of some others like Angus Deaton, finds evidence of unusually high tolerance for poor health and health systems among the poor in many countries. Across countries, there is no clear relationship⁵ between per capita income levels and health satisfaction: it is surprisingly high in some poor countries, like Guatemala, and surprisingly low in wealthier countries with much better health systems, like Chile. Within countries, the rich are more satisfied with their health than are the poor, and objective measures, such as morbidity and life expectancy, track with socioeconomic status. Yet the gaps in the assessments of satisfaction are much smaller than gaps in objective conditions (quality, access, outcomes) would predict. The same often holds across education, job, and economic satisfaction domains.⁶ This paradox is due to lower expectations and available information among those living in poorer contexts, as well as to lower expectations.

Another and related issue is adaptation. In research on happiness around the world, Graham (2010) finds that humans have a remarkable capacity to adapt to extreme adversity and still report to be happy. Respondents in Afghanistan, for example, are happier than the world average, on par with Latin Americans, and 20% more likely to smile in a day as Cubans. While this ability to adapt may be a good thing from an individual psychological perspective – in other words individuals can retain their natural cheerfulness despite adversity – it may also result in collective tolerance for bad equilibrium such as

¹Sen’s description of entrenched deprivation, for example, shows how desire fulfillment is neglectful of the claims of those who are too subdued to have the courage to desire too much. See Dolan and Kahneman (2008).

²Kaptein *et al.* (2007).

³See Thomas and Frankenburg (2000); and Parker *et al.* (2008).

⁴*Beyond Facts* (2008).

⁵The significant positive association between health satisfaction and per capita income across countries worldwide is not robust to splitting the sample between high income and low income countries.

⁶Of course, this could also be a pessimism bias of the rich. See *Beyond Facts* (2008), Graham and Chattopadhyay (2008) and Deaton (2008).

poor norms of health. Another issue is cognitive forecasting. A substantial literature shows that individuals mis-predict what will make them happy in the future – typically investing more in the pecuniary area, such as large houses and cars, rather than in the non-pecuniary area such as health or stable partnerships (Easterlin, 2003; Kahneman, 2000). Yet the well-being gains of the former are short-lived compared with those in the latter arena. While an extensive review of these literatures is beyond the scope of this paper, it is relevant to note that each can help explain seeming paradoxes in norms of health across cohorts.

In this paper, we attempt to explain the variance in tolerance across socioeconomic and other cohorts, and the extent to which it is mediated by types of health conditions and by social and cultural norms. We propose a new method for addressing some of these puzzles, which relies on happiness economics as a point of departure and is based on comparisons between individuals' reporting suffering (or not) from an index of specific health conditions on the one hand, and their life and health satisfaction scores on the other. A nascent literature establishes a positive correlation between happiness and better health, although it is difficult to definitively prove causality – it likely runs in both directions. Health, meanwhile, is one of the most important determinants of happiness in virtually every context in which it has been studied.⁷

Our empirical work is based on a unique data set, which combines health and life satisfaction assessments with a widely accepted measure of health – the EQ5D, which captures five dimensions of health across physical and mental domains. While the EQ5D is based on self-reports, it has been widely used as a tool to assess health status in both Europe and the United States. Our data set covers respondents in 19 countries in Latin America.

We look at health status in its entirety and then explore how effects of individual health conditions, as well as variance across income, gender, and age cohorts. We explore the extent to which variance is explained by social connections and by differences in health norms (and other un-observables) across countries. We also compare the values attached to the various health states based on subjective evaluations of health and life satisfaction with those derived by medical studies based on patients' preferences. Finally, we generate life satisfaction equivalents (in US PPP dollars) for various health conditions.

2. METHODS FOR EVALUATING HEALTH CONDITIONS

Our analysis takes the work of a number of scholars in evaluating health conditions as a point of departure. Time trade-off methods give individuals time scales on which to trade-off healthy life years for years spent in particular health conditions, allowing respondents to rank conditions on a 1 to –1 scale. Those conditions ranked below zero are considered worse than death.⁸ Experience sampling methods typically ask people to rate their different feelings at various points in the day. Daily reconstruction methods divide the previous day into various episodes and then rate different elements of affect during these activities on a 0–6 scale.⁹ They have been used on large samples, and often highlight factors that survey research does not, such as the importance of sleep quality – over that of marriage or income – to good feelings.¹⁰

Our work is based on the EQ5D descriptive system which consists of five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The 'usual activities' variable

⁷For a review, see Graham (2008b). Guven and Saloumides use the German socio-economic panel to show that happier people live longer. Guven and Saloumides (2009). A well-known study of American nuns corroborates this. See Chapter 4 of Graham (2010).

⁸See Dolan (1997).

⁹Kahneman (2000) and Kahneman and Krueger (2006).

¹⁰Dolan and Kahneman (2008); and Dolan (1997).

pertains to respondents' typical daily routine: going to work and school, leisure time, and so on. Each dimension has three levels, reflecting no health problems, moderate problems, and extreme problems. The original EQ5D studies were conducted in the United Kingdom and then implemented in the United States, Germany, Spain, and Denmark, among others. The original UK study was led by Professor Alan Williams and also included Paul Dolan, who authored a subsequent paper reporting the analysis of the UK survey (Dolan, 1997). It covered 2997 respondents in 1993.¹¹ The US study was led by Professor Stephen Coons and included James Shaw, who, like Dolan, subsequently co-authored a paper recording the results. (Shaw *et al.*, 2005). That US study was conducted in 2002 and was based on 12 000 respondents.¹² Values were attached to responses on each of the conditions. Health state preferences, based on a time trade-off method, were then developed by the same authors. With this method, respondents are posed questions that indirectly get at how many healthy life years they would trade off to not have the particular conditions that they report. (The details of the method are in Appendix A).

