

**Supplementary Appendix to [U.S. Trends in Quality-Adjusted Life Expectancy from 1987 to 2008: Combining National Surveys to More Broadly Track the Health of the Nation.](#) Stewart ST, Cutler DM & Rosen AB. *American Journal of Public Health*, 2013;103(11): e78→e87**

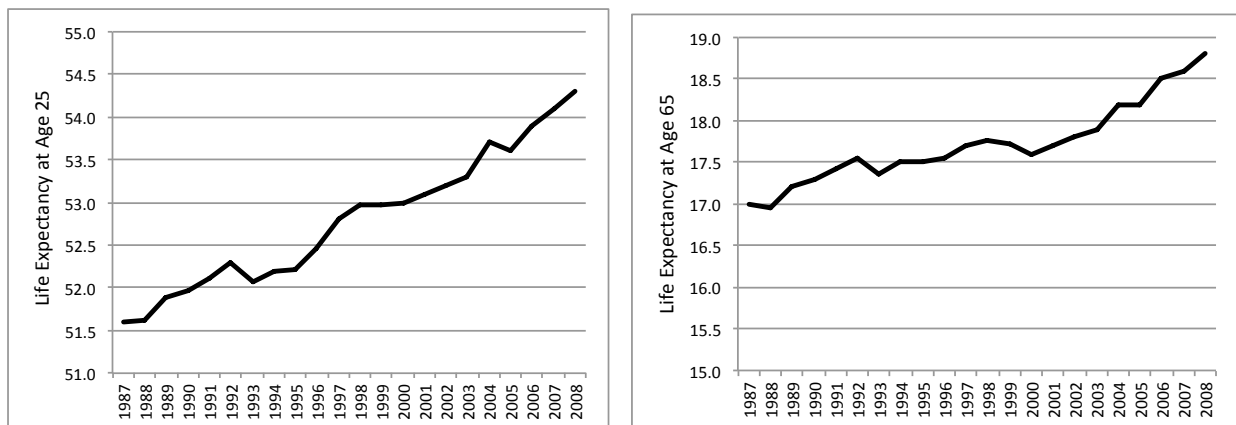
This appendix describes the data and methodology used to measure changes in population health. We calculated trends in life expectancy (LE) and quality-adjusted life expectancy (QALE) from 1987 to 1994/95, 1994/95 to 2000, and annually from 2000 to 2008; the years for which consistent data on impairments and symptoms are available. Analyses were performed using SAS (version 9.1<sup>1</sup> for Unix) and Microsoft Excel (version 14.1.3 for Mac). Figures were created using Microsoft Excel). Statistical methods designed for survey data and sampling weights were used in SAS to account for sampling factors including stratification, clustering, oversampling of minorities, and nonresponse to the overall survey and the mail-in health questionnaire (in MEPS data).

### **Mortality**

The first step in QALE calculation is to determine life expectancy at each age in each year. We used published National Center for Health Statistics (NCHS) mortality rates by year of age.<sup>2</sup> Social Security Administration Projected Life Tables<sup>3</sup> were used to calculate mortality rates for ages above the cutoffs in NCHS life Tables: age 85 from 1987 to 1996, and age 100 from 1997 to 2008.

Figure 1A shows life expectancy at ages 25 and 65 over the time period we examined. Life expectancy has increased at both ages, with the exception of plateaus and dips in some years. These small declines are not historically uncommon in the context of an overall increase, and are likely due to random fluctuations in the data from year to year.<sup>4,5</sup>

**Figure 1A: Trends in Life Expectancy at Ages 25 and 65**



## Quality of Life

The second step in deriving QALE is to calculate the prevalence of impairments and symptoms in the population over time, in order to calculate quality of life scores by age group in each year. For this we used three data sources that measure impairments and symptoms: the National Medical Expenditure Survey (NMES)<sup>6</sup> for the year 1987, the National Health Interview Survey (NHIS)<sup>7</sup> for 1994/95 (which included an expanded set of health questions in a disability supplement) and the Medical Expenditure Panel Survey (MEPS)<sup>8</sup> for the years 2000 to 2008. The 1987 and 1996 NHIS were also used for some items, as described below. These data all included the community-based population only. We added in the institutionalized population as noted below.

NMES and MEPS are household-based medical expenditure surveys sponsored by the Agency for Healthcare Research and Quality (AHRQ) (and its predecessor agency the National Center for Health Services Research), and the NHIS is a yearly health monitoring survey collected by NCHS. All three surveys are nationally representative of the non-institutionalized U.S. civilian population in each year. Sample sizes are given in **Table 1**.

