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Valuing Health Conditions

Insights from Happiness Surveys across Countries and Cultures

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Abstract[1]

This paper assesses the effects of different health conditions on happiness. Based on a large data set for Latin America, the effects of different conditions are examined across age, gender, and income cohorts. Anxiety and pain have stronger effects than physical problems, likely because people can adapt better to one-time shocks than to constant uncertainty. The negative effects of health conditions are very large when compared to the effects of income on happiness. While higher peer income typically elicits envy, better peer health provides positive signals for life and health satisfaction. Nonetheless, health norms vary widely across countries. The results suggest that the life satisfaction approach applied to surveys of health may contribute to better health expenditure and policy decisions.

JEL Classifications: C83, I18, I30, I38
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1. Introduction

Do the health standards and conditions of those around you affect your own 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 care 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. New methods for doing so, however, can guide policymakers in decisions about how 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 we can only use the information that comes from actual choices, such as consumption. The relative weights of health conditions are thus gauged by how much individuals are willing to pay for particular treatments. Applying such approaches to health policy raises normative questions, particularly 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.[2]

A number of scholars have developed alternative approaches to valuing health conditions. 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.[3] Experience sampling methods (ESM) typically ask people to rate their different feelings at various points in the day, while daily reconstruction methods (DRM) divide the previous day into various episodes and then rate different elements of affect during these activities on a 0-6 scale.[4] These methods have been used on large samples of respondents and often highlight factors that survey research

[2] Amartya Sen's description of entrenched deprivation, for example, shows that discussing desire fulfillment in isolation does not fully capture the predicament of those who are so deprived that they dare not desire too much. See Dolan and Kahneman (2008).

[3] See Dolan (1997).

[4] See Kahneman (2000) and Kahneman and Krueger (2006).

does not, such as the importance of sleep quality—greater than that of marriage or income—for good feelings.[5]

All of these approaches 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 that cannot be explained by objective differences, but rather is linked to norms, expectations, and other unobservable factors. For example, although objective health indicators are better in the Netherlands than in the United States, reports of work-related disability are higher in the former.[6] Reports of conditions such as diabetes and hypertension, meanwhile, are notoriously inaccurate, particularly in poor countries where awareness of these conditions is low. Across all countries, they are mediated by income and education, among other factors.[7]

We therefore propose a new method for addressing some of these puzzles, which complements the methods described above and is based on comparisons between objective and subjective assessments of health states and their relationship to happiness. While a nascent body of literature establishes a positive correlation between happiness and better health and longevity, it is difficult to definitively prove causality, which likely runs in both directions. Nonetheless, health represents one of the most important determinants of happiness in virtually every context in which it has been studied.[8]

Our empirical work is based on a unique data set, which combines subjective health and life satisfaction assessments with a widely accepted measure of health, the EQ5D. The EQ5D descriptive system consists of five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension has three levels, reflecting no health problems, moderate health problems, and extreme health problems. While the EQ5D is based on self reports, it captures various aspects of physical and mental health and has been widely used

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[5] Dolan and Kahneman (2008) and Dolan (1997).

[6] Kapteyn, Smith and van Soest (2007).

[7] Thomas and Frankenburg (2000) first studied differences in self-reported and measured health based on the Indonesian Family Life Survey. Parker, Rubalcava and Teruel (2008) built on that work and studied these differences based on a broad purpose, multi-topic, nationally representative survey in Mexico, first conducted in 2002 and then repeated in 2005. Income predicts lower differences between measured and reported height, while the probability of having seen a doctor in the past three months increases the probability of accurately reporting weight among the obese and overweight. Of the total sample, 7 percent have hypertension but think they do, and 13 percent have hypertension but do not know it.

[8] For a review, see Graham (2008). Guven and Saloumides (2009), meanwhile, use the German socio-economic panel to show that happier people live longer. A well-known study of American nuns corroborates this, with cheerful nuns more likely to live longer. See Chapter 4 of Graham (forthcoming 2009).

as a tool to assess health status in both Europe and the United States. We have responses to both the EQ5D and life and health satisfaction for respondents in a region-wide data set for Latin America and the Caribbean (LAC).