Regression results based on the UK and US responses demonstrate that any move away from full health was associated with a substantial loss of utility. The largest loss for a moderate drop was associated with pain or discomfort, an effect that was four times greater than that for a corresponding move on the usual activities dimension. Pain or discomfort continued to dominate the weighting for level 3, although mobility level 3 (confined to bed) was given a similar weight. For most dimensions, the move from moderate to extreme conditions caused a much greater loss in utility than did moving into a moderate condition from full health.¹³

2.1. Our data

In collaboration with the Gallup World Poll and the Inter-American Development Bank, we were able to include the EQ5D questions in a sample of approximately 14 000 respondents across 18 Latin America countries in the Gallup Poll for 2007.¹⁴ The questionnaire also included questions on health and life satisfaction. Latin America provides an excellent laboratory for examining variance across socioeconomic levels, as it includes countries with incomes ranging from near OECD levels to near sub-Saharan African levels, as well as high levels of income variance *within* each set of countries.

The Gallup Poll has been conducted in more than 130 countries world wide since 2006, providing the widest coverage to date by a poll that includes reported well-being. The country samples are nationally representative and respondents 15 years old or more. All interviews in Latin America were conducted face to face, and household members were selected randomly. Household members were selected randomly (from those 15 years or older) to avoid bias coming from interviewing only the first available household member. The survey is particularly rich in self-reported measures of quality of life, opinions, and perceptions. It also includes basic questions on demographics, education, and employment, and a question on household income.

The 2007 wave surveyed roughly 150 000 persons, 21 200 of them from the 23 LAC countries included in the survey (all the 17 Latin countries plus the main nations in the Caribbean according to their population: Cuba, Dominican Republic, Haiti, Jamaica, Puerto Rico, and Trinidad and Tobago). The country samples have around 1000 observations, except in Haiti, Jamaica, Puerto Rico, and Trinidad & Tobago, which have about 500 observations. The basic socio-demographic statistics (age, gender composition, number of children, and rural–urban composition) from the Gallup Poll are

¹¹See Dolan (1997).

¹²The study initially over-sampled blacks and Hispanics, to ensure adequate representation of minorities. James *et al.* (2005).

¹³For a more detailed discussion of both methodology and results, see Dolan (1997).

¹⁴See www.euroqol.org. The only difference was the scale used for the health state, which was 0–10, instead of 0–100 in the original EQ5D. See Inter-American Development Bank (2008).

Table I. Basic descriptive statistics, national averages

	Per capita GDP 2007	Life expectancy at birth	Infant mortality rate	Age	Male	Urban	Population with complete secondary or higher	Health satisfaction [0,1]	Health state [0,10]	EQ-5D Health Score [Max 1]	Own poc health expenditu
Country	Constant 2000 US\$	Total (years)	Per 1000 live births	Average (years)	(%)	(%)	(%)	(%)	Average	Average	(%)
Venezuela, RB	\$ 5784	73.56	16.21	40.07	38.10	72.80	56.15	92.56	na	na	na
Brazil	\$ 4274	72.16	19.30	41.71	41.33	73.51	42.89	84.74	7.74	0.88	17.05
Mexico	\$ 6543	74.91	16.10	36.97	49.65	61.86	36.27	86.67	7.81	0.92	45.05
Costa Rica	\$ 5124	78.79	10.25	37.61	50.40	64.10	34.53	93.58	8.47	0.93	18.46
Argentina	\$ 9360	75.15	15.00	42.20	39.80	82.88	47.05	86.04	7.50	0.90	21.90
Belize	\$ 3678	76.04	17.53	34.75	48.61	29.88	52.00	86.40	7.53	0.94	38.45
Bolivia	\$ 1125	65.36	48.07	37.52	43.20	51.19	62.87	82.64	6.57	0.88	80.00
Chile	\$ 6082	78.50	7.40	46.36	41.74	65.62	70.27	68.44	2.66	0.86	26.20
Colombia	\$ 2955	72.75	16.99	40.17	33.10	50.00	67.61	84.21	7.65	0.91	24.10
Cuba	na	78.51	5.00	41.71	50.20	100.00	na	76.82	na	na	na
Dominican Republic	\$ 3491	72.43	27.81	40.78	42.90	58.80	49.67	83.28	7.60	0.92	62.10
Ecuador	\$ 1657	74.99	21.90	38.54	37.79	58.34	54.48	80.02	6.51	0.93	80.30
El Salvador	\$ 2622	71.06	16.87	36.85	47.75	47.90	45.87	84.07	7.24	0.94	64.94
Guatemala	\$ 1878	70.12	29.68	34.72	49.90	61.96	50.49	92.96	7.89	0.94	67.90
Guyana	\$ 1070	66.59	47.40	36.23	49.70	33.53	68.52	87.32	7.38	0.93	37.13
Haiti	\$ 388	60.96	56.78	34.23	50.69	50.30	na	53.60	na	na	na
Honduras	\$ 1410	71.98	26.53	34.99	49.50	44.20	26.72	88.26	7.47	0.92	73.90
Jamaica	\$ 3862	71.63	26.06	35.14	48.80	39.41	na	90.89	na	na	na
Nicaragua	\$ 886	72.77	24.04	33.97	50.70	53.70	45.57	80.48	7.20	0.89	65.70
Panama	\$ 5196	75.50	19.47	37.96	50.10	69.74	55.07	89.53	8.01	0.96	45.30
Paraguay	\$ 1459	71.69	24.43	40.12	36.50	52.81	40.73	80.68	7.31	0.93	69.60
Peru	\$ 2692	73.02	23.45	37.34	42.60	66.20	72.25	79.04	6.38	0.89	72.70
Puerto Rico	na	78.43	na	50.35	38.60	42.48	na	83.30	na	na	na
Trinidad and Tobago	\$ 10 738	69.10	31.10	38.71	50.00	12.72	na	82.57	na	na	na
Uruguay	\$8095	75.86	12.10	46.40	41.73	91.33	69.85	84.80	7.29	0.92	8.67
Total Lac	3929	75.87	23.31	39.02	44.94	57.41	52.44	83.32	7.38	0.92	48.39

