Estimating EuroQol EQ-5D Scores from Population Healthy Days Data

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Background. *Preference-based assessments of population health, which may be used for cost-utility analyses, are lacking for most states and communities. With adequate population data, preference-based values can be estimated from non-preference-based health-related quality of life (HRQOL) data. This study estimates scores on the EuroQol EQ-5D, a preference-based measure, from the Healthy Days Measures.* ***Methods.*** *No data set from the US population asks both the Healthy Days and EQ-5D questions for the same respondents. Therefore, estimates for EQ-5D scores were obtained indirectly by matching cumulative distributions of the 2 measures. These distributions were estimated from the 2000–2002 Behavioral Risk Factor Surveillance System (BRFSS) and the Medical Expenditure Panel Survey (MEPS). The validity of estimates was examined by comparing the mean estimated and observed scores across particular population subgroups. A simulation study was conducted to compare the performance of the proposed method to the regression method.* ***Results.*** *The overall mean observed EQ-5D index was 0.871 and the mean estimated EQ-5D index was 0.872. In the majority of examined subgroups, the mean scores demonstrated a good match according to sociodemographic variables and health-related conditions and, with the exception of the most impaired health states, the differences tended to be less than 0.04.* ***Conclusions.*** *This study provided preliminary estimates of EQ-5D scores from the Healthy Days Measures and demonstrated acceptable validity of the estimates. Because the Healthy Days Measures have been included in many state and local surveys, preliminary cost-utility analyses and determination of burden of disease might be able to be conducted at the national, state, and community levels as well as over time.* ***Key words:*** *health-related quality of life; EQ-5D; Healthy Days Measures; cost-effective analysis.* ***(Med Decis Making 2008;28:491–499)***

The Centers for Disease Control and Prevention (CDC) and the Agency for Healthcare Research and Quality (AHRQ) have studied and incorporated different measures of health-related quality of life (HRQOL) in surveys of the US general population. These measures include slightly different concepts/constructs that are viewed to "best represent" health and may be administered with relative ease.[1,2] The Healthy Days Measures are a set of non-preference-based HRQOL survey measures developed by the CDC and administered in the Behavioral Risk Factor Surveillance System (BRFSS) that were designed to be brief and valid.[1,3] By contrast, the EQ-5D, an internationally developed preference-based measure,[4,5] was used by the AHRQ in the Medical Expenditure Panel Survey (MEPS) and has been shown to be valid and reliable.[6,7]

Many investigators have proposed estimating preference-based scores from non-preference-based measures.[8–12] For example, with the inclusion of both the SF-12 and EQ-5D in the MEPS from 2000 to 2003, algorithms have been developed that may convert the SF-12 subscale scores to an EQ-5D index score using multiple regressions.[8,9,13,14] The resultant scores can be used to measure quality-adjusted life years (QALYs) in cost-utility analyses.

The CDC has incorporated the Healthy Days Measures as part of the BRFSS since 1993[1,2,15] and in the National Health and Nutrition Examination Survey (NHANES) since 2000. These measures define HRQOL as "perceived physical and mental health over time" and ask respondents about their recent number of poor health days. Unlike the MEPS, the

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BRFSS was designed to provide reliable state-level estimates of healthy days and estimates for some substate areas,[16] or detailed annual and monthly estimates for large geographic areas.[1] Healthy Days Measures identify known or suspected groups with unmet health-related needs, including persons of low socioeconomic status or with disabilities.[1] Additionally, the Healthy Days Measures and EQ-5D scores were designed to measure HRQOL using the same level of measurement (ratio scale).[1,3,17] Thus, estimation of the EQ-5D scores from the Healthy Days Measures can provide data for cost-utility analyses and can capture the advantages and disadvantages of both measures.

However, developing an estimation equation of EQ-5D scores from the Healthy Days Measures cannot be done directly[8,9] because of the lack of population-based data that includes responses to both HRQOL measures for the same respondents. This study proposed an alternative method to estimate EQ-5D scores from the Healthy Days Measures indirectly. In particular, this study estimated EQ-5D scores from the number of overall healthy days for subgroups of persons in any given age category and for any given age and self-rated heath. The validity of estimates was examined by ecological analyses of mean scores in different population subgroups and by simulations.

