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Hvidberg, M., Petersen, K., Davidsen, M. et al. (4 more authors) (2023) Catalogue of EQ-5D-3L health-related quality-of-life scores for 199 chronic conditions and health risks in Denmark. MDM Policy & Practice, 8 (1). ISSN 2381-4683

https://doi.org/10.1177/23814683231159023

Original Research Article

MDM Policy & Practice

MDM Policy & Practice
2023, Vol. 8(1) 1–42

DOI: 10.1177/23814683231159023
journals.sagepub.com/home/mpp
SAGE

Catalog of EQ-5D-3L Health-Related Quality-of-Life Scores for 199 Chronic Conditions and Health Risks in Denmark

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Abstract

Background. Assessments of health-related quality of life (HRQoL) are essential in estimating quality-adjusted life-years. It is sometimes not feasible to collect primary HRQoL data, and reliable secondary sources are necessary. Current "off-the-shelf" HRQoL catalogs are based on older diagnosis classifications and include a limited number of diseases. This article aims to provide 1) a Danish EQ-5D-3L–based HRQoL catalog for 199 nationally representative chronic conditions based on ICD-10 codes and 2) a complementary model-based catalog controlling for age, sex, comorbidities, lifestyle, and health risks. **Design**. A total of 55,616 respondents from 3 national health survey samples were pooled and combined with 7 national registers containing patient-level information on diagnoses, health care activity, and sociodemographics. EQ-5D-3L data were converted to utility scores using the Danish EQ-5D-3L value set to estimate the mean utility for each chronic disease population. Adjusted limited dependent variable mixture models were estimated and used to provide a regression-based catalog of utilities/disutilities. **Results**. Diseases with the lowest mean EQ-5D score in the Danish population were systemic sclerosis (M34; score = 0.432), fibromyalgia (M797; score = 0.490), rheumatism (M790; score = 0.515), dementia (F00, G30; score = 0.546), posttraumatic stress syndrome (F431; score = 0.557), and systemic atrophies (G10-G14; score = 0.583. Based on the estimated models, the largest estimated disutilities were cystic fibrosis, cerebral palsy, depression, dorsalgia, sclerosis, and fibromyalgia. Lifestyle factors, including perceived stress, loneliness, and body mass index, were also significantly associated with low HRQoL. **Conclusions**. This study provides a comprehensive nationally representative catalog and a model-based catalog of EQ-5D-3L–based HRQoL scores for Denmark that can be used to describe aspects of disease burden and allocate resources within health care. Additional Stata programs are also provided to facilitate predictions in other populations.

Highlights

- A Danish national representative catalog of health-related quality-of-life scores for 199 chronic conditions is presented, which provides population estimates for chronic conditions subgroups that can be used for health economic evaluation.
- Two separate regression models of EQ-5D-3L utility scores with different sets of control variables are estimated to allow researchers to adjust for differences in the composition of the subgroups and provide a tool that can be used in other settings.

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- Results indicate that health-related quality of life varies across disease groups but is lowest for renal disease, mental and behavioral disorders, benign neoplasms and diseases of the blood, digestive systems, and nervous systems.
- Health risks and lifestyle factors such as perceived stress, loneliness, and a large body mass index are highly correlated with health-related quality of life, and, in many cases, the correlation is higher than with individual diseases.

Keywords
chronic condition, chronic disease, cost-effectiveness analysis, cost-utility analysis, Denmark, EQ-5D, health-related quality of life, health risks, HRQoL, ICD-10, lifestyle factors, long-term illness, socioeconomic factors, utility