Source: Authors' calculations using Gallup World Poll (2007) and The World Bank data. *Notes:* 2006 data for Jamaica, Puerto Rico, Trinidad and Tobago, Cuba, and Haiti. 2007 data for the other countries. (na) data not available. (*) If you had to go to a hospital because of an accident or illness, who would take care of the cost of your assistance?

consistent with those in the household surveys collected by the National Statistical Offices (NSO) of the LAC countries.¹⁵ Descriptive statistics for the Gallup data are in Table I.

Our analysis uses the same 3*5 EQ5D categories and possible responses, and indexed onto an 11-point scale.¹⁶ We use the coefficients from separate life and health satisfaction equations which include the different EQ5D categories as the basis for assessing the well-being 'costs' of different scores on these categories, both for the full sample and also for specific age, gender, and income cohorts. The underlying intuition is that both objective health conditions and tolerance for those conditions vary across these cohorts. In Latin America, for example, men are less likely to report pain and anxiety in the EQ5D, but more likely to report extreme difficulties with usual acts.

¹⁵This comparison is based on data sets processed at CEDLAS and the World Bank's LAC Poverty Group (LCSPG), with the help of the MECOVI Program at the Inter-American Development Bank. See www.cedlas.org.

¹⁶This is distinct from some of the earlier work in the health economics literature, where the EQ-5D index refers to the utility-weighted index form of the measure. In that work, the EQ-5D is normally scaled from 0 to 100.

3. ECONOMETRIC STRATEGY

Our basic question is how health status as assessed by the EQ5D relates to more subjective evaluations – life and health satisfaction. Our usage of framed health satisfaction and open-ended life satisfaction questions allows us to explore how the relationship varies depending on the question used. Our basic model uses these questions as dependent variables, and socio-demographic traits, individual level income, the EQ5D as a measure of objective health, and controls for shared country level characteristics as right hand side variables. The full equations are Appendix B; our method for assigning relative weights to the respective health conditions is in section C.

We use two separate questions in the Gallup Poll. The first is a 0–10 question, which asks respondents: ‘Using a scale from 0 to 10 which the best state you can imagine is marked 10 and the worst is marked 0, indicate how good or bad your own health is today.’ Responses to this question are skewed to the right, higher end of the scale.

The second question is a life satisfaction question, based on Cantril’s original best possible life question, which asks respondents: ‘Please imagine a ladder/mountain with steps numbered from zero at bottom to ten at the top. The top of the ladder/mountain represents the best possible life for you and the bottom represents the worst possible life for you. On which step of the ladder would you say that you personally feel that you stand at this time, assuming that the higher the step the better you feel about your life and the lower then step the worst you feel about it? Which step comes closest to the way that you feel?’ Responses to this question are normally distributed (bell shaped). It is important to note that this ladder based life satisfaction question is more framed than a completely open-ended happiness question, and thus responses to the former typically correlate more closely with income.¹⁷

4. RESULTS

At a general level, the EQ5D score is strongly and significantly correlated with subjective health status and with life satisfaction, although the effect is five times larger for health than for life satisfaction. In contrast, material goods, such as assets and telephones, are more important to life satisfaction than they are to health satisfaction. Telephones likely affect life satisfaction in two ways. They are status goods in many developing countries, and they also facilitate friendships and social networks.¹⁸ These latter goods maintain their significance on life satisfaction but not health satisfaction when individual optimism controls are included.

We also explored the effects of the individual EQ5D conditions. The negative effects of extreme conditions in self-care and mobility on both life satisfaction and health satisfaction disappear when a control for personal optimism is included. The latter is a method that controls for unobservable personality traits. In the absence of panel data, which allows for the inclusion person fixed effects, we measure personal optimism as the tendency of the individual to respond affirmatively to a number of satisfaction questions in the Gallup survey. We then calculate the first principal component of the residuals of all the regressions for the satisfaction questions on all the objective variables that might help explain satisfaction.

It is likely that people adapt to physical conditions, and inherent character traits are, in the long run, able to maintain satisfaction despite (irreversible) objective conditions. In contrast, extreme pain, extreme anxiety, and the usual activities continue to have negative effects on health satisfaction when the optimism control is included, suggesting that even naturally optimistic people cannot adapt to these conditions. In general, moderate conditions have a more consistent effect, as only a few people report having extreme conditions (Table II).

¹⁷See Graham *et al.* (2010).

¹⁸Labonne and Chase (2008).