We look at the EQ5D index in its entirety and then explore how relationships vary across its individual health condition components, additionally considering variance by income and gender and across age cohorts. We explore the extent to which variance is explained by the social connections that individual respondents have and by differences in health norms (and other un-observables) across countries. We also compare the values attached to health states based on the EQ5D and its individual components based on subjective evaluations of health and life satisfaction with those derived by medical studies based on patients' preferences. Based on the coefficients on the EQ5D and its various components, we are able to generate life satisfaction equivalents (in U.S. PPP dollars) for various health conditions. On the same basis, we calculate health adjusted per capita income per country in the region, based on the individual EQ5D responses (and their effects of life satisfaction) for each respondent in the survey and the country in which they live.

2. The EQ5D and Time Trade-Offs Methods

The original EQ5D studies were conducted in the United Kingdom and then implemented in the United States. The U.K. study, led by Dolan (1997), covered 2,997 respondents in 1993.[9] The U.S. study, led by Shaw et al. (2005) was conducted in 2002 and was based on a 12,000 respondent, nationally representative sample.[10] 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.[11]

Health state *preferences*, based on a time trade-off method, were then developed for each context by the same authors. The preference rankings were based on interviews using the time

[9] See Dolan (1997).
[10] The study initially over-sampled blacks and Hispanics, to ensure adequate representation of minorities. See Shaw, Johnson and Coons (2005).
[11] The designers of the EQ5D emphasize that it is not without flaws. It emphasizes physical conditions over mental ones, for example. People typically imagine that mental health problems are less bad than they actually are, and that physical health problems are worse than they actually are. Despite these imperfections, the EQ5D is one of the better objective measures that we have.

trade-off method. In the time trade-off method, individuals were asked to describe their own health using the EQ5D description system, and then to rate their health state on a 0 to 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 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.[12]

Respondents were asked to provide time trade-off 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.[13]

Regression results based on the U.K. and U.S. 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 which 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.[14]

3. EQ5D, Subjective Health, and Life Satisfaction

In collaboration with the Gallup World Poll with support from the Inter-American Development Bank, we were able to include the EQ5D questions in a sample of approximately 14,000 respondents across 18 LAC countries for 2007.[15] The Latin America questionnaire also included a number of questions on health and life satisfaction. Latin America additionally provides an

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[12] The authors thank Paul Dolan for explaining this process.

[13] Shaw, Johnson and Coons (2005).

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

[15] The set of questions was included verbatim in Spanish, English and Portuguese, according with the translations provided by Euroqol Group (see 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 IDB (2008).

excellent laboratory for examining variance across socioeconomic levels, as the region 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 World Poll has been conducted in more than 130 countries worldwide since 2006, providing the widest coverage to date by a poll that includes data on reported well-being. The country samples are nationally representative and include respondents 15 years of age or older. The interviews were conducted by telephone in countries with land line coverage of 80 percent or more of the population, and in person in the rest; the LAC countries fall into the latter category. Household members were selected randomly.

Our analysis uses the same 3*5 EQ5D categories and possible responses. 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. These two variables interact as individuals assess their health state *and* deal with particular health challenges. 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 activities.

A literature complementing that on health and happiness suggests that more positive perceptions of health lead to better objective outcomes, and even to success in combating potentially fatal diseases.[16] (Alternatively, one can imagine overly optimistic health assessments leading to under-use of preventive health care.) Our analysis will assess the well-being effects of various reported conditions across cohorts and attempt to better understand how varying degrees of tolerance across cohorts in turn mediate the well-being effects of various health conditions.

Our recent research,[17] as well as that of some others like Angus Deaton, finds evidence of an "aspirations paradox" that helps explain unusually high tolerance for poor health and for weak health systems on the part of the poor in many countries. Across countries, there is no clear relationship[18] between per capita income levels and health satisfaction: it is surprisingly high in

[16] For a review of that literature, see Graham (2008).
[17] IDB (2008).
[18] The 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.

some very poor countries like Guatemala, and surprisingly low in relatively wealthy countries with much better health systems, like Chile. Within countries, while rich people are more satisfied with their health than poor ones and objective measures—such as morbidity and life expectancy—track with socioeconomic status, the gaps in 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, although less consistently.[19] This paradox is likely due to lower expectations and available information among those living in poorer contexts, as well as to lower expectations. We attempt to explain, to the extent possible, the variance in tolerance across socioeconomic and other cohorts, and the extent to which it is mediated by types of health conditions on the one hand, and by social and cultural norms on the other.