Date received: June 24, 2022; accepted: January 27, 2023

Health economic evaluation is used in health care resource allocation to assess the relationship between the effectiveness and costs of alternative medical technologies.[1] Quality-adjusted life-years (QALYs) represent a composite measure of survival and health-related quality of life (HRQoL)[2] widely used as a measure of benefit in economic evaluations.[1] The EQ-5D instrument is often used to measure HRQoL,[3–6] and this approach is also recommended for health technology assessment, for example, in the United Kingdom.[7] In Denmark, as in many other European countries, EQ-5D–based health economic evaluations (cost-utility analyses) are used regularly for market access approval of new medicines.[8] EQ-5D uses 5 dimensions to describe health: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. There are now 2 different versions of the EQ-5D instrument. In the original version, EQ-5D-3L, each dimension covers 3 possible levels (no problems, some problems, extreme problems) and can describe 243 unique health states.[5] The EQ-5D health states can, with the help of validated national preference-based utility weights, be combined into a single utility score with an upper value of 1 corresponding to no problems in any of the 5 dimensions (perfect health) and a value of 0 being equivalent to dead. Negative values are possible and represent health states considered worse than being dead.[5] A newer EQ-5D-5L version of the instrument has been developed[6] with identical health dimensions but extends the number of possible responses to each health dimension from 3 to 5. However, it was only very recently that Danish societal weights for the EQ-5D-5L were published,[9] and since this study is based on retrospective register data, we have used the EQ-5D-3L with associated Danish utilities.[10]

Several studies have published nationally representative off-the-shelf catalogs to assist health economic evaluation when it is not feasible to obtain EQ-5D responses from a target population prospectively or to decrease the cost of collecting estimates of EQ-5D-3L utility scores for chronic diseases that can be used to calculate QALYs. Sullivan et al.[11,12] published a US catalog including 157 self-reported conditions using national representative data pooled over the years 2000 to 2002. The same survey with the inclusion of 2003 data as an additional year was also used in 2011 by Sullivan et al.[13] to provide utility scores for the same 157 conditions using the UK EQ-5D-3L value set.[14] Saarni et al.[15] provided utility scores for 29 conditions for Finland in 2006, and Kang and Ko[16] estimated EQ-5D-3L utility scores using Korean tariffs for 27 major conditions in 2009. In 2019, a meta-review of 207 studies collected different EQ-5D-3L estimates among 15 ICD-10 disease groups. However, these were not derived from uniform sampling and

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methodology as in earlier studies.[17] In a Danish context, EQ-5D-3L utility scores of age, gender, and education have been created.[18] Yet, no Danish off-the-shelf catalog of utility scores of chronic conditions currently exists.

Furthermore, existing off-the-shelf catalogs have some limitations if they are to be used in a health care resource allocation context today. First, they are all based on the International Classification of Diseases, Ninth Revision (ICD-9), rather than the newer ICD-10 implemented in many countries. Second, they (largely) rely on self-reported health conditions, and the accuracy of this approach has been questioned.[12,19–22] Third, behavioral risk factors (e.g., smoking, exercise, alcohol and fruit intake, body mass index [BMI], stress, and social networks) on the EQ-5D have been suggested as potentially necessary controls[23] but are missing from existing catalogs. Fourth, recognizing the biases induced by model misspecification when using linear regressions to estimate utilities bounded at 1,[24,25] alternatives to linear regression models such as the Tobit model or the median-based censored least absolute deviation regression (CLAD) have been used. The latter is a robust alternative to the Tobit model in the presence of nonnormality of the error term. However, medians are generally of limited use in economic evaluation,[1] and the consistency of the CLAD estimator is based on the assumption that the conditional density of the error term is bounded away from zero.[26] Unfortunately, the well-known gap in the EQ-5D distribution between full health and the next feasible value implies that the conditional density function will be zero in some areas violating this assumption. Furthermore, even though these models were developed to deal with a large number of observations at the boundary value of 1, they are still unable to handle the remaining idiosyncrasies of the distribution of EQ-5D that are now well documented. Consequently, alternative models have been proposed,[27–30] and new models such as the Adjusted Limited Dependent Variable Mixture Model (ALDVMM)[31–33] used here have been developed.[24,25,31–34] Finally, existing catalogs have been developed primarily to give population-based estimates of individual chronic diseases, which are often not the population of interest in economic evaluations. Therefore, a number of researchers have instead investigated methods to estimate utilities for comorbid diseases by combining estimates of utilities for individual chronic conditions in the populations of interest—multiplicative, additive, and minimum estimators are some common choices.[35–38]