Table II. Basic results

	Health satisfaction 0–10				Life satisfaction 0–10			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 if male	0.132*** [0.041]	0.113** [0.040]	0.110** [0.038]	0.088** [0.036]	−0.162*** [0.041]	−0.166*** [0.042]	−0.248*** [0.043]	−0.253*** [0.043]
Age	−0.035*** [0.006]	−0.034*** [0.006]	−0.037*** [0.008]	−0.036*** [0.007]	−0.054*** [0.009]	−0.052*** [0.009]	−0.059*** [0.010]	−0.057*** [0.010]
Age squared	0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]	0.001*** [0.000]	0.000*** [0.000]
Log, monthly per capita household income, US\$ PPP	0.166*** [0.028]	0.147*** [0.028]	0.171*** [0.030]	0.155*** [0.030]	0.330*** [0.033]	0.326*** [0.031]	0.302*** [0.028]	0.302*** [0.028]
1 if urban	0.092* [0.049]	0.082 [0.049]	0.131** [0.059]	0.118* [0.062]	−0.074 [0.060]	−0.072 [0.061]	0.011 [0.063]	0.014 [0.065]
1 if married	0.012 [0.048]	0.012 [0.043]	0.043 [0.062]	0.038 [0.056]	−0.024 [0.046]	−0.022 [0.044]	0.073 [0.059]	0.074 [0.058]
1 if divorced	0.089 [0.095]	0.056 [0.086]	0.106 [0.107]	0.044 [0.093]	−0.057 [0.071]	−0.049 [0.072]	−0.035 [0.082]	−0.033 [0.085]
1 if widow	0.143* [0.079]	0.150* [0.077]	0.188* [0.096]	0.185* [0.096]	0.118 [0.102]	0.137 [0.100]	0.201* [0.112]	0.213* [0.111]
1 if has one child	0.080* [0.046]	0.071 [0.042]	0.053 [0.058]	0.039 [0.057]	0.021 [0.052]	0.02 [0.050]	−0.005 [0.048]	−0.008 [0.048]
1 if has more than one children	0.114* [0.049]	0.098* [0.049]	0.093 [0.070]	0.079 [0.071]	−0.018 [0.055]	−0.022 [0.055]	0.023 [0.065]	0.017 [0.066]
1 if has friends	0.238*** [0.040]	0.233*** [0.037]	0.164** [0.057]	0.152** [0.054]	0.611*** [0.069]	0.596*** [0.069]	0.444*** [0.072]	0.432*** [0.073]
1 if has running water	0.063 [0.068]	0.063 [0.070]	0.108 [0.081]	0.105 [0.083]	0.106 [0.110]	0.112 [0.110]	0.145 [0.087]	0.151 [0.087]
1 if has electricity	0.233* [0.105]	0.216* [0.113]	0.128 [0.084]	0.106 [0.091]	0.456* [0.260]	0.452* [0.258]	0.179 [0.176]	0.18 [0.183]
1 if has telephone	0.02 [0.035]	0.021 [0.032]	−0.026 [0.035]	−0.03 [0.034]	0.224*** [0.065]	0.224*** [0.063]	0.218*** [0.059]	0.215*** [0.059]
Assets, PCA 1st component score	0.053*** [0.015]	0.050*** [0.015]	0.047*** [0.013]	0.045*** [0.013]	0.201*** [0.029]	0.202*** [0.029]	0.206*** [0.032]	0.206*** [0.032]
Psychological traits score			0.112*** [0.020]	0.108*** [0.021]			0.397*** [0.022]	0.393*** [0.023]
EQ5D index	5.455*** [0.197]		5.188*** [0.192]		1.765*** [0.245]		1.436*** [0.273]	
Mobility moderate		−0.448*** [0.055]		−0.460*** [0.071]		0.058 [0.066]		0.086 [0.083]
Mobility extreme		−0.792** [0.365]		−0.032 [0.500]		0.216 [0.283]		0.091 [0.554]
Self-care moderate		−0.198 [0.121]		−0.142 [0.177]		0.026 [0.143]		0.157 [0.125]
Self-care extreme		−0.13 [0.278]		−0.236 [0.467]		0.283 [0.458]		0.281 [0.422]

Table II. *Continued*

	Health satisfaction 0–10				Life satisfaction 0–10			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Usual activities moderate		–0.726*** [0.102]		–0.690*** [0.123]		–0.325*** [0.107]		–0.230* [0.120]
Usual activities extreme		–0.994** [0.447]		–1.136* [0.577]		–0.804* [0.424]		–0.498 [0.562]
Pain moderate		–1.027*** [0.067]		–1.016*** [0.067]		–0.125 [0.073]		–0.135 [0.094]
Pain extreme		–2.185*** [0.147]		–2.143*** [0.171]		–0.451** [0.194]		–0.477** [0.195]
Anxiety moderate		–0.540*** [0.050]		–0.480*** [0.048]		–0.459*** [0.078]		–0.303*** [0.097]
Anxiety extreme		–1.026*** [0.151]		–0.883*** [0.176]		–0.842*** [0.146]		–0.786*** [0.213]
Constant	2.207*** [0.216]	7.775*** [0.186]	2.619*** [0.201]	7.912*** [0.196]	3.288*** [0.336]	5.062*** [0.312]	3.974*** [0.331]	5.385*** [0.320]
Observations	12335	12335	8249	8249	12279	12279	8250	8250
Adjusted R squared	0.344	0.368	0.338	0.363	0.203	0.205	0.253	0.254
Countries	19	19	17	17	19	19	17	17
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors in brackets Robust standard errors in brackets.