Survey	Sample age 25+	Percent used for QALE trends*	Percent used for disaggregation**
1987 NMES	19,579	95%	83%
1987 NHIS	75,623	97%	94%
1994/95 NHIS	127,215	96%	93%
2000 MEPS	15,207	97%	81%
2001 MEPS	20,437	96%	81%
2002 MEPS	23,550	94%	80%
2003 MEPS	20,143	93%	79%
2004 MEPS	20,433	93%	78%
2005 MEPS	20,261	93%	78%
2006 MEPS	20,603	93%	78%
2007 MEPS	18,812	92%	77%
2008 MEPS	19,815	90%	77%

\*Excludes those of 'other' race (not white or black). \*\*Excludes those of 'other' race, those with a BMI under 18.5, and those with incomplete smoking or BMI data. In NHIS, where smoking was measured in supplements administered to only a portion of respondents, those missing on smoking were not excluded for that reason. A small additional portion of respondents were missing on particular impairments and symptoms in each year, varying from under 10 to near 2,500.

Question wording for symptoms and impairments measured in each survey is given in **Table 2** (end of appendix). The regression used to derive disutility weights for impairments and symptoms is shown in **Table 3** (end of appendix), and the last column of Table 3 contains the weight calculated for each impairment and symptom. We calculated these weights following the methodology used in a prior paper<sup>9</sup>, with a slightly revised coding of impairments and symptoms (the addition of ‘routine needs’ (also known as IADLs), a binary anxiety variable, and separate variables for bending, lifting, standing, reaching, and dexterity, which were previously combined). These changes resulted in a very small changes compared to the prior paper, including slightly reduced weights for primary and social activity and self-care (also known as ADLs).

Weights for bending/lifting combined and for levels of walking combined, for use with 1987 data in which these questions were not asked separately, were calculated using a separate regression model that combined them (not shown). Though some disutilities may appear small relative to the impact that the problem would be expected have on health-related quality of life, the weights are to be considered as a group and not individually. We include a broad array of these symptoms and impairments that are interrelated, which reduces the direct effect of each one individually, but provides a more comprehensive picture of their impact on health and identifies those with the worst independent effects.

In our prior paper<sup>9</sup> we found that weight for impairments and symptoms changed very little between two years of MEPS. This supported holding constant the impact of each impairment and symptom over time, with changes in the prevalence of symptoms and impairments driving changes in population HRQOL. That is, the effect of a problem such as difficulty bending on HRQOL is held constant, while rates of reported bending difficulty change over time.

#### *Adjustment for non-response*

In the 1987 NMES, vision and hearing questions were missing responses for 6% and 26% of the sample respectively. To retain these respondents in the sample, we assigned them a probability of having vision problems based on rates of vision problems reported by those with and without corrective eyewear in each age group, and a probability of having hearing problems based on the use of a hearing aid, gender, and age. This imputation slightly increased the actual prevalence of hearing problems (by 11%, from 9 to 10% of those 25+), and did not change the prevalence of vision problems (13%).

### *Adjustment for question wording change*

In order to ensure consistency in question wording for limitations in primary activity, self-care, and routine needs between 1987, 1994/95, and 2000, these variables were measured using the NHIS in 1987, 1994/95, and 1996 (the NHIS questionnaire changed after 1996). To adjust the rates from the NHIS questions to the rates from the MEPS questions in 2000 and beyond, the 1996 NHIS rates for these impairments were compared to the 1996 MEPS rates. The difference between rates across the two 1996 surveys was used to adjust rates of limitations in primary activity and self-care by 10 year age group in the 1987 and 1994/95 NHIS.

To measure walking, the 1987 NMES asked about difficulty walking 1 block, whereas the 1994/95 NHIS and the MEPS surveys asked about difficulty walking 3 blocks (1/4 mile). We adjusted for this difference using the 2000 Health and Retirement Survey (HRS)<sup>10</sup>, which asked the same individuals about difficulty walking 1 block and 3 blocks. In each 10-year age group, we calculated the portion of those who did not have trouble walking 1 block but did have trouble walking 3 blocks. We then increased the rate of walking problems in NMES by this amount, to estimate the proportion of people with trouble walking 3 blocks in 1987.