MATERIALS AND METHODS

Data Sources

Data came from 2 representative samples of the US adult population: the 2000–2002 BRFSS and the 2000–2002 MEPS. The BRFSS is an ongoing annual state-based telephone interview survey using the random-digit dial method to generate population-based representative samples of noninstitutionalized civilian adult residents from each of the 50 states and the District of Columbia.[15,18]

The BRFSS included the Healthy Days Measures to track population HRQOL. Respondents were asked to report the number of days in the past 30 days when their physical health was not good (physically unhealthy days) and when their mental health was not good (mentally unhealthy days). The overall healthy days were calculated by subtracting respondents' physically unhealthy and mentally unhealthy days from 30 days, with a logical minimum of zero healthy days.[3] From 2000 to 2002, 626,119 adults responded to the BRFSS; however, respondents from the 29 states that did not answer all the Healthy Days questions in 2002 were excluded from the analysis, leaving a total sample size of 489,624.

The MEPS, a representative survey of the US noninstitutionalized, civilian population, provided the data source for the EQ-5D.[19,20] The household component of the MEPS contains detailed data about sociodemographic characteristics and selected chronic conditions. Since 2000 the MEPS distributed a self-administrated paper questionnaire to adult participants that included the EQ-5D from 2000 until 2003.[21]

The EQ-5D comprises a descriptive system and a visual analog scale (EQ VAS) intended to assess health today. The descriptive system enables respondents to classify their health on 1 of 3 levels according to 5 dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The data may be used to represent a profile of health status or converted into a single summary index (EQ-5D index) by applying scores from a valuation set.[4] The scoring algorithm used for this research is based on preferences from the US general population using the time tradeoff (TTO) method.[22] The EQ VAS is anchored at 100 (best imaginable health) and 0 (worst imaginable health) and captures a self-rating of health status.[4] Although 60,653 adults were in the 2000–2002 MEPS, only the responses of the 53,666 adults who completed questions in the self-administrated paper questionnaire are analyzed here.

Estimating EQ-5D Scores from Healthy Days

The estimates were obtained by matching the cumulative distributions of the 2 HRQOL measures. First, the cumulative distributions of the healthy days and the EQ-5D scores were estimated separately from the BRFSS and MEPS, respectively. The cumulative distribution is the percentage of the population whose scores were less than or equal to a given value or the percentile. Then, the 2 cumulative distributions were merged by matching their percentiles. The merged data gave the equivalent scores of the 2 measures at the same percentile and thus provided the estimated EQ-5D scores for any given number of healthy days. For example, approximately 34.7% of US adults reported having 25 or fewer overall healthy days during the past 30 days. Because the estimated percentage of respondents who scored 0.815 or less in EQ-5D index was 34.7%, too, the estimated EQ-5D index score for persons with 25 healthy days was 0.815. The underlying assumption of the proposed method is that the MEPS and BRFSS are roughly comparable surveys that provide approximately the same estimated mean score of HRQOL for the community resident adults if the same HRQOL measure was used.

To obtain a reliable and "smooth" estimation of the cumulative distributions, this study used the nonparametric density estimation method based on data smoothing.[23] The estimation also was adjusted for the differences in sampling weights and post-stratification of the BRFSS and MEPS to eliminate differences in bias of 2 data sets. Because age is strongly related to EQ-5D but weakly related to healthy days,[3,17] age must be incorporated as an additional predicting variable. To do this, the above analysis was done separately in 5 age categories (18–24, 25–44, 45–64, 65–74, and 75 years and over) to provide estimated EQ-5D scores based on the number of healthy days and age categories. Because the self-rated general health question is included in many health surveys and frequently is used to measure population health status,[24,25] we also provided the estimated EQ-5D scores based on the number of healthy days, age categories, and self-rated general health using the above method with the logical requirement that EQ-5D scores increase with the improvement of self-rated health status from the lowest level ("poor") to the highest level ("excellent").