This study aims to 1) create 2 off-the-shelf catalogs of Danish EQ-5D-3L preference-based scores for 199 ICD-10–based chronic conditions accounting for the limitations associated with previous catalogs and 2) provide 2 separate models to enable researchers to estimate utilities and utility decrements for any combination of chronic conditions in their population of interest. The first catalog provides nationally representative estimates of mean utilities for 199 chronic conditions, socioeconomic variables, and health risks. These are subpopulation estimates that do not adjust for differences in the composition of the groups. A second catalog provides regression-based estimates of utilities and marginal effects for the same chronic conditions, socioeconomic variables, and health risks, controlling for differences in the subgroup composition to allow for comparisons across chronic conditions for the same representative individual. To build this second catalog, 2 separate models of EQ-5D-3L with different sets of control variables are estimated. Furthermore, for these estimated models, a Stata .do file and a user guide are provided as online Supplemental Material to assist researchers in estimating EQ-5D-3L in their specific setting. In conjunction with another publication on the prevalence of the same 199 chronic conditions,[39] these estimates can provide valuable information for future resource allocation in Denmark.

Methods

Data Types and Linkage

Two types of data were used: national registers and survey data. Patient-level data on sociodemographics, diagnoses, and health care activity were found in 7 national registers. These were combined with 3 national health surveys containing self-reported data on HRQoL and health behaviors (e.g., lifestyle) with the help of the unique civil registration number that Danish citizens receive at birth.[40]

Survey Data

Self-reported EQ-5D-3L responses and health behaviors have been collected from the nationally representative cross-sectional survey—the Danish National Health Survey (DNHS)—distributed either by post or electronically to a personal online mailbox to a large sample of Danish citizens. Each wave is collected every 3 or 4 y, and informed consent is given. The recipients and mailboxes are uniquely identified based on the civil registration number. These population surveys are conducted by the 5 regions responsible for health care in Denmark in collaboration with the National Institute of Public Health (NIPH). Full details of the DNHS can be found

elsewhere.[41] The DNHS has a core questionnaire shared between regions related to health and health behaviors. However, some themes and question content variations are allowed across regions and over time in addition to the core questionnaire. Core questions at the time of this study included several measures of HRQoL, the Cohens Perceived Stress Scale, as well as 18 self-reported conditions, behavioral risk factors (smoking, exercise, alcohol, and fruit intake), BMI, and social networks.[41]

This study pooled the DNHS data collected in 2 subsequent waves, 2010 and 2013. Six samples were collected: a regional sample for each of the 5 regions and a national sample collected by NIPH. The 6 samples were mutually exclusive random subsamples within the sampling year. Only 3 samples included EQ-5D-3L: the DNHS surveys from the North Denmark Region in 2010 and 2013 and the survey from the NIPH in 2010.[41–44] Thus, these 3 samples were included in the current study with a total of 56,988 initial respondents (before handling missing values) and an overall response rate across the 3 samples of 60.2% of the population after removing a small proportion of duplicate responses (Table 1). Statistics Denmark provides sampling weights to account for both nonresponse and stratified design. These were standardized to fit the national average on gender, age, and educational levels for the raw estimates.[41,45] To assess representativeness, all samples were compared with the national sample on gender proportions, average age, and proportions in 5 categories of education.

Chronic Conditions and Registers

The applied chronic conditions stemmed from earlier work that defined 199 chronic conditions from information in national public registers,[46,47] where a medical review team identified and grouped chronic conditions from ICD-10 codes based on the following definition of a chronic condition: "a condition that had lasted or was expected to last twelve or more months and resulted in functional limitations and/or the need for functional limitations and/or the need for ongoing medical care."[12,13,48]

Each respondent from the DNHS was linked to 5 national registers by their unique 10-digit civil registration number, which allowed for a clear linkage between the register data, including the ICD-10 codes and the DNHS. The registers contained information from somatic[49] and psychiatric[50] hospital contacts (with ICD-10 codes), primary health care,[51] and prescribed medicines.[52] A total of 166 ICD-10–based chronic conditions were suggested to be captured by hospital discharge diagnosis alone. However, more complex definitions of 33 chronic conditions were proposed based on additional information from the other health registers (primary health care and medicine prescriptions), as ICD-10 hospital codes were not considered sufficient to identify these conditions as they are often treated in primary care. The content of all registers, methods used, linkage, and pros and cons are described in detail elsewhere.[40,46,47]