Questions in MEPS remained the same from 2000-2008 with the exception of three that changed slightly in 2003 due to the adoption of a revised version (v2) of the SF-12 health questionnaire: depressive symptoms, energy, and anxiety. (See Table 1A for details.) To adjust for this, we assumed no change in those symptoms between 2002 and 2003. HRQOL for 1987 to 2002 were adjusted for this by 10 year age group.

### *Impairment and symptom rates by age group*

In order to estimate the rates of reported impairments and symptoms by age group in each year, their prevalence in each survey was predicted from regression models relating the presence of each symptom and impairment to 10 year age categories, gender, race, and gender\*race. Race was represented by a binary variable for blacks, with whites as the referent group. Those reporting other races—Asian or Native American/Alaskan/ Hawaiian/Pacific Islander--were omitted from these regressions. Omitting this 5 to 10 percent of the sample (see Table 1) and had little effect on results. Predictions of impairment/symptom rates were performed separately in NMES and NHIS. For MEPS, the data from 2000 to 2008 were pooled, and a dummy variable for each year, interacted with age group, was used to capture trends. For the MEPS variables that changed in 2003 (depressive symptoms, energy and anxiety), separate pooled data sets from 2000 to 2002 and 2003 to 2008 were used to predict prevalence rates. For each year, the prevalence of each symptom and impairment was predicted for

each 10-year age group.

#### *Incorporating the institutionalized population*

To incorporate the institutionalized population, we used data from the National Nursing Home Survey (NNHS) and the Medicare Current Beneficiary Survey (MCBS). The NNHS is a nationally representative survey of nursing homes, their residents, and staff. NNHS data from 1985<sup>11</sup> were used to estimate the nursing home population in 1987, and NNHS 1995<sup>12</sup> and 1999<sup>13</sup> data were used for comparisons of 1987 to 1994/95 and 2000, respectively. For trends from 1994/95 to 2008, we used the institutionalized population of the MCBS,<sup>14</sup> a nationally representative survey of Medicare beneficiaries sponsored by the Centers for Medicare & Medicaid Services (CMS).

Symptoms and impairments not available in these data for the institutionalized population were treated as follows: all residents of institutions were assumed to be unable to perform their major role activity, those with difficulty bending were also assumed to have difficulty standing for 20 minutes, and rates of depressive symptoms, anxiety, pain, cognitive impairment, and energy were assumed to be equal to community rates. These assumptions were conservative, since rates of these problems would likely be higher in the institutionalized population. However, their effects were very small due to the relatively small size of the population in institutions.

To create HRQOL scores for the combined community and institutionalized population in each year, impairment and symptom rates were averaged by 10-year age group across the institutionalized and non-institutionalized populations, weighted using population prevalence estimates. Rates of institutionalization for the elderly were calculated using MCBS data, and obtained from publications for years for which we used the NNHS.<sup>15</sup> For the non-elderly, nursing home rates were obtained from NCHS.<sup>16</sup>

#### *Adjustment of earlier years to MEPS*

The national health surveys that we used to measure HRQOL provided data on the largest number of symptoms and impairments that were comparable over time. However, some of the questions in MEPS were not available in the earlier 1987 NMES and 1994/95 NHIS (lifting, standing, reaching and dexterity in 1987, pain and cognition prior to 2000) and other impairments and symptoms were omitted from our analyses because they were asked about in ways that were not comparable across surveys (limitation in activities besides primary activity; difficulty seeing and hearing in NHIS; and depressive and anxious symptoms in NHIS). Thus we based HRQOL at these earlier time periods on

models using a smaller number of symptoms and impairments, as detailed in Table 1 of the paper.

To measure and adjust for the effect of including more impairments and symptoms in 2000 onward, we calculated two additional HRQOL scores for each 10-year age group in 2000: one using only the impairments and symptoms available in the 1987 NMES, and one using only those available in the 1994/95 NHIS. For each 10-year age group, we calculated the difference in 2000 between the HRQOL scores using the smaller number of impairments and symptoms and the HRQOL score using all of the impairments and symptoms available in 2000. This difference was used to adjust the 1987 and 1994/95 scores downward by 10-year age group to account for the fact that the scores in those years were based on fewer impairments and symptoms. (This adjustment also accounted for the fact that walking 1 mile was added to the measurement of walking problems in 2000 onward; shorter models used for adjustment included only the version of walking based on the ¼ mile question.) To account for differences in coverage of the institutionalized population by the NNHS vs. MCBS, shorter models in 2000 used data from the 1995 and 1999 NNHS (comparable with NNHS data used in 1987), whereas the longer model used MCBS 2000 data (comparable with MCBS data used through 2008).