Evaluation of Estimations

The validity of estimates was evaluated in 2 ways. First, we compared the mean estimated EQ-5D scores from the BRFSS to the mean observed EQ-5D scores from the MEPS according to the following sociodemographic subgroups and health characteristics: age, gender, race/ethnicity, educational attainment, category of body mass index (BMI), self-rated health, presence and degree of activity limitations, and the presence of selected chronic diseases (asthma, hypertension, diabetes, heart disease, or stroke).

Second, simulations were conducted to compare the performance of estimation using the proposed method and the commonly used regression method.[8,9] The EQ-5D scores of respondents in the BRFSS data set were generated based on respondent's age, race/ethnicity, gender, education, self-rated health, and activity limitation level and a Gauss random term. The equation to generate EQ-5D scores was estimated from the MEPS. We then estimated respondents' EQ-5D scores from their responses of healthy days and age category using the 2 estimation methods separately and compared some goodness-of-fit statistics between these 2 methods.

RESULTS

First, we examined the comparability of MEPS and BRFSS data by comparing the population distribution of some demographic and health variables in the 2 data sets (Table 1). The difference of estimated proportions between the 2 data sources is less than 3 percentage points in the 3 demographic variables and the activity limitation variable. Compared with BRFSS respondents, MEPS respondents were less likely to report "excellent" and "poor" health, but the difference is less than 5 percentage points.

Table 2 presents the estimated EQ-5D index and EQ VAS scores based on respondents' age category and the number of healthy days. For example, the estimated EQ-5D index and EQ VAS are 0.842 and 83.4, respectively, for a 30-year-old person who reports 27 overall healthy days. Similarly, we also estimated EQ-5D index and EQ VAS scores from the number of healthy days for any adult in a given age category and level of self-reported health status. (These data are not shown but are available from the authors upon request.) For example, the estimated EQ-5D index is 0.841 for a 30-year-old person who reports 27 overall healthy days and "good" health.

Because individual level cross-validation of estimates was impossible due to the lack of data, validity of estimation was evaluated at the community level. The estimated EQ-5D scores were evaluated by comparing the mean estimated EQ-5D scores from the BRFSS to the mean observed EQ-5D scores from the MEPS in subgroups according to selected sociodemographic variables and health conditions. Table 3 presents the results. In the table, the estimates are based on model 1, using age and healthy days to estimate EQ-5D scores, as well as model 2, using age, self-rated health status, and healthy days to estimate EQ-5D index scores. The overall means of estimated EQ-5D index scores based on the 2 models were 0.866 and 0.872, respectively, which were very close to the mean of the actual score (0.871). The overall means of estimated EQ VAS scores from both models (80.8 and 80.7, respectively) also were very close to the mean observed score (80.5).

When examined by subgroups of sociodemographic and health-related variables, the mean predicted EQ-5D scores (both EQ-5D Index and EQ VAS) based on both models and the mean actual scores varied similarly according to subgroups for all examined variables. The data showed a good match of mean estimated and observed scores. The differences were particularly small according to age,

Table 1 Comparison of Estimated Proportion by Some Demographic and Health Variables from the 2000–02 BRFSS and MEPS

	BRFSS, %	MEPS, %	Difference, %
Age			
18–24	12.9	12.0	0.9
25–44	39.7	40.5	0.8
45–64	30.4	31.7	1.3
65–74	10.2	8.9	1.3
75+	6.9	6.9	0.0
Sex			
Male	48.2	45.2	3.0
Female	51.8	54.8	3.0
Race/ethnicity			
White, non-Hispanic	72.8	73.6	0.8
Black, non-Hispanic	9.6	11.2	1.6
Hispanic	13.4	11.2	2.2
Asian/Pacific Islander	3.2	3.4	0.2
AI/AN	1.1	0.6	0.4
Self-rated health			
Excellent	22.0	17.7	4.3
Very good	33.1	37.7	4.6
Good	29.4	31.1	1.7
Fair	11.4	11.1	0.3
Poor	4.1	2.5	1.7
Activity limitation (AL)			
No AL	83.2	85.3	2.1
AL, no help needed	13.9	12.1	1.8
IADL, no ADL	1.9	1.5	0.4
ADL	0.9	1.1	0.2

Note: BRFSS = Behavioral Risk Factor Surveillance System; MEPS = Medical Expenditure Panel Survey; AI/AN = American Indian/Alaskan Native; IADL = instrumental activities of daily living; ADL = activities of daily living.