4. Econometric Strategy

Our basic question is how health status as assessed by the EQ5D relates to more subjective evaluations (i.e., life and health satisfaction) and how this varies across cohorts. Our use of framed health satisfaction questions and open-ended life satisfaction questions allows us to explore how the relationship varies depending on the subjective evaluation used. Our basic model uses life and health satisfaction questions, respectively, 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 in the Technical Appendix.

We use two separate subjective variables in the Gallup Poll. The first is a 0-10 state of health 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

[19] Of course, this could also be considered a pessimism bias of the rich. See IDB (2008), Graham and Chattopadhyay (2008), and Deaton (2007).

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 or life satisfaction question, and thus responses to the former typically correlate more closely with income.[20]

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).[21] 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.[22] Our EQ5D index is calculated according to the equations and coefficients reported in Shaw, Johnson and Coons (2005) for each of the possible reported health conditions: mobility, self-care, usual activities, pain, and anxiety.

5. Results

At a general level, the EQ5D score is strongly and significantly correlated with subjective health status and with life satisfaction, although the magnitude of the coefficient is five times larger for health scores than for life satisfaction. In contrast, material goods, such as assets and telephones, are more important to life satisfaction then they are to health satisfaction. Telephones likely affect life satisfaction (rather than health satisfaction) in two ways. They are material in that they are status goods in many developing countries, and they also facilitate another factor which is very important to life satisfaction: friendships and social networks.[23] These latter goods maintain

[20] For a fuller description of question framing issues, see Graham, Chattopadhyay and Picón (forthcoming 2009).
[21] For a detailed discussion and numerous applications see van Praag and Ferrer-i-Carbonell (2007).
[22] Probit and ordered probit results are available from the authors on request.
[23] Labonne and Chase (2008).

their significance for life satisfaction but not health satisfaction when individual optimism controls are included (see Table 1 and Appendix Table A.1).

We also explored the effects of the individual EQ5D components/conditions on our subjective variables, finding that the (expected) 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.[24] It is likely that people adapt to these conditions, and the importance of inherent character traits in maintaining happiness or satisfaction is more important than (irreversible) objective conditions. In contrast, extreme pain, extreme anxiety, and 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 1).

It is likely that people are 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 returns to pre-traumatic levels, while many epileptics face a lifetime of uncertainty about when they will have seizures. A number of studies on the quality of life of epileptics find that age—and in particular higher age of onset—poses significant and negative effects on health-related quality of life. Adapting to uncertainty appears to be more difficult later in life, when individuals' social, economic, and psychological dimensions are more established.[25]

Arie Kapteyn finds that people's well-being is more affected by anxiety about certain conditions, such as financial or health difficulties, than by the difficulties themselves.[26] Graham and her co-authors similarly find that innate optimism mediates the intensity of the effects of anxiety, such as fear of unemployment, on well-being.[27] Optimism likely interacts with the anxieties related to particular conditions to determine health satisfaction. Finally, different levels of tolerance for disease and pain, which can vary significantly across countries and cultures, also mediate the relationship between objective and subjective health conditions. Country-level controls account for these cross-country differences in our equations.

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[24] Personal optimism is measured as the tendency of the individual to respond affirmatively to all the dichotomous satisfaction questions included in the Gallup survey. It is calculated as 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.
[25] See Lua et al. (2007).
[26] Kapteyn, Smith and van Soest (2007).
[27] Graham, Eggers and Sukhtankar (2004).

When we analyzed each of the EQ5D components individually, we found that they have less of an effect on life satisfaction (with the exception of extreme pain and anxiety) than they do on health satisfaction, suggesting the more ephemeral and multi-faceted nature of life satisfaction responses than that of health evaluations, which have more of a frame—or perhaps a smaller range of causal variables (Table 1).

We next interacted our gender, age, and income variables—in separate respective equations—with the EQ5D index. With personal optimism controls included, the results were insignificant.[28] In contrast, when we interacted the same three variables with each of the 10 EQ5D components separately, there were significant results. *Age* moderates difficulties with usual activities—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.[29]

We tested for the effects of two other related phenomena: reference group norms and social interactions and/or 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.[30] In the regressions for reference groups we tested whether the mean EQ5D of the reference group was associated with life or health satisfaction of the individual, controlling also for mean income of the reference group.