#### *Trends in Impairments and Symptoms*

Figure 2A (end of appendix) plots trends in some of the measured symptoms and impairments, adjusted by 10-year age groups to the 2000 population. (While plotted trends include both the community and institutionalized population, tests of trend significance included only the non-institutionalized population.) Full results are discussed in the main paper (pages 8-9) and shown in Table 2 of the main paper. Trends in impairments and symptoms were tested using logistic regressions, controlling for 10-year age group, gender, race, gender\*race, BMI category, and BMI/smoking category.

#### *HRQOL Scores*

The proportion of the population with each impairment or symptom was multiplied by the disutility weight for that impairment or symptom, shown in Table 2 of the main paper, and the resulting total was subtracted from 1. We subtracted an additional 0.08 from quality of life for all ages, which was our estimate of the average utility decrement in absence of any of these impairments and symptoms (or equivalently, the average health considering only impairments and symptoms not asked about in our data), based on the intercept of our regressions.

Trends in quality of life scores age-adjusted to the 2000 population are plotted in **Figure 3A**. Overall (Panel A), HRQOL was lower in older age groups but rose 0.026 among those 65+, and was

essentially unchanged for the non elderly (rising by 0.004 among those age 25-44 and 0.001 among those age 45-64). Examining HRQOL by gender and race (Panel B), males had the highest HRQOL, with similar levels among blacks and whites. Black females had the lowest HRQOL overall in all years. While all groups showed improvements in HRQOL over time, all experienced dips in the mid 2000's, and whites dropped between the mid 1990's and 2000. The rise among white males in 2001 was driven by small reductions among young adults (age 25-44) and the young elderly (age 65-74) in rates of severe depressive symptoms and low energy.

Quality increased by 0.025 at age 65, was essentially unchanged at younger ages. The greatest driver of HRQOL increases among the elderly over the 2000's was increased energy; other top contributors were increased ability to work, and decreased pain, ADL limitations, and depressive symptoms.

### Calculation of QALE and Confidence Intervals

Given the mortality and quality of life data, quality-adjusted life expectancy was calculated as follows:

$$(A1) \quad QALE_a = \sum_s \Pr[\text{alive at } s | \text{alive at } a] \cdot QOL_{a+s}$$

where  $a$  is the current age and  $s$  indexes future ages. Equation (A1) was estimated at each time period.

The standard error of QALE was calculated using the delta method<sup>17</sup> (formula A2<sup>18</sup>), assuming independence between mortality and HRQOL.\*

$$(A2) \quad \text{var}(QALE_x) = \frac{1}{l_x^2} \sum_{i=x}^{I-1} l_i^2 (QALE_{i+1} + 0.5u_i)^2 \text{var}(q_i) + \frac{1}{l_x^2} l_i^2 \text{var}(QALE_i) + \frac{1}{l_x^2} \sum_{i=x}^I L_i^2 \text{var}(u_i)$$

where QALE = quality/health-adjusted life expectancy  
 $x$  = the age at which QALE is calculated;  
 $i$  = index for age intervals  
 $I$  = the index of the final age in the tabulation  
 $l$  = number of survivors at the beginning of an age interval  
 $u$  = average quality of life score  
0.5 is the "separation factor" times the length of the age intervals, i.e. 0.5 x 1 year  
 $q$  = death rate within an age interval  
 $L$  = total life years lived in an age interval

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\*Other authors<sup>15</sup> estimating the variance of QALE have compared the results of the delta method to those of a bootstrapping method that did not assume independence between mortality and HRQOL. They found standard errors for life expectancy and QALE that were almost identical across the two methods, with the errors being slightly overestimated by the delta method.

To estimate the variance of the mortality rate at each age, we used published standard errors from the NCHS decennial life tables.<sup>19</sup> Since standard errors are published only in decennial tables and not in yearly NCHS life tables, we used errors from the 1990 decennial table for our analyses in 1987 and 1994, and errors from the 2000 decennial table for our analyses from the year 2000 onward. We increased these standard errors by the square root of 3 to account for the fact that decennial life tables are based on 3 years of mortality data whereas the yearly NCHS life tables used in our analyses are based on a single year of data.

Our calculations of the variance of HRQOL scores took into account the uncertainty surrounding our estimates of the prevalence of each symptom and impairment in each year among each 10-year age group in both the community and institutionalized populations. We also took into account the variance in the estimates of the share of the population that was institutionalized at each age in each year, and the variance of the weights for each symptom and impairment.