gender, race/ethnicity, educational attainment, category of BMI, and the presence of any disease (< 5%). Self-rated health status and activity limitation affected estimated and observed mean EQ-5D scores in a similar manner. The mean estimated and observed scores decreased with worsening category of self-rated health and impairment of activity limitation. However, the differences between the estimated scores using model 1 and observed scores were among the biggest for persons who reported "fair" or "poor" health, for persons who had impairments of instrumental activities of daily living (IADL) or activities of daily living (ADL), and for persons who had reported a stroke. By adding self-rated health in the model (model 2), the estimated scores became much closer to the observed scores, particularly among respondents who reported "excellent," "fair," and "poor" health. However, even after adding self-rated health in the model, the magnitude of difference between estimated scores and observed scores was greatest for the most impaired health states—that is, fair and poor self-rated health, impairments in IADL or ADL, and persons who had reported a stroke.

We also applied a simulation study to compare the performance of the alternative method to the commonly used regression method. By changing the variance of the random term, we generated several sets of EQ-5D scores at different levels of association with healthy days. Figure 1 presents plots of R^2 and root of mean square error (RMSE) against correlation coefficients between healthy days and simulated EQ-5D scores. As expected, the R^2 of estimations from both methods increased as the correlation coefficient increased and the RMSE of both methods decreased as the correlation coefficient increased. Also, as expected, the R^2 values of alternative estimates were 9–12% lower than that of regression estimates and the RMSEs of alternative estimates were 0.012–0.015 points higher than that of regression estimates.

Table 2 Estimated EQ-5D Index and EQ VAS Scores from the Number of Healthy Days by Age Category

Healthy Days	18–24 Years		25–44 Years		45–64 Years		65–74 Years		75 + Years	
	EQ-5D	EQ VAS	EQ-5D	EQ VAS	EQ-5D	EQ VAS	EQ-5D	EQ VAS	EQ-5D	EQ VAS
30	0.999	97.2	0.998	94.3	0.968	91.8	0.905	88.7	0.883	85.8
29	0.998	93.6	0.995	89.6	0.834	84.3	0.823	79.6	0.811	75.1
28	0.997	90.5	0.949	86.5	0.827	80.5	0.817	77.4	0.806	73.3
27	0.994	89.6	0.842	83.4	0.823	79.7	0.809	74.6	0.795	70.2
26	0.992	88.0	0.833	80.4	0.818	79.1	0.802	71.6	0.782	69.8
25	0.914	85.1	0.827	79.8	0.809	75.5	0.796	70.2	0.778	69.4
24	0.843	84.1	0.824	79.4	0.803	74.5	0.784	69.8	0.776	67.2
23	0.839	80.9	0.821	77.2	0.800	71.5	0.779	69.5	0.773	64.3
22	0.832	80.0	0.816	75.1	0.797	70.2	0.776	68.2	0.770	61.0
21	0.829	79.8	0.811	74.8	0.795	70.0	0.776	66.0	0.769	60.6
20	0.826	79.2	0.804	73.1	0.787	69.7	0.773	64.1	0.764	60.2
19	0.824	77.0	0.801	70.5	0.778	69.4	0.770	61.4	0.758	59.9
18	0.823	75.6	0.800	70.3	0.777	69.2	0.769	60.9	0.756	59.8
17	0.821	75.2	0.799	70.1	0.776	68.5	0.768	60.6	0.753	59.8
16	0.817	74.7	0.798	69.9	0.773	65.5	0.765	60.2	0.716	59.5
15	0.805	71.3	0.793	69.2	0.767	61.5	0.740	59.6	0.708	55.7
14	0.800	70.0	0.781	66.0	0.761	60.0	0.711	58.7	0.706	51.5
13	0.799	69.8	0.776	65.1	0.759	59.9	0.711	55.9	0.706	51.1
12	0.797	69.6	0.773	64.6	0.757	59.8	0.710	55.3	0.705	50.9
11	0.797	69.4	0.771	63.7	0.755	59.7	0.710	55.0	0.705	50.8
10	0.794	66.9	0.767	60.7	0.717	58.4	0.708	53.2	0.704	50.5
9	0.789	64.7	0.763	60.0	0.709	55.1	0.707	50.9	0.702	50.2
8	0.779	63.4	0.760	59.8	0.708	54.2	0.706	50.6	0.701	50.2
7	0.773	61.0	0.758	59.7	0.708	52.4	0.706	50.5	0.701	50.2
6	0.771	60.6	0.754	59.6	0.707	51.6	0.706	50.5	0.700	50.1
5	0.768	60.1	0.716	59.1	0.706	50.8	0.705	50.4	0.699	50.1
4	0.766	59.9	0.710	56.1	0.705	50.5	0.705	50.3	0.695	50.0
3	0.765	59.8	0.709	55.4	0.705	50.4	0.705	50.2	0.694	50.0
2	0.763	59.6	0.708	54.3	0.704	50.3	0.704	50.2	0.692	50.0
1	0.760	59.0	0.706	51.9	0.704	50.2	0.703	50.2	0.689	50.0
0	0.528	44.4	0.479	39.8	0.464	38.6	0.453	37.4	0.441	37.2