Both mean EQ5D score 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

[28] Regression results are available from the authors.
[29] Regression results available from the authors.
[30] A reference group must have at least three individual members. We had between 992 and 1,601 reference groups, depending on the regression.

the region, for example.[31] More generally, previous studies in the United States, Europe, Latin America, and Africa find that comparison effects in the income domain tend to be negative (perhaps due to envy).[32] Comparison effects in the health arena, though, may provide more positive signals than do those in the income realm (Table 2 and Appendix Table A.2).

To the extent that 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. This is likely due to less stigma and greater solidarity.[33] In contrast, there is an extensive body of research which suggests that concerns for relative incomes go up as incomes are higher, and that the signaling effects of higher comparison incomes are negative for life satisfaction.[34]

Our “friends” variable, which measures the extent to which friendships are important to respondents, was strong and significant for both health and life satisfaction. The question asks: “if you were in trouble, do you have relatives or friends you can count on to help you whenever you need them?” Indeed, “friends” eclipsed the explanatory power of the mean EQ5D score for the reference groups: the reference group score loses its significance, suggesting that interactions with friends (and their health status, in turn) matter more than the reference groups that we constructed, where most of those in the group are strangers (Table 2 and Appendix Table A.2).

It may be that, quite simply, those people that have 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 that are also obese).[35] Because respondents and their friends select each other, it makes sense that the variable “friends” has stronger explanatory power than arbitrary reference groups.

The signaling effects of reference group health seem, for the most part, positive. 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 under

[31] IDB (2008), Table 3.3.
[32] Luttmer (2005); Alesina, Di Tella and MacCulloch (2004); and Graham and Felton (2006).
[33] For divorce, see IDB (2008, Chapter 4). For unemployment see Clark (2003), and Eggers, Gaddy and Graham (2006). For obesity, see Graham (2008).
[34] See Graham and Felton (2006), IDB (2008, Chapter 3), and Luttmer (2005).
[35] See, for example, Christakis and Fowler (2007) and Graham (2008).

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.[36] There may be similar effects for smokers: having more peers with the same condition or addiction reduces the associated stigma.

New work by Peter De Wan and Nicholas Christakis highlights positive signaling effects. Based on the Framington Heart Study Social Network, they find that the positive role of social influence on health is stronger than the potential negative influences of social comparison. Indeed, they find that those individuals with better health than the average for their networks actually fare worse than those who are worse off than their networks—a clear "pulling-up" effect. They attribute their findings to disease transmission, to social and peer influence, and to the support that comes from social engagement.[37]

6. Equivalent Income Calculations

Many scholars in the happiness literature have calculated life satisfaction equivalents for a number of 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. They 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.[38] We replicated the general approach, and calculated life satisfaction equivalents for each of the EQ5D conditions for our sample. We find that the negative effects of some of the health conditions are very high compared to those of other important variables, such as the loss of income or friendships.

Baseline/initial median per capita household income in U.S. PPP dollars is $93.7 per month, which is the average income of the sample taken for these calculations. The amount of income needed to compensate an individual for the life satisfaction drop associated with moderate problems with usual activities is 2.1 times average per capita income (Figure 1). Problems with self-care and with mobility, meanwhile, had insignificant effects (and therefore are not shown). Pain and anxiety are the most "expensive" in life satisfaction terms: having

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[36] Christakis and Fowler (2007), Graham (2008).
[37] De Wan and Christakis (2009).
[38] Blanchflower and Oswald (2004).

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.

The much higher levels for pain and anxiety, particularly the latter, highlight a point that is made earlier in the paper: people adapt better to unfortunate but stable conditions than they do to conditions that are uncertain. It is thus interesting to note that only a very small percentage of the sample report problems with self-care.

For the individual conditions, the coefficients on health satisfaction were significantly higher than those for 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, 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 time-trade-offs methods for the United States and the United Kingdom? For the United Kingdom, the largest drop associated with a move from no problem to a moderate health problem was for pain or discomfort. Indeed, the effect for pain was four times that of a similar move for the usual activities (Dolan, 1997). For the United States the effects of severe problems were much greater than those of moderate problems; indeed, in much of the analysis moderate problems had insignificant effects. The strongest effects of severe problems were for mobility and pain, followed by severe problems with anxiety and self-care (Shaw, Johnson and Coons, 2005).