We did a final adjustment to the standard error of each estimate to account for the fact that our HRQOL scores were derived from regression analyses (to obtain weights for impairments and symptoms, and their predicted prevalence by age). Because the use of regression introduces a degree of artificial precision compared to directly measuring quality of life, we divided the standard errors by the square root of the  $r^2$  from the regression.<sup>20</sup>

### **Disaggregation of QALE trends**

The final step in our analyses was to disaggregate total QALE change in each time period by contributing factors: life expectancy change (independent of smoking/obesity change), changes in the prevalence of each symptom and impairment (independent of smoking/obesity change), and changes in smoking and obesity. To calculate the effect of changes in life expectancy on QALE, we simulated the change in QALE assuming that quality of life at each age was unchanged, but that mortality rates fell as actually occurred.

A similar methodology was used to estimate the impact of changes in symptom and impairment prevalence on QALE. We simulated the change in QALE if only a particular impairment or symptom had changed, holding constant mortality rates, smoking/obesity rates, and the rates of all other symptoms and impairments.

To calculate the effects of smoking and obesity on LE and QALE change over time, we began by dividing people into 12 BMI-smoking cells. We modeled four weight (normal weight (BMI 18.5–24.9



kg/m<sup>2</sup>), overweight (25.0–29.9 kg/m<sup>2</sup>), obese (30.0–34.9 kg/m<sup>2</sup>, obesity class I), and morbidly obese ( $\geq 35.0$  kg/m<sup>2</sup>, obesity classes II and III)), and three smoking categories (never smoker, former smoker, current smoker). We excluded from our analyses people who were severely underweight (BMI $\leq 18.5$ ) because low BMI can be indicative of pre-existing illness.<sup>21</sup>

For each year, we calculated the predicted distribution of the population at each single year of age into 12 smoking/BMI categories, using predictions from regressions of a dummy for each smoking/BMI category on age, age squared, black race, gender and black race\*gender in the National Health and Nutrition Examination Survey (NHANES) data.<sup>22</sup> Height and weight in the NHANES were taken from physical measures, to avoid reporting bias,<sup>23</sup> and pregnant females were omitted. A small number of predicted risk shares were negative at the oldest ages and these were set to zero. The first part of NHANES III, spanning 1988-1991, was used to estimate rates for 1987, and the second part of NHANES III, spanning 1992-1994, was used for 1994/95. The 1999-2000 wave of NHANES was used to obtain rates for the year 2000, the 2001-2002 wave for 2001 and 2002, the 2003-2004 wave for 2003 and 2004, the 2005-2006 NHANES for 2005 and 2006, and the 2007-2008 NHANES for 2007 and 2008. For rates from the year 2000 onward, the regression analysis was estimated in pooled data including all years from 1999 to 2008, with dummy variables for successive 2-year waves of NHANES. Risk shares were predicted for each year of age for each calendar year.

For those in institutions, the actual proportion in different smoking and BMI categories was calculated in the MCBS. Since smoking and BMI were not measured in the NNHS, MCBS 1992 rates were used to estimate 1987 rates.

### *Relative risks*

To determine the mortality changes attributable to smoking and obesity, the prevalences of each smoking/obesity category were multiplied by the relative risks of death for each category. Estimates of the relative risks of all-cause mortality were calculated for each of 12 smoking/obesity categories using data from combined NHANES I, II and III surveys, matched to subsequent death records, as described in Stewart et al, 2009.<sup>24</sup> The current analyses were updated using deaths through 2006 for NHANES III. **Table 4** shows the risks of death from any cause, for smoking/BMI groups relative to normal weight never smokers. Consistent with past findings,<sup>25</sup> overweight individuals had reduced mortality relative to those classified as normal weight, however this was true only for never smokers in both age groups. Obesity was even slightly protective among never-smokers under age 60. Former smoking was

also protective among those under 60 who were normal weight or overweight, perhaps due to improvements in other health behaviors that accompanied smoking cessation.

**Table 4: Risk of mortality from any cause for smoking/BMI groups relative to normal weight never smokers**

Smoking status	BMI category			
	Normal (18.5–24.9)	Overweight (25.0–29.9)	Obese (30.0–34.9)	Morbid Obese (≥35.0)
<b>&lt; age 60</b>				
Never	1.00	0.92	0.974	2.39
Former	0.97	0.95	1.16	1.84
Current	2.55	1.65	3.18	4.73
<b>60+</b>				
Never	1.00	0.96	1.20	1.85
Former	1.25	1.26	1.50	2.25
Current	2.80	2.38	3.70	5.27

The effect of risk factors on QALE through their impact on life expectancy was calculated by subtracting the improvement seen while holding smoking and obesity rates constant at baseline levels from the actual improvement in QALE due to life expectancy improvements over time. In each simulation, impairment and symptom rates were held constant at baseline levels as well.