People seem to be less able to adapt to the unpredictability of certain health conditions than they are to the unpleasant certainty of others. The well-being of paraplegics, for example, typically adapts back to its pre-accident levels, while many epileptics face a lifetime of uncertainty about the timing of seizures. Epilepsy – and in particular higher age of onset – poses lasting negative effects on quality of life, and adapting to that uncertainty seems to be more difficult later in life.¹⁹

Arie Kapteyn finds that well-being is more affected by anxiety about certain conditions, such as financial or health difficulties, than it is by the difficulties themselves.²⁰ Graham *et al.* find that innate optimism mediates the intensity of the effects of anxiety, such as fear of unemployment, on well-being.²¹ Optimism likely mediates the anxieties related to particular health conditions. Finally, different levels of tolerance for disease and pain also mediate the relationship between objective and subjective health conditions. Country level controls – e.g. ‘dummies’ – account for these cross country differences in our equations.

When we analyzed the EQ5D components individually, they have less of an effect on life satisfaction than they do on health satisfaction, suggesting the multi-faceted nature of life satisfaction responses compared with those of health evaluations (Table II). We next inter-acted our gender, age, and income variables – in separate respective equations – with the EQ5D index. With personal optimism controls included, the results were insignificant.²² In contrast, when we inter-acted the same three variables with each of the EQ5D components separately, there were significant results. Age moderates difficulties with usual acts – perhaps as older people expect to have these difficulties, but makes anxiety worse. Income moderates the effects of extreme pain on life satisfaction, but makes difficulties with self-care worse, perhaps because wealthier people have higher health expectations to begin with. Finally, gender moderates mobility and anxiety problems: men seem to feel the negative effects of mobility problems more than women do, while the latter suffer worse effects from anxiety.²³

We tested for the effects of two other related phenomena: reference group norms and social interactions/friendships. We define a reference group as the subsample of individuals of the same country and area of residence (rural or urban), of the same gender, the same age group (within a 10-year interval), and with a similar education level.²⁴ We tested whether the mean EQ5D of the reference group was associated with life or health satisfaction of the individual, controlling for mean income for the group.

Both mean EQ5D and mean income for the reference group were positively and significantly correlated with both health and life satisfaction. Thus, the effects of health were above and beyond those of mean income for the reference group. This is an interesting contrast with the effects of reference group income on economic and other forms of satisfaction. Mean income of the reference group has negative effects on economic, job, and housing satisfaction in the region, for example, likely due to envy channels.²⁵ Comparison effects in the health arena may provide more positive signals than do those in the income realm (Table III).

To the extent the latter is an empathy or solidarity finding, it seems to cross various non-material domains. The research of others has found that the negative effects of divorce, unemployment, and obesity are less severe in contexts where the rates for these respective phenomena are higher, due to less stigma and greater solidarity.²⁶ In contrast, there is a wide body of research which suggests that

¹⁹See Lua *et al.* (2007).

²⁰Kapteyn *et al.* (2007).

²¹Graham *et al.* (2004).

²²Regression results are available from the authors.

²³Regression results available from the authors.

²⁴A reference group must have at least three individual members. We had between 992 and 1601 reference groups, depending on the regression.

²⁵*Beyond Facts*, Table 3.3; Luttmer (2005); Alesina *et al.* (2004); and Graham and Felton (2006).

²⁶For divorce, see *Beyond Facts* (2008, Chapter 4). For unemployment see Clark (2003); and Eggers *et al.* (2006). For obesity, see Graham (2008b).

Table III. Reference group results

	Health satisfaction 0–10								Life satisfaction 0–10							
	(1)	(12)	(13)	(14)	(15)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Log, monthly per capita household income, US\$ PPP	0.169***	0.161***	0.147***	0.194**	0.164***	0.156***	0.143***	0.176**	0.308***	0.305***	0.288***	0.385***	0.297***	0.294***	0.280***	0.386***
1 if has friends	[0.032]	[0.032]	[0.030]	[0.070]	[0.032]	[0.033]	[0.031]	[0.070]	[0.031]	[0.029]	[0.030]	[0.100]	[0.031]	[0.031]	[0.030]	[0.101]
					0.158**	0.163**	0.156**	0.145**					0.447***	0.474***	0.438***	0.474***
					[0.067]	[0.067]	[0.069]	[0.066]					[0.078]	[0.093]	[0.080]	[0.093]
EQ5D index	5.277***	5.251***	5.335***	5.251***	5.259***	5.240***	5.317***	5.204***	1.575***	1.551***	1.556***	1.551***	1.488***	1.468***	1.469***	1.469***
	[0.219]	[0.183]	[0.195]	[0.182]	[0.224]	[0.185]	[0.202]	[0.185]	[0.304]	[0.277]	[0.318]	[0.278]	[0.309]	[0.283]	[0.324]	[0.285]
Mean EQ5D, education reference group	0.630*		0.654*		0.59		0.198		0.309		0.37		0.323		−0.207	
	[0.353]		[0.362]		[0.358]		[0.420]		[0.357]		[0.357]		[0.651]		[0.607]	
Mean EQ5D, income reference group		0.621		0.216		0.598		0.600		0.381		−0.199		0.278		0.348
		[0.360]		[0.425]		[0.351]		[0.367]		[0.630]		[0.601]		[0.377]		[0.378]
Mean income, education reference group			0.175***				0.166***				0.179***				0.158**	
			[0.045]				[0.043]				[0.059]				[0.059]	
Mean income, income reference group				−0.039				−0.051				−0.096				−0.111
				[0.070]				[0.070]				[0.101]				[0.103]
Observations	7725	7317	7572	7317	7684	7281	7532	7281	7725	7318	7572	7318	7684	7282	7532	7282
Adjusted <i>R</i> squared	0.33	0.324	0.332	0.324	0.33	0.325	0.333	0.325	0.248	0.246	0.245	0.246	0.252	0.25	0.249	0.25
Countries	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

concerns for relative incomes go up as incomes are higher, and that the signaling effects of higher comparison incomes are negative for life satisfaction.²⁷

Our 'friends' variable measures the extent to which friendships are important to respondents and asks: 'if you were in trouble, do you have relatives or friends you can count on to help you whenever you need them?' The coefficient on this variable was strong and significant on both health and life satisfaction (and takes away the significance of reference groups) (Table III). People with friends are more likely to receive sympathy for whatever health conditions they have. In the case of conditions that have stigma attached, such as obesity, those that have the condition but also have friends feel less stigma (and are more likely to select friends with similar conditions).²⁸ Because respondents and their friends select each other, it makes sense that 'friends' has stronger explanatory power than that of arbitrary reference groups.