All of these findings highlight the importance of pain and anxiety as greater than that of mobility and self-care, albeit with different weights. These findings confirm the emphasis in much earlier work written from a different perspective, by Jonathan Miller, pinpointing the first signals of ill health as having four dimensions: anxiety, pain, stigma or shame, and incapacity, all of which also have strong psychological components.[39]

The less framed health and life satisfaction questions may be more effective at picking up the psychological effects of these conditions than are questions which are more framed by the particulars of the conditions, as are the time trade-off questions. At the same time, those same psychological conditions can bias life and health satisfaction responses. While less happy (more

[39] See Miller (1978).

anxious) people answer both life and health satisfaction questions more negatively, it is not clear that less happy, more anxious people value healthy life years versus ill life years differently than happier people do.

Finally, we calculated the income equivalents required to compensate for the presence of health problems, at the country level, based on our Latin America sample. We calculated the equivalence income that each respondent would need to be compensated, based on the life satisfaction effects of the EQ5D health condition or conditions that he or she reported, and then calculated the average equivalence income per country (as the effects of health conditions on life satisfaction vary by country). Table 3 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 across countries, 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 significant differences in norms, knowledge, and expectations about health standards across countries.

7. Conclusions

In this paper, we aimed to further our understanding of how different health conditions affect welfare, how these effects vary across different cohorts depending on their socio-demographic characteristics and their norms of health, and how the effects of the health and health standards of peers affect individual health. We took advantage of a unique data set to study the effects of various health conditions on life and health satisfaction, and how these effects were mediated by socio-demographics, reference groups, and cultural and other norms.

The EQ5D was an extremely strong predictor of health satisfaction, and a good although less strong predictor of life satisfaction. Our analysis of the individual components in the index highlighted the importance of any move away from full health, and then the relative importance of pain, anxiety, and difficulties with usual activities. We found some modest differences across age, gender, and income cohorts. The elderly, for example, seem to cope better than the average with mobility/self-care problems, but worse than the average with anxiety.

Values based on the overall EQ5D index, as opposed to its individual components, were typically higher than those based on extreme conditions. While a small number of respondents report extreme conditions, the composite index accentuates them by including a squared term for

them. The values for life and health satisfaction were much closer for the aggregate index than they were for the components, while the individual components had much higher values for health satisfaction, suggesting that the composite index is better at capturing general effects, while the components attenuate the effects of particular conditions on health satisfaction.

We additionally calculated life satisfaction equivalents for the particular components and found that compared to a baseline per capita house hold income of $93.7, the average respondent in Latin America would need to be compensated 2.1 times that income for moderate problems with the usual acts, and 2.7 times for moderate anxiety. Extreme pain was more "expensive" in life satisfaction terms: almost five times average income, while extreme anxiety was the most "expensive" at 13.5 times average income.

Both our findings and those based on time trade-offs methods highlight the importance of pain and anxiety—conditions associated with uncertainty—as greater than that of problems with mobility and self-care, albeit with different weights. People's priors tend to be that physical conditions will be worse than they actually are, and that mental conditions are less serious than they actually are. Thus when people actually experience those conditions, they are mediated by these expectations, and the effects of the former are weaker than expected and those of the latter are stronger.

Our method can help inform health policy. Individuals seem to be better at adapting to health shocks that lead to a one-time change, such as a loss in mobility, than they are to conditions associated with uncertainty, such as anxiety and some types of pain. The appropriate balance of investments in different kinds of health is a question that must be resolved at the level of particular cultures and societies. Yet better understanding the causes of anxiety, and how it varies across cohorts, countries, and cultures, might go a long way towards improving well being in general. The strong negative effects of uncertainty in conditions might also affect how we think about and/or calculate policy-relevant measures such as quality-adjusted life years (QALYs).

Our findings also highlight the role of comparison effects on health. The mean EQ5D score for a reference group had positive and significant effects on health and life satisfaction. This is an important contrast with the usual reference group effects of income, which tend to be negative. This suggests that people do not react to health changes the same way that they do to income changes. While rapid income growth is often associated with unhappiness and anxiety

among some cohorts, better health seems more likely 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 an important role for norms of health in explaining cross-country differences in health policies and outcomes, as well as a potential positive influence of peers in improving health behaviors.