To disaggregate the proportion of QALE change due to the effects of risk factors on HRQOL, the rates of impairments and symptoms in each year were predicted (by 10-year age group) for each of 8 smoking and BMI categories, as measured by variables on smoking and height/weight in the NMES, NHIS, and MEPS surveys. We used 8 categories because MEPS included only a dichotomous variable reflecting current smoking; hence, former smokers were included with never smokers. Predictions excluded those who were underweight and those missing on smoking or obesity status. An exception was that for impairments and symptoms from NHIS data (1987 and 1994/95), a dummy variable was included for those missing on smoking status, due to the large proportion missing on that variable in those samples. (Smoking was asked of only one person 18+ in half of NHIS households in 1987, and in ¼ of households in 1994/95.)

The effect of risk factors on QALE through quality of life was calculated by subtracting the improvement seen while holding constant smoking and obesity rates at baseline levels from the actual improvement in QALE over time, in each case holding life expectancy fixed.

**Table 2:** Symptom/Impairment Question wording Across Surveys

	Survey/Year in which Impairment/Symptom was Measured and Question Wording		
	NMES 1987	NHIS 1987, 1994/95, 1996	MEPS 2000-2008
Primary activity		Moderate: Limited in kind/amount of major activity (working at a job or business, keeping house, or going to school). Severe: Unable to perform major activity.	Moderate: Limited in ability to perform major activity (work at a job, do housework, or go to school) because of an impairment or a physical or mental health problem. Severe: completely unable to do this.
Social activity	--	--	Besides the limitations we just talked about, limited in participating in social, recreational, or family activities because of an impairment or a physical or mental health problem.
Self-care		Because of a physical, mental, or emotional problem, need help with/reminding/special equipment/someone close by/have difficulty/don't do bathing or showering, dressing, getting around inside the home.	Receive help or supervision with personal care such as bathing, dressing, or getting around the house because of an impairment or physical health problem.
Routine Needs		Need the help of other persons in handling routine needs, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes.*	Receive help or supervision using the telephone, paying bills, taking medications, preparing light meals, doing laundry, or going shopping
Walking	Any trouble walking one block because of your health. (Adjusted to 3 blocks using HRS.)	Difficulty walking 1/4 of a mile- -about 3 city blocks.	Moderate: Unable or some/a lot of difficulty walking a mile and/or some difficulty walking about 3 city blocks or about a quarter of a mile. Severe: Unable or a lot of difficulty walking 3 blocks.

Bending	Trouble bending, lifting, or stooping because of your health.	Any difficulty bending down from a standing position to pick up an object from the floor, for example a shoe.	Difficulty bending down or stooping from a standing position to pick up an object from the floor or tie a shoe (some/a lot/completely unable).
Lifting		Any difficulty lifting something as heavy as 10 pounds, such as a full bag of groceries.	Difficulty lifting 10 lbs (some/a lot/completely unable).
Standing		Any difficulty standing for about 20 minutes.	Difficulty standing for 20 minutes (some/a lot/completely unable).
Reaching		Any difficulty reaching up over the head or reaching out as if to shake someone's hand.	Difficulty reaching up overhead, for example to remove something from a shelf (some/a lot/completely unable).
Dexterity		Any difficulty using fingers to grasp or handle something, such as picking up a glass from the table.	Difficulty using fingers to grasp (some/a lot/completely unable).
Depressive Symptoms	Felt downhearted and blue during the past 30 days  Moderate: some of the time or a good bit of the time (vs. a little or none of the time); Severe: most or all of the time (vs. a little or none of the time).	--	Felt downhearted and blue during the past 4 weeks  Moderate: some of the time or a good bit of the time (vs. a little or none of the time); Severe: most or all of the time (vs. a little or none of the time)  (SF-12v1)**
Anxiety	Felt calm and peaceful during the past 30 days only some, a little, or none of the time (vs. a good bit, most or all of the time).	--	Felt calm and peaceful during the past 4 weeks only some, a little, or none of the time (vs. a good bit, most or all of the time)  (SF-12v1)**
Vision	Any difficulty seeing (with glasses if used).	--	Difficulty seeing (with glasses or contacts, if used): some difficulty seeing or can not read ordinary newspaper print or can not recognize familiar people standing two or three feet away or blind.