Note: EQ-5D = EuroQol EQ-5D; EQ VAS = EQ visual analog scale.

DISCUSSION

Using Healthy Days Measures to track population HRQOL has become increasingly common because it provides a simple yet valid measurement of population overall health.[1,3] Since no representative data set includes both EQ-5D scores and the number of healthy days, we obtained the equivalent EQ-5D score of a given number of healthy days at the same percentile indirectly. Because Healthy Days Measures have been used in the BRFSS since 1993 and the NHANES since 2000, translating the number of healthy days to a preference-based measure would be applicable in certain circumstances. We should take advantage of the BRFSS and NHANES data and conduct analyses that previously were unable to be done. Specifically, our derived EQ-5D scores might be particularly useful when examining changes in HRQOL over time (with regard to long term time trend and seasonal variations) as well as HRQOL at the state and community levels and for small socio-demographic subgroups.

Such a method that compares the distributions of different measures across populations has been used in studies of the impact of inequalities of wealth on health[26] and in comparing different SF-36 scoring methods in the US and UK population.[27] The estimated EQ-5D scores based on the proposed method are unique and unbiased with the 2 HRQOL measures monotonically increasing (i.e., increasing healthy days must result in increasing estimated EQ-5D scores). Also, all estimated EQ-5D scores from regressions must satisfy the requirement of a matching cumulative distribution with the healthy

Table 3 Comparing Observed EQ-5D Scores to Estimated EQ-5D Scores by Sociodemographic and Health Characteristics