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Table 1. Basic Results

	Health satisfaction 0-10		Life satisfaction 0-10	
	(1)	(2)	(3)	(4)
EQ5D index	5.188***		1.436***	
Mobility moderate		-0.460***		0.086
Mobility extreme		-0.032		0.091
Self-care moderate		-0.142		0.157
Self-care extreme		-0.236		0.281
Usual activities moderate		-0.690***		-0.230*
Usual activities extreme		-1.136*		-0.498
Pain moderate		-1.016***		-0.135
Pain extreme		-2.143***		-0.477**
Anxiety moderate		-0.480***		-0.303***
Anxiety extreme		-0.883***		-0.786***
Observations	8,249	8,249	8,250	8,250
Countries	17	17	17	17

*** p<0.01, ** p<0.05, * p<0.1
Results presented in this Exhibit are excerpts from columns 3, 4, 7 and 8 in Appendix Table A.1., where full regression results are presented.

Table 2. Reference Groups Results

	Health satisfaction 0-10			
	(1)	(2)	(3)	(4)
1 if has friends			0.158**	0.156**
Log, monthly per capita household income, US$ PPP	0.169***	0.147***	0.164***	0.143***
EQ5D index	5.277***	5.335***	5.259***	5.317***
Mean EQ5D, education reference group	0.630*	0.654*	0.59	0.198
Mean Income, education reference group		0.175***		0.166***
Observations	7,725	7,572	7,684	7,532
Reference groups	992	1,600	992	1,600
Countries	17	17	17	17
	Life satisfaction 0-10			
	(5)	(6)	(7)	(8)
1 if has friends			0.447***	0.438***
Log, monthly per capita household income, US$ PPP	0.308***	0.288***	0.297***	0.280***
EQ5D index	1.575***	1.556***	1.488***	1.469***
Mean EQ5D, education reference group	0.309	0.37	0.323	-0.207
Mean Income, education reference group		0.179***		0.158**
Observations	7,725	7,572	7,684	7,532
Reference groups	993	1,601	993	1,601
Countries	17	17	17	17

*** p<0.01, ** p<0.05, * p<0.1
Complete results are presented in Appendix Table A.2.

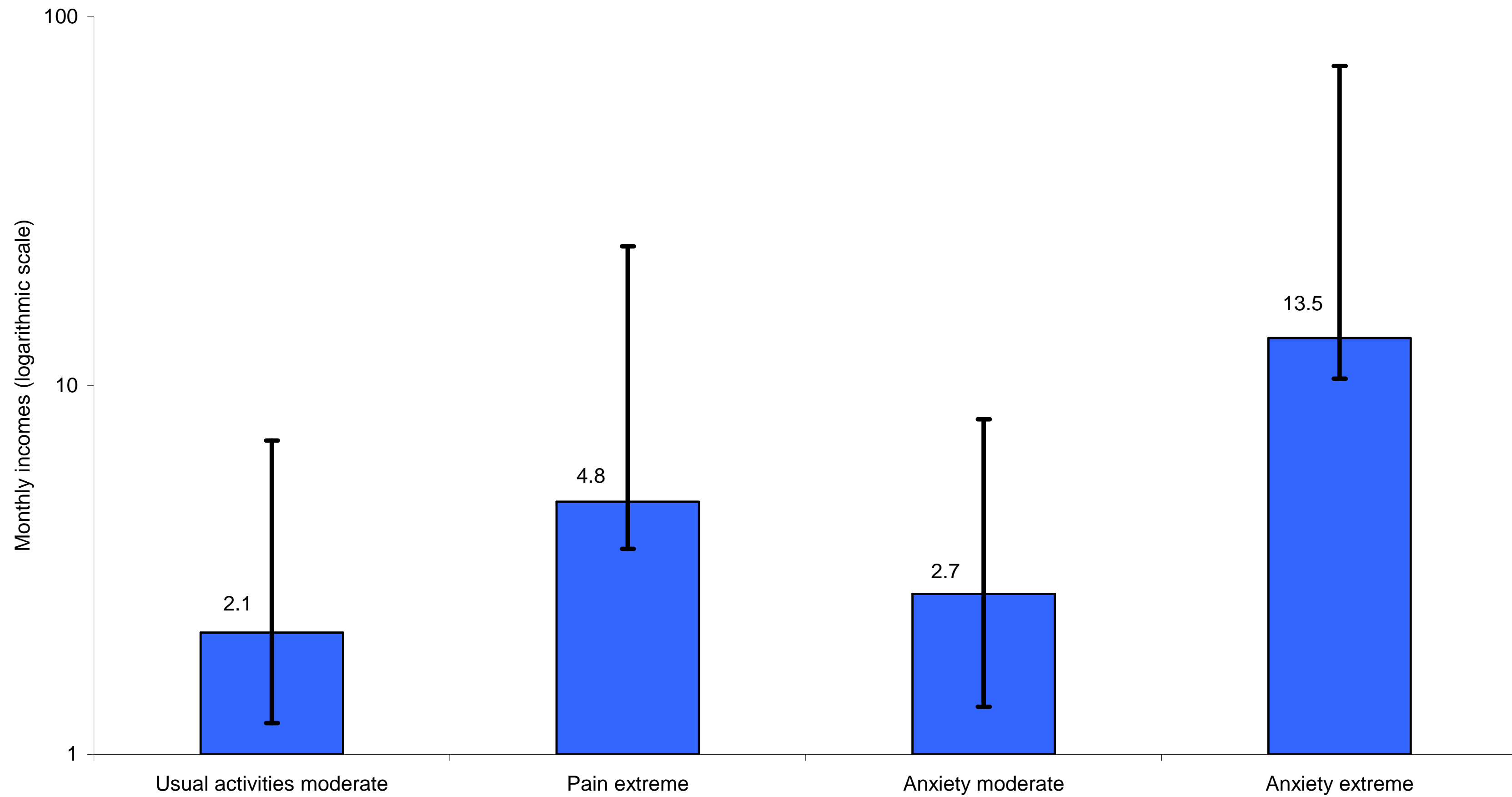
Table 3. Incomes Adjusted for the Life Satisfaction Cost of Health Problems