Hearing	Any difficulty hearing (with hearing aid, if used).	--	Difficulty hearing (with hearing aid, if used): some difficulty hearing or can not hear some or most things people say or deaf.
Pain	--	--	Pain interfered with normal work (including both work outside the home and housework) during the past 4 weeks  Moderate: a little bit, moderately, or quite a bit (vs. not at all); Severe: extremely (vs. not at all, a little bit, moderately, or quite a bit) (SF-12).
Cognition	--	--	Experience confusion or memory loss such that it interferes with daily activities; have problems making decisions to the point that it interferes with daily activities; require supervision for own safety.
Energy			Portion of the time person had a lot of energy during the past 4 weeks (vs. most or all of the time). Moderate: a good bit of the time or some of the time  Severe: a little or none of the time (SF-12v1)**

\*Those 70+ and those reporting self-care (ADL) difficulty were not asked this question. Thus, all those with self care (ADL) problems were coded as having IADL problems. In addition, those 70+ reporting that they were 'limited in performing other routine needs' besides self-care are coded as having problems with routine needs.)

\*\*Changes to questions on depressive symptoms, anxiety, and energy in 2003 as a result of the switch from SF12 version 1 to version 2: The 'good bit of the time' response option was omitted, affecting the distribution of responses into other categories. Depressive wording changed to 'downhearted and depressed'. Thus, our analyses assumed no change in these symptoms between 2002 and 2003.

**Table 3:** Coefficients from OLS Regression of a 100-Point<sup>†</sup> Self-Rating of Health on Impairments and Symptoms in MEPS 2002, and Disutility Weights Derived for Impairments and Symptoms

Domains and symptoms/impairments	Regression Coefficient	P Value	Disutility Weight*
<b>Primary Activity</b>			
Limited major role activity	-0.04	0.003	-0.03
Unable to perform major role activity	-0.06	<.0001	-0.06
Limited in social activity	-0.03	0.119	-0.02
<b>Physical Activity</b>			
Self-care limitations	-0.11	0.038	-0.12
Routine needs	-0.09	0.001	-0.07
Bending	-0.01	0.556	-0.01
Lifting	-0.01	0.397	-0.01
Standing	0.00	0.663	0.01
Reaching	0.00	0.919	0
Dexterity	-0.02	0.046	-0.02
Moderate walking limitation	-0.01	0.825	0
Severe walking limitation	-0.02	0.206	-0.03
<b>Mental Health<sup>d</sup></b>			
Moderate Depressive symptoms	-0.03	<.0001	-0.03
Severe Depressive symptoms	-0.07	<.0001	-0.07
Anxiety symptoms	-0.02	<.0001	-0.02
<b>Sensory</b>			
Vision impairment	-0.03	0.002	-0.02
Hearing impairment	-0.02	0.001	-0.02

Domains and symptoms/impairments	Regression Coefficient	P Value	Disutility Weight*
<b>Pain</b>			
Moderate pain	-0.05	<.0001	-0.06
Severe pain	-0.17	<.0001	-0.16
<b>Cognitive impairment</b>			
Cognitive impairment	-0.03	0.131	-0.03
<b>Vitality</b>			
Have a lot of energy a little/none of time	-0.05	<.0001	-0.06
Have a lot of energy only some of time	-0.12	<.0001	-0.11
<b>Interactions</b>			
Major role & social activity limitations	0.00	0.929	
Major role & self-care limitations	0.03	0.519	
Major role & routine needs limitations	-0.01	0.696	
Major role & walking limitations	0.02	0.418	
Major role & bending/lifting limitations*	0.02	0.527	
Major role limitation & depressive symptoms	0.04	0.017	
Major role limitation & anxiety symptoms	0.03	0.055	
Major role limitation & vision impairment	-0.02	0.321	
Major role limitation & hearing impairment	0.01	0.431	
Major role limitation & cognitive impairment	-0.01	0.554	
Major role limitation & pain	-0.04	0.005	
Major role limitation & vitality loss	-0.01	0.410	
Secondary activity & self-care limitations	-0.04	0.168	
Secondary activity & routine needs limitations	0.01	0.767	
Secondary activity & walking limitations	-0.04	0.230	