Sociodemographic Variables and Registers

Sociodemographic information on age, gender, ethnicity, and place of residence was also obtained from national registers.[53] To allow for income adjustments, the data were linked to the "Danish Registers on Personal Income and Transfer Payments."[54] All employers in Denmark are required to report income data for each employee to a national register, thereby enabling individual-specific information on income, transfers, and tax payment for each Danish citizen. Finally, data on educational attainment were obtained from the Danish Population's Education Register.[55]

Missing values. The data include both self-reported and register-based variables. While most register covariates (e.g., all 199 chronic conditions, age, and gender) did not have any missing values, a few register-based covariates ("education," "partnership," "children living at home," and "family equalized income") had missing values. These were replaced by self-reported auxiliary information from the DNHS (e.g., respondents were asked about their education and others in the DNHS survey). The advantage of this approach is that we use a value confirmed by the respondent as an imputed value instead of a regression-estimated value. After using the available self-reported information, "education" and "children living at home" still had a small number of missing values (4%). Some self-reported variables ("social network/loneliness," "stress," "BMI," "smoker," "alcohol intake," "exercise," and "fruit intake") were also found to have a small number of missing values. Missing covariates were included as separate categories of "missing" for each variable affected. Sensitivity analyses were performed using multiple imputations, and dropping the observations demonstrated no significant differences. After handling missing values for all the covariates, 2.4% of missing values of the dependent variable EQ-5D could not be replaced in the same way. These cases were excluded from the data. The final sample size for all models was 55,616 respondents (Table 1).

Table 1 Respondent Characteristics of the 3 Samples Compared with the Full Population Register Data (Where Applicable)[a]

	1. NIPH National Sample 2010	2. NDR Sample 2010	3. NDR Sample 2013	All Samples Combined[b]	Full Population Data 1 January 2013[c]
Initial sample, *n*[d]	25,000	35,700	35,700/33,911[d]	96,400/94,611[d]	4,555,439
Valid responses,[e] *n* (%)[d]	15,165 (60.7%)	23,392 (65.5%)	20,220 (56.6%)[d]	58,777 (61.0%)[d]	—
Valid responses[e] after removal of duplicate respondents, *n* (%)	15,165 (60.7%)	23,392 (65.5%)	18,431 (54.4%)[b]	56,988 (60.2%)[b]	—
Valid responses[e] after removal of EQ-5D missing, *n* (%)	14,800 (59.2%)	22,952 (64.3%)	17,864 (50.0%)	55,616 (58.8 %)[b,f]	—
Data collection method, *n* (%)					
Internet survey[b,d]	4,802 (31.7%)	2,329 (10.0%)	8,165 (40.4%)	12,969 (23.0%)	—
Paper[b,d]	10,363 (68.3%)	21,063 (90.0%)	12,055 (59.6%)	43,481 (77.0%)	—
Mean age at time of response [CI] (SE; SD)	47.6 [47.3–47.9] (0.1653; 18.77)	47.5 [47.2–47.8] (0.148; 18.66)	47.8 [47.5–48.1] (0.171; 19.02)	47.6 [47.4– 47.8] (0.093; 18.79)	47.7 [n/a] (n/a; 18.99)
Gender, men (%) [CI]	49.1% [48.3–50.0]	49.2% [48.5,50.0]	49.2% [48.4–50.1]	49.2% [48.7–49.7]	49.2% [n/a]
Education, *n* (%)					
No education	3,420 (22.6%)	6,392 (27.3%)	4,181 (22.7%)	13,994 (24.6%)	1,128,588 (24.8%)
Students or in training	1,544 (10.2%)	2,208 (9.4%)	2,681 (14.5%)	6,433 (11.3%)	243,726 (5.4%)
Short education	6,512 (42.9%)	9,859 (42.2%)	7,437 (40.4%)	23,807 (41.8%)	2,002,633 (44.0%)
Middle education (e.g., bachelor)	2,296 (15.1%)	3,167 (13.5%)	2,898 (15.7%)	8,361 (14.7%)	657,252 (14,4)
High education (master's degree or higher)	1,254 (8.3%)	1,498 (6.4%)	1,127 (6.1%)	3,879 (6.8%)	321,254 (7.1%)
Missing	138 (0.9%)	267 (1.1%)	108 (0.6%)	514 (0.9%)	201,986 (4.53%)
Mean EQ5D-3L DK (SE)[f]					
All	0.857 (0.0016)	0.852 (0.0015)	0.849 (0.0017)	0.852 (0.0009)	[n/a]
Men	0.871 (0.0023)	0.869 (0.0021)	0.868 (0.0022)	0.869 (0.0013)	[n/a]
Women	0.842 (0.0024)	0.835 (0.0021)	0.829 (0.0025)	0.835 (0.0013)	[n/a]
No education	0.803 (0.0042)	0.793 (0.0031)	0.776 (0.0041)	0.790 (0.0021)	[n/a]
Students or in training	0.897 (0.0047)	0.906 (0.0041)	0.899 (0.0038)	0.901 (0.0024)	[n/a]
Short education	0.856 (0.0023)	0.861 (0.0022)	0.852 (0.0024)	0.857 (0.0013)	[n/a]
Middle education (e.g., bachelor)	0.888 (0.0033)	0.881 (0.0032)	0.878 (0.0035)	0.882 (0.0020)	[n/a]
High education (master's degree or higher)	0.908 (0.0042)	0.915 (0.0052)	0.901 (0.0056)	0.909 (0.0029)	[n/a]