	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 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.

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 EQ5 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.

Appendix Table A.1. Basic Results

	Health satisfaction 0-10				Life satisfaction 0-10			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 if male	0.132***	0.113**	0.110**	0.088**	-0.162***	-0.166***	-0.248***	-0.253***
	[0.041]	[0.040]	[0.038]	[0.036]	[0.041]	[0.042]	[0.043]	[0.043]
Age	-0.035***	-0.034***	-0.037***	-0.036***	-0.054***	-0.052***	-0.059***	-0.057***
	[0.006]	[0.006]	[0.008]	[0.007]	[0.009]	[0.009]	[0.010]	[0.010]
Age squared	0.000**	0.000***	0.000**	0.000**	0.000***	0.000***	0.001***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Log, monthly per capita household income, US$ PPP	0.166***	0.147***	0.171***	0.155***	0.330***	0.326***	0.302***	0.302***
	[0.028]	[0.028]	[0.030]	[0.030]	[0.033]	[0.031]	[0.028]	[0.028]
1 if urban	0.092*	0.082	0.131**	0.118*	-0.074	-0.072	0.011	0.014
	[0.049]	[0.049]	[0.059]	[0.062]	[0.060]	[0.061]	[0.063]	[0.065]
1 if married	0.012	0.012	0.043	0.038	-0.024	-0.022	0.073	0.074
	[0.048]	[0.043]	[0.062]	[0.056]	[0.046]	[0.044]	[0.059]	[0.058]
1 if divorced	0.089	0.056	0.106	0.044	-0.057	-0.049	-0.035	-0.033
	[0.095]	[0.086]	[0.107]	[0.093]	[0.071]	[0.072]	[0.082]	[0.085]
1 if widow	0.143*	0.150*	0.188*	0.185*	0.118	0.137	0.201*	0.213*
	[0.079]	[0.077]	[0.096]	[0.096]	[0.102]	[0.100]	[0.112]	[0.111]
1 if has one child	0.080*	0.071	0.053	0.039	0.021	0.02	-0.005	-0.008
	[0.046]	[0.042]	[0.058]	[0.057]	[0.052]	[0.050]	[0.048]	[0.048]
1 if has more than one children	0.114**	0.098*	0.093	0.079	-0.018	-0.022	0.023	0.017
	[0.049]	[0.049]	[0.070]	[0.071]	[0.055]	[0.055]	[0.065]	[0.066]
1 if has friends	0.238***	0.233***	0.164**	0.152**	0.611***	0.596***	0.444***	0.432***
	[0.040]	[0.037]	[0.057]	[0.054]	[0.069]	[0.069]	[0.072]	[0.073]
1 if has running water	0.063	0.063	0.108	0.105	0.106	0.112	0.145	0.151
	[0.068]	[0.070]	[0.081]	[0.083]	[0.110]	[0.111]	[0.087]	[0.087]
1 if has electricity	0.233**	0.216*	0.128	0.106	0.456*	0.452*	0.179	0.18
	[0.105]	[0.113]	[0.084]	[0.091]	[0.260]	[0.258]	[0.176]	[0.183]
1 if has telephone	0.02	0.021	-0.026	-0.03	0.224***	0.224***	0.218***	0.215***
	[0.035]	[0.032]	[0.035]	[0.034]	[0.065]	[0.063]	[0.059]	[0.059]
Assets, PCA 1st component score	0.053***	0.050***	0.047***	0.045***	0.201***	0.202***	0.206***	0.206***
	[0.015]	[0.015]	[0.013]	[0.013]	[0.029]	[0.029]	[0.032]	[0.032]
Psychological traits score			0.112***	0.108***			0.397***	0.393***
			[0.020]	[0.021]			[0.022]	[0.023]
EQ5D index	5.455***		5.188***		1.765***		1.436***	
	[0.197]		[0.192]		[0.245]		[0.273]	
Mobility moderate		-0.448***		-0.460***		0.058		0.086
		[0.055]		[0.071]		[0.066]		[0.083]
Mobility extreme		-0.792**		-0.032		0.216		0.091
		[0.365]		[0.500]		[0.283]		[0.554]