	EQ-5D Index			EQ VAS		
		Estimated (BRFSS)			Estimated (BRFSS)	
	Observed (MEPS)	Model 1	Model 2	Observed (MEPS)	Model 1	Model 2
Total	0.871	0.866	0.872	80.5	80.8	80.7
Age, y						
18–24	0.923	0.919	0.920	85.9	86.1	86.0
25–44	0.899	0.893	0.899	82.7	83.1	83.1
45–64	0.848	0.843	0.849	78.7	78.7	78.7
65–74	0.819	0.816	0.829	75.9	76.7	76.1
75 +	0.782	0.782	0.787	71.7	72.3	71.5
Sex[a]						
Male	0.884	0.881	0.885	81.4	82.5	81.9
Female	0.860	0.851	0.859	79.6	79.1	79.3
Race/ethnicity[b]						
White, non-Hispanic	0.872	0.867	0.875	80.8	80.8	81.3
Black, non-Hispanic	0.854	0.859	0.859	79.1	80.0	78.8
Hispanic	0.863	0.859	0.853	78.8	80.0	77.5
Asian/PI	0.901	0.898	0.900	80.6	84.4	83.7
AI/AN	0.802	0.825	0.828	75.4	76.0	75.3
Education[b]						
< High school	0.825	0.831	0.822	74.9	76.8	73.6
High school or GED	0.859	0.860	0.863	79.9	80.1	79.4
> High school	0.893	0.876	0.887	82.6	81.9	82.7
BMI categories[b]						
< 18.5	0.837	0.834	0.836	74.2	77.3	76.6
18.5–25	0.888	0.874	0.884	82.4	81.6	82.3
25–30	0.876	0.870	0.876	81.3	81.3	81.1
30–35	0.850	0.852	0.853	78.1	79.2	78.1
35 +	0.814	0.813	0.809	74.0	74.9	72.7
Self-rated health[b]						
Excellent	0.955	0.919	0.960	93.1	86.8	92.2
Very good	0.913	0.893	0.916	86.5	83.9	86.7
Good	0.852	0.866	0.851	76.7	80.8	77.4
Fair	0.729	0.770	0.742	59.8	69.8	61.8
Poor	0.511	0.589	0.551	39.2	50.9	41.9
Activity limitation (AL)[b]						
No AL	0.899	0.890	0.898	83.3	83.5	83.7
AL, no help needed	0.727	0.749	0.754	66.0	67.8	66.9
IADL	0.581	0.658	0.663	53.5	58.0	56.3
ADL	0.485	0.631	0.631	47.8	55.3	53.0
Disease[b]						
None	0.891	0.882	0.894	83.1	82.6	83.4
Any diseases	0.829	0.818	0.816	75.5	75.5	73.8
Asthma	0.823	0.800	0.801	75.0	73.4	72.2
Hypertension	0.813	0.829	0.825	73.9	76.6	74.5
Diabetes	0.793	0.797	0.786	69.8	73.2	69.4
Heart disease	0.745	0.766	0.759	64.7	69.9	66.7
Stroke	0.699	0.743	0.738	60.9	67.3	64.3

Note: EQ-5D = EuroQol EQ-5D; EQ VAS = EQ visual analog scale; MEPS = Medical Expenditure Panel Survey; BRFSS = Behavioral Risk Factor Surveillance System; PI = Pacific Islander; AI/AN = American Indian/Alaskan Native; GED = General Educational Development; BMI = body mass index; IADL = instrumental activities of daily living; ADL = activities of daily living. Model 1: estimation variables include age and healthy days; model 2: estimation variables include age, self-rated health, and healthy days.
a. Adjusted for age.
b. Adjusted for age and sex.

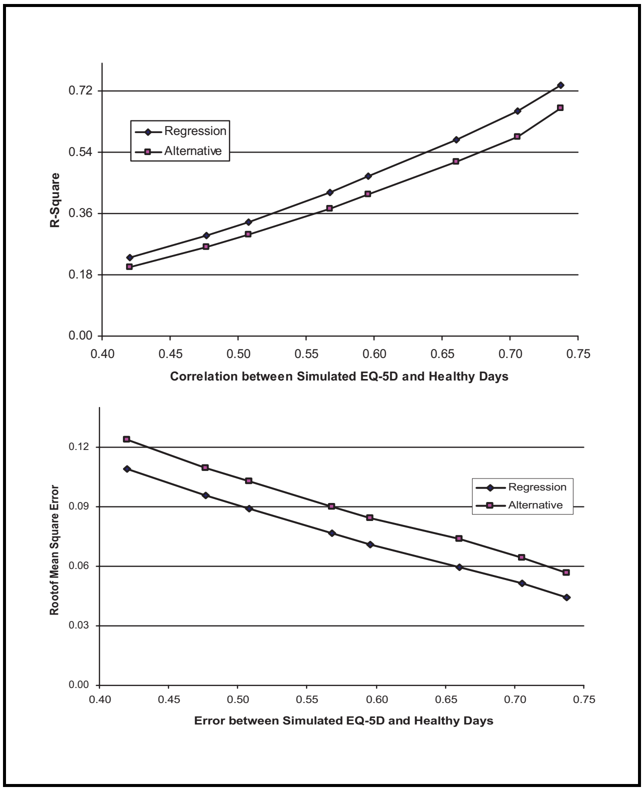

Figure 1 Comparison of regression method and alternative method using simulation.

days because the estimation equation should be a monotonic increase.