If you are made happier by those around you having better health, then it is plausible that you are also likely to invest in your own health to conform to the norm. Yet there are also conditions in which a poor health norm may make those with poor health or low standards feel less stigmatized and less likely to invest in their health, as in the case of obesity. The obese suffer lower well-being costs when they are in a socioeconomic or professional cohort where obesity is the norm.²⁹ There may be similar effects for smokers: more peers with the same condition or addiction reduce the associated stigma.

Supporting the more positive interpretation, a study based on the Framington Heart Study by Peter De Wan and Nicholas Cristakis finds that the positive role of social influence on health is stronger than the negative influences of social comparison. They attribute their findings to disease transmission, to social and peer influence, and to the support that comes from social engagement.³⁰

4.1. Equivalent income calculations

A number of economists have calculated life satisfaction equivalents for conditions ranging from divorce and marriage to unemployment. These are the monetary equivalents needed to compensate for the happiness losses or gains from these conditions.³¹ We calculated life satisfaction equivalents for each of the EQ5D conditions for our sample, and find that the negative effects of some of those conditions are very high compared with those of other key variables such as the loss of income or friendships.

Baseline/initial median per capita household income in US PPP dollars is \$93.7 per month – the average income of the sample. The amount of income needed to compensate an individual for the life satisfaction drop associated with moderate problems with the usual acts is 2.1 times that income (Figure 1). Problems with self-care and with mobility, meanwhile, had insignificant effects. Pain and anxiety are the most 'expensive' in life satisfaction terms: having extreme pain is equivalent to a loss of 5 per capita incomes, while extreme anxiety is worth 13.5 incomes. Moderate anxiety is worth 2.7 incomes. One caveat: these ratios reflect orders of magnitude; they are based on self-reports and in some cases are larger than the available income that respondents could realistically trade off (for example, a respondent giving up income equivalent to 13 times its size in order to reduce anxiety would place most in extreme debt or poverty).

The effects of the individual conditions on health satisfaction were significantly higher than those on life satisfaction. In part this is because health conditions have more direct effects on health satisfaction than they do on life satisfaction. In part it is an artifact of construction: the coefficients on income,

²⁷See Graham and Felton (2006); *Beyond Facts* (2008, Chapter 3); and Luttmer (2005).

²⁸See, for example, Cristakis and Fowler (2007); and Graham (2008b).

²⁹Cristakis and Fowler (2007); Graham (2008b). Nick Powdthavavee finds that the well-being effects from various diseases in Britain are negatively correlated with the average number of health problems per other members of the respondents' families. See Powdthavee (2008).

³⁰Cristakis and De Wan (2009).

³¹These are calculated based on the size of the coefficients on those conditions relative to the size of the coefficient on income in a standard happiness equation (Blanchflower and Oswald, 2004).

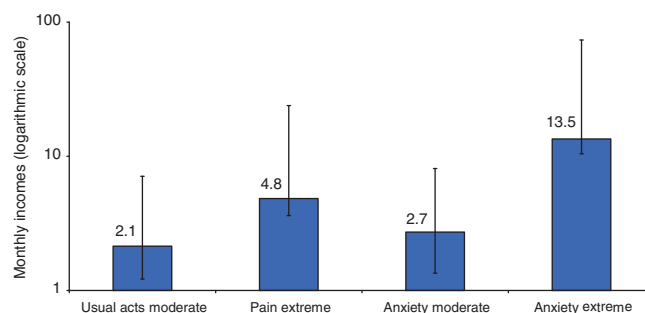


Figure 1. Income equivalences of health conditions in EQ5D in monthly incomes. Comparison income: US\$ 93.7 PPP. *Source:* Authors' calculations based in Gallup 2006 and 2007. *Note:* direct equivalences are based on the effect of each health component on life satisfaction. The EQ5D equivalences are based on the effect of changes in the EQ5D index, derived from changes in each health component. Vertical bars represent a 95% confidence interval

which are the base (the denominator) for calculating the marginal effects, are much smaller for health satisfaction than they are for life satisfaction. At the same time, income matters more to life than health satisfaction, not least because it helps acquire things that matter to life satisfaction more than to health satisfaction, such as cell phones.

How do these results compare to those based on TTO methods? For the UK, the largest drop associated with a move from no problem to a moderate health problem was for pain – four times that of a similar move for the usual activities (Dolan, 1997). For the US, the effects of severe problems were much greater than those of moderate problems. The strongest effects of severe problems were for mobility and pain, followed by severe problems with anxiety and self-care. (Shaw *et al.*, 2005). In making these comparisons, it is important to note that these TTO responses represent social preferences elicited from population samples in different countries and, in the case of the UK, are dated and may not represent contemporary values for health.