Self-care moderate		-0.198		-0.142		0.026		0.157
		[0.121]		[0.177]		[0.143]		[0.125]
Self-care extreme		-0.13		-0.236		0.283		0.281
		[0.278]		[0.467]		[0.458]		[0.422]
Usual activities moderate		-0.726***		-0.690***		-0.325***		-0.230*
		[0.102]		[0.123]		[0.107]		[0.120]
Usual activities extreme		-0.994**		-1.136*		-0.804*		-0.498
		[0.447]		[0.577]		[0.424]		[0.562]
Pain moderate		-1.027***		-1.016***		-0.125		-0.135
		[0.067]		[0.067]		[0.073]		[0.094]
Pain extreme		-2.185***		-2.143***		-0.451**		-0.477**
		[0.147]		[0.171]		[0.194]		[0.195]
Anxiety moderate		-0.540***		-0.480***		-0.459***		-0.303***
		[0.050]		[0.048]		[0.078]		[0.097]
Anxiety extreme		-1.026***		-0.883***		-0.842***		-0.786***
		[0.151]		[0.176]		[0.146]		[0.213]
Constant	2.207***	7.775***	2.619***	7.912***	3.288***	5.062***	3.974***	5.385***
	[0.216]	[0.186]	[0.201]	[0.196]	[0.336]	[0.312]	[0.331]	[0.320]
Observations	12,335	12,335	8,249	8,249	12,279	12,279	8,250	8,250
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

Appendix Table A.2. Reference Groups Results

	Health satisfaction 0-10								Life satisfaction 0-10							
	(1)	(2)	(3)	(4)	(5)	(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***
	[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]
1 if has friends					0.158**	0.163**	0.156**	0.145**					0.447***	0.474***	0.438***	0.477***
					[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	7,725	7,317	7,572	7,317	7,684	7,281	7,532	7,281	7,725	7,318	7,572	7,318	7,684	7,282	7,532	7,282
Adjusted R 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

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in brackets.
Regression include the same controls listed in Appendix Table A.1.

Technical Appendix

A. Our basic model for our life and health satisfaction equations is the following:

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

where S_i 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 income of individual *i* in US$ PPP,[40] *EQ5* is the EQ5D score, constructed by the method described in Shaw et al. (2005), X'_i 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 optimism.[41] 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).

B. Shaw, Johnson and Coons (2005) use the following equation:

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

For these authors, m_1 is moderate mobility, m_2 is extreme mobility, and so on. 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.

[40] The Gallup World Poll does not 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.

[41] More precisely, *b*4 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 five years' time; personal economic satisfaction; satisfaction with housing; expectations held for the country in five 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 and marital status. The methodology is taken from van Praag and Ferrer-i-Carbonell (2007).