Domains and symptoms/impairments	Regression Coefficient	P Value	Disutility Weight*
Secondary activity & bending/lifting limitations	0.03	0.315	
Secondary activity & depressive symptoms	-0.02	0.411	
Secondary activity limitation & anxiety symptoms	-0.04	0.035	
Secondary activity limitation & vision impairment	0.01	0.485	
Secondary activity limitation & hearing impairment	-0.02	0.399	
Secondary activity & cognitive impairment	-0.01	0.762	
Secondary activity limitation & pain	0.02	0.350	
Secondary activity limitation & vitality loss	0.04	0.071	
Self care & & routine needs limitations	0.06	0.116	
Self-care & walking limitations	0.10	0.364	
Self-care & bending/lifting limitations	-0.01	0.939	
Self-care limitations & depressive symptoms	-0.03	0.410	
Self-care limitations & anxiety symptoms	0.00	0.956	
Self-care limitations & vision impairment	-0.02	0.463	
Self-care limitations & hearing impairment	0.01	0.783	
Self-care limitations & cognitive impairment	-0.01	0.736	
Self-care limitations & pain	-0.02	0.769	
Self-care limitations & vitality loss	-0.05	0.318	
Routine needs & walking limitations	-0.13	0.043	
Routine needs & bending/lifting limitations	0.16	0.012	
Routine needs limitations & depressive symptoms	-0.01	0.529	
Routine needs limitations & anxiety symptoms	0.03	0.172	
Routine needs limitations & vision impairment	0.03	0.122	
Routine needs limitations & hearing impairment	-0.04	0.069	
Routine needs limitations & cognitive impairment	0.06	0.018	



Domains and symptoms/impairments	Regression Coefficient	P Value	Disutility Weight*
Routine needs limitations & pain	0.01	0.814	
Routine needs limitations & vitality loss	-0.01	0.655	
Walking & bending/lifting limitations	-0.03	0.153	
Walking limitations & depressive symptoms	0.02	0.699	
Walking limitations & anxiety symptoms	-0.01	0.625	
Walking limitations & vision impairment	-0.01	0.694	
Walking limitations & hearing impairment	0.02	0.439	
Walking limitations & cognitive impairment	0.01	0.846	
Walking limitations & pain	0.02	0.339	
Walking limitations & vitality loss	-0.01	0.494	
Bending/lifting limitations & depressive symptoms	-0.02	0.523	
Bending/lifting limitations & anxiety symptoms	0.01	0.464	
Bending/lifting limitations & vision impairment	0.01	0.495	
Bending/lifting limitations & hearing impairment	0.00	0.869	
Bending/lifting limitations & cognitive impairment	0.01	0.755	
Bending/lifting limitations & pain	-0.01	0.652	
Bending/lifting limitations & vitality loss	-0.01	0.465	
Depressive & anxiety symptoms	-0.02	0.006	
Depressive symptoms & vision impairment	0.00	0.992	
Depressive symptoms & hearing impairment	0.02	0.079	
Depressive symptoms & cognitive impairment	-0.04	0.050	
Depressive symptoms & pain	-0.02	0.068	
Depressive symptoms & vitality loss	0.01	0.141	
Anxiety symptoms & vision impairment	0.00	0.772	
Anxiety symptoms & hearing impairment	0.00	0.683	

Domains and symptoms/impairments	Regression Coefficient	P Value	Disutility Weight*
Anxiety symptoms & cognitive impairment	-0.03	0.206	
Anxiety symptoms & pain	0.00	0.788	
Anxiety symptoms & vitality loss	-0.01	0.017	
Vision & hearing impairments	0.01	0.287	
Vision & cognitive impairments	0.02	0.279	
Vision impairment & pain	0.01	0.210	
Vision impairment & vitality loss	-0.02	0.130	
Hearing & cognitive impairments	0.01	0.447	
Hearing impairment and pain	0.00	0.940	
Hearing impairment & vitality loss	-0.01	0.334	
Cognitive impairment & pain	0.00	0.926	
Cognitive impairment & vitality loss	0.00	0.964	
Pain & vitality loss	-0.04	<.0001	
Intercept	.92		
Summary statistics			
N	22,647		
R <sup>2</sup>	0.537		

<sup>†</sup>100-point Visual Analog Scale from the EuroQol EQ-5D instrument, transformed to a 0-1 scale.

\*in interaction terms, “bending/lifting” includes any of: bending, lifting, standing, reaching and dexterity

\*\*Calculated to incorporate the effects of interactions, as described above and done in Stewart et al., 2008.