All of these findings highlight the importance of pain and anxiety over those of mobility and self-care – and people's ability to adapt better to unfortunate but stable conditions than to conditions that are uncertain. These findings confirm the emphasis in much earlier work written from a different perspective, by Jonathan Miller, highlighting the strong psychological components of the first signals of ill health as having four dimensions: anxiety, pain, stigma or shame, and incapacity.³²

Health and life satisfaction questions may be more effective at picking up the psychological effects of these conditions than are more framed questions, such as the TTO questions. At the same time, those same psychological conditions can bias life and health satisfaction responses. While less happy (more anxious) people answer both life and health satisfaction questions more negatively, it is not clear that less happy people value healthy life years versus ill life years differently than happier ones do.

We also calculated the income equivalents required to compensate for health problems at the country level. We calculated the life satisfaction effects of the EQ5D health condition or conditions that the average individual for each country reported, and then calculated the average equivalence income that he or she would need to be compensated (note that the effects of health conditions on life satisfaction vary by country). Table IV shows how average of country level adjusted incomes compare to the average of income for the country the respondent lives in. There is significant variance, with the values being much higher – and the income trade-offs greater – for Brazil and Chile, for example, than for El Salvador, Guatemala, and Panama. These values reflect differences in norms, knowledge, and expectations about health standards across the countries, in addition to differences in income levels.

³²See Wolf Miller (1978).

Table IV. Incomes adjusted for the life satisfaction cost of health problems

	Original income	Income adjusted for the life satisfaction cost of health problems – components	Income adjusted for the life satisfaction cost of health problems – EQ5D score	Relative adjustment required – components (%)	Relative adjustment required – EQ5D score (%)
Argentina	408.0	579.5	999.7	42.0	145.0
Belize	618.2	751.5	968.5	21.6	56.7
Bolivia	173.3	273.1	484.7	57.6	179.7
Brazil	299.9	445.7	939.4	48.6	213.2
Chile	340.9	529.5	1045.1	55.3	206.6
Colombia	395.3	559.2	765.9	41.5	93.7
Costa Rica	416.9	548.0	775.4	31.4	86.0
Dominican Republic	288.7	383.9	590.6	33.0	104.6
Ecuador	170.9	215.6	288.8	26.1	68.9
El Salvador	166.7	204.4	292.6	22.6	75.5
Guatemala	177.1	249.0	457.2	40.6	158.1
Guyana	369.9	486.3	715.5	31.5	93.4
Honduras	213.5	275.8	554.1	29.2	159.5
Mexico	222.4	300.2	1044.9	35.0	369.8
Nicaragua	227.5	320.9	680.0	41.0	198.9
Panama	233.5	275.4	340.8	17.9	46.0
Paraguay	221.7	300.4	485.4	35.5	119.0
Peru	157.8	242.0	430.8	53.3	172.9
Uruguay	391.1	544.4	909.0	39.2	132.4

Source: Authors' calculations based in Gallup World Polls 2006 and 2007. *Note:* The table shows the monthly household income per capita in US\$ PPP, averaged by country, and then adjusted by the effect of reported health conditions over life satisfaction. Thus, adjusted income is the income that would produce the same levels of life satisfaction of the original income in the absence of all the health problems reported by the individuals.

5. CONCLUSIONS

We aimed to better understand the effects of different health conditions on life and health satisfaction; how they vary depending on socio-demographic characteristics and norms of health; and how they are mediated by the health and health standards of peers. We took advantage of a unique data set for Latin America.

Our analysis highlighted the importance of ill health, and then the relative importance of pain, anxiety, and difficulties with usual activities, with some modest differences across cohorts. The elderly seem to cope better than the average with mobility/self-care problems, but worse than the average with anxiety. Our findings highlight the importance of conditions associated with uncertainty over those of mobility and self-care. People's priors may be that physical conditions are worse than mental conditions. Thus when they actually experience them, they are mediated by these expectations, and the effects of the former are weaker than expected and those of the latter are stronger.

We calculated life satisfaction equivalents for our health conditions, and found that compared with baseline per capita household income for Latin America, the effects of some conditions were very large. The average respondent in Latin America would need to be compensated approximately twice baseline income for moderate problems with the usual acts, and three times for moderate anxiety. Extreme pain was more 'expensive' in life satisfaction terms: almost five average incomes, while extreme anxiety was the most 'expensive': 13.5 times. This suggests that improvements in health, and in particular reductions of extreme forms of damage to quality of life, contribute a lot to human happiness compared with gains in income.

Our findings also highlight the role of comparison effects. Better reference group health had positive and significant effects on health and life satisfaction. This is an important contrast with the effects of reference group income on happiness, which tend to be negative. While higher relative income is often associated with negative comparisons, better health seems to produce positive signals. It is more enjoyable to be surrounded by healthy people, while being surrounded by people with ill health often

risks contagion, among other negative externalities. This suggests a potentially positive influence of peers in improving health behaviors. Our cross-country findings, meanwhile, and in particular surprisingly high levels of health satisfaction among poor cohorts with low standards of health, highlight the role of differential norms in explaining weak demand for better health from people in cohorts and countries with poor objective conditions.

The balance of investments in different health policies is a question that must be resolved at the level of particular societies. Our method can inform such decisions by assigning relative well-being weights to particular conditions. Individuals seem better able to adapt to one-time health shocks – such as a loss in mobility – than they are to conditions which are associated with uncertainty, such as anxiety and pain. Better understanding how these conditions undermine quality of life, and how that varies across cohorts, countries, and cultures, could enhance well-being in general. The strong negative effects of uncertainty might also affect how we think about policy relevant measures such as quality adjusted life years.