The proposed method works only when the explanatory variable and dependent variable have a strong monotonic relationship. This is the case for the Healthy Days and EQ-5D because both scores were designed to measure the same respondents' characteristic (i.e., HRQOL) using a similar ratio scale.[3,28] The number of healthy days can be used to estimate the proportion of time each respondent lived without any impairment or illness based on his or her reported number of unhealthy days. Similarly, the EQ-5D index uses the TTO rating of current health and quantifies the utility of a health state by the equivalent percentage of expected life that people are willing to trade for being free from illness.[2,4]

Although estimates based on the proposed method usually have a larger RMSE and smaller R^2 than regression estimates because the least square method-based regression estimates had a minimum RMSE and maximum R^2, the simulation study showed that the proposed method performed well. The alternative estimates were about 10% worse than the regression estimates differences in terms of R^2 values and such a difference was acceptable considering the lack of data for direct model fitting.

We compared group means because mean scores of estimated and observed EQ-5D scores in particular population subgroups should be comparable, even if data were from different sources.[26,27] Such comparisons are important because there has been increasing interest in using the EQ-5D for population health assessment and indicators for community health.[5,27,29] Although the descriptive and ecological nature of the study imposes some limitations, such a comparison of mean of observed and estimated EQ-5D scores at the community level can determine whether the estimated EQ-5D can be used for community health indicators.[30]

The evaluation study demonstrated that estimated EQ-5D scores matched well with the actual EQ-5D scores with regard to community averages in the vast majority of examined subgroups of a representative sample of the US noninstitutionalized adult population. The exceptions occurred for the most impaired health states where the model overpredicted the actual mean scores and the magnitude of this difference would be considered to be clinically important.[31,32] However, the overestimation of the lowest score has been explicitly noted in the estimation of preference-based health measure from SF-36[10] and always happens for any model-based estimates due to regression toward the mean. The results also conformed to the patterns of scores according to a number of sociodemographic and clinical variables in the published literature[1,3,33,34]

Several limitations are present in the proposed estimation method. First, the 2 measures differed with regard to modes of administration and recall periods (i.e., Healthy Days was administered over the telephone and measured health over the past 30 days and the EQ-5D was administered through the mail and measured health "today"). The difference in recall period may make less of a difference in assessing population health than in the clinical setting where health might change according to the nature of the visit or intervention.[35] Second, the method requires use of only 1 explanatory variable and, therefore, only can estimate EQ-5D scores using overall healthy days as opposed to both physical and mental unhealthy days. Including additional explanatory variables such as age and self-rated general health entails relying upon data stratification, requiring enough respondents in each subgroup of stratification. Third, both the Healthy Days Measures and the EQ-5D have been noted to have a ceiling effect that may occur when measuring the health of populations.[18,36] Fourth, the quality of estimated scores cannot be evaluated using some model fitting statistics such as R^2 and RMSE, and therefore, we have to rely on simulations to calculate model-fitting statistics.

This study provides preliminary results of estimating EQ-5D from healthy days at this point in time, given that, to date, no single HRQOL measure has been incorporated into every national health survey. For example, the Healthy Days Measures have been included in the BRFSS and NHANES whereas the SF-12 has been included in the MEPS since 2000 and the EQ-5D was included in the MEPS from 2000 to 2003. By contrast, the National Health Interview Survey (NHIS) contains a single question on self-reported health. The estimates of EQ-5D scores from the number of overall healthy days had acceptable validity (unbiased, consistent, and valid for tracking community mean scores of EQ-5D). However, even when done well, the indirect method and ecologic validation are not definitive.

Developing the best estimation equation may be possible in the future with the release of a population-based representative data set that includes both measures and, ideally, would be administered longitudinally. If a direct head-to-head comparison of the Healthy Days Measures and EQ-5D cannot be conducted, focusing on subpopulations with a greater magnitude of difference between estimated and observed EQ-5D scores—that is, groups in the most impaired health states—would provide useful information for future research and policy planning.

The Healthy Days Measures are particularly useful to track health time, especially in small subgroups with unmet health needs, and facilitate monitoring of Healthy People 2010 goals and comparisons at the national, state, and community levels. The integration and synthesis of 2 different nationally representative surveys would expand the data available for QALY-based cost-utility analyses and burden of disease studies. In addition, the availability of these preliminary scores could reduce respondent burden in primary data collection and provide an additional use for the BRFSS data.

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