APPENDIX A

A.1. Time trade-offs methods

Values are assigned based on the responses to the five conditions in the EQ5D: mobility, self-care, the usual acts, pain, and anxiety. A dimension for which there is no problem was assigned a level 1 while a dimension with extreme problems was assigned a level 3. Each health state described by the instrument had a five-digit descriptor, ranging from 11111 for perfect health to 33333 for the worst possible state. The resulting descriptive system defined 243 (3 to the power of 5) health states.³³

In the time trade-offs method, individuals were asked to describe their own health using the EQ5D description system, and then to rate their health state on a 0–100 scale, with 0 being the worst imaginable health state and 100 being the best imaginable health state. They are then asked to value 13 of the possible health states: the 12 EQ5D states plus unconscious, based on the assumption that respondents could not realistically evaluate a higher number of states; the selection of states was based on the range of responses.³⁴

Respondents were asked time trade-offs values for time spent in various states (e.g. either losing or gaining time spent in full health; the smallest possible time that an individual could choose to spend in a health state was 0.25 years, and the total time period was 10 years, with 5 years being the middle value offered for full health). Values for worse than death states were transformed and bounded by 0 and –1, with the lowest possible health state being the choice of 0.25 years in a given state followed by 9.75 years in full health that were considered as bad as death.³⁵

A.2. Basic model for life and health satisfaction equations

$$S_{ij} = X_{ij}\beta_1 + Y_{ij}\beta_2 + EQ5_{ij}\beta_3 + EQ5_{ij} * X'_{ij}\beta_4 + O_{ij}\beta_5 + F_j + \varepsilon_{ij}$$

where S_{ij} is, in separate regressions, life or health satisfaction of individual i in country j . X_i is a vector of socio-demographic variables, such as age, gender, education, marital status, etc. Y_i is the monthly

³³The designers of the EQ5D emphasize that it is not without flaws. It emphasizes physical conditions over mental ones, for example. People typically underweight the importance of mental health problems and overweight those of physical health problems. While it is impossible to attach precise weights to these, the analysis based on time trade-offs, as well as our own, reported in this paper, highlights the relative (negative) weight of psychological conditions and those associated with uncertainty over physical ones. Despite these imperfections, the EQ5D is one of the better objective measures that we have.

³⁴The authors thank Paul Dolan for explaining this process.

³⁵Typically, these conditions are severe cognitive or mental burden (anxiety/depression) or coma. Shaw *et al.* (2005). See also Patrick *et al.* (1994).

income of individual i in US\$ PPP,³⁶ EQ5 is the EQ5D score, constructed by the method described in Shaw *et al.* (2005), X'_{ij} is a vector of socio-demographic variables which we are interacting with the EQ5 score, and O_i is a psychological traits variable, used as a control for optimism³⁷. F_j are country fixed effects.

In alternative regressions we replace the variable EQ5 by the set of ten dichotomous variables that represent the presence of health problems captured by the EQ5D system of questions (that is, each of the five conditions in their moderate or extreme form).

Shaw *et al.* use the following equation:

$$\begin{aligned} \text{Pred} = & 0.146m_1 + 0.558m_2 + 0.175s_1 + 0.471s_2 + 0.140u_1 + 0.374u_2 + 0.173p_1 + 0.537p_2 + 0.156a_1 \\ & + 0.450a_2 + 0.140d_1 + 0.011i_{22} + 0.122i_3 \\ \text{EQ5} = & 1 - \text{Pred} \end{aligned}$$

For Shaw *et al.*, m_1 is moderate mobility, m_2 is extreme mobility, and so on through p for pain and a for anxiety. The variable d_1 is the number of conditions not presented, minus 1. The variables i_3 and i_2 are the number of extreme and moderate conditions, minus 1, respectively. i_{32} and i_{22} are the square of i_3 and i_2 . We use the same equation and coefficients for the reported responses in our Latin America sample.

A.3. Categorical variables and weighting coefficients

Standard econometrics requires that categorical questions such as the health state and ladder of life questions be analyzed via ordered logit or probit equations, which do not assume continuity or cardinality in the response categories, but instead assume discrete probabilities. With the increased use of happiness data, however, many scholars are running simultaneous logit/probit and OLS equations, and finding that the relative coefficients are virtually identical (that is, when comparing coefficients across specifications, differences are due, almost completely, to a scale factor).³⁸ The OLS results can be used to compare the magnitude of the values of the coefficients. In our case, the results of ordered logit and OLS equations for the life satisfaction equations were virtually synonymous, while those for the health state equations were close if not identical in value. Accepting that there is a slight margin for error, we report the OLS results, so that we can compare (roughly) across the variables.³⁹ Our EQ5D index is calculated according to the equations and coefficients reported in Shaw *et al.* for each of the possible reported health conditions: mobility, self-care, usual acts, pain, and anxiety. Alternatively, we include the individual scores on each of the conditions when we assess the life and health satisfaction effects of each condition independently.

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³⁶The Gallup World Poll doesn't provide a continuous income question. We follow the transformation in Gasparini *et al.* (2008) to transform the range-based income variable into a continuous variable.

³⁷More precisely O_i is calculated as the first principal component of the residuals of regressions for six variables of personal satisfaction (satisfaction with the life that a person expects to lead in 5 years' time; personal economic satisfaction; satisfaction with housing; expectations held for the country in 5 years' time; satisfaction with the national economic situation; and satisfaction with the education system) after controlling in each of the regressions for gender, age, residential zone, marital status and several country variables. The methodology is taken from van Praag and Ferrer-i-Carbonell (2007).

³⁸For a detailed discussion and numerous applications see van Praag and Ferrer-i-Carbonell (2007).

³⁹Probit and ordered probit results are available from the authors on request.

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