Source: National Health Profiles 2010, 2013.[40–43]

CI, confidence interval; n/a, not available; NDR, North Denmark Region; NIPH, National Institute for Public Health; SE, standard error.

[a]All samples and full population data include residents age 16 to 100 + y. Unless stated otherwise, all estimates are complete cases only, and samples are weighted/standardized. Education is defined as the highest archived education level. Also, as self-reported educational status is used to impute missing values, we expect some small differences between the samples and the full population data as no self-reported data can be used for imputation of missings to the full population data.

[b]Numbers after removal of duplicates respondents/included from 2010 samples.

[c]Full population data were extracted from Statistics Denmark's Research servers using population register data.[39]

[d]Nonweighted/standardized.

[e]Valid responses are equivalent to the response rate including the removal of any invalid responses assessed by the Danish Regions or the NIPH.[40–43]

[f]After removal of missing observations of the EQ-5D (complete cases).

Statistical Analysis

Two separate analyses were implemented. First, mean EQ-5D-3L utilities for the 199 conditions, socioeconomic variables, and health risks were computed to provide a catalog of utility estimates reflecting the Danish population. These averages were adjusted using combined nonresponse and national standardized sampling weights and gave estimates of the mean EQ-5D-3L for those subpopulations.

Second, 2 separate models of EQ-5D-3L utility scores were estimated as a means to control for the sample composition and to allow comparisons across chronic conditions based on the same population. Utilities derived from generic preference-based measures, such as the EQ-5D, present specific characteristics that make statistical modelling challenging. The range of values they can take is bounded between the value of 1 (full health) and the minimum value, which differs by country and measure. The data distribution is often multimodal and tends to be highly skewed within each mode, presenting a large mass of observations at the boundary value of 1, followed by a gap to the next feasible utility value.[32,33] The minimum value in the Danish EQ-5D-3L utility scores is −0.624, and the highest utility score below 1 is 0.838, leaving a large gap of 0.162 (10% of the EQ-5D-3L utility range) to full health. Although biases in the parameter estimates due to model misspecification have long been recognized, it is only relatively recently that statistical models have been developed to model these data. This is in contrast with the parallel literature modeling costs in economic evaluation, which shares some of the same issues, where it has been long recognized that linear regression models are not appropriate and alternative models have been proposed.[56]

The ALDVMM was developed to model EQ-5D-3L UK utility scores and has been shown to perform better than models traditionally applied to EQ-5D (3L and 5L) and other generic preference-based model measures such as SF-6D and HUI.[25,34,57,58] The model is based on mixtures of Tobit-like components and accounts for the bounded nature of the data, the mass of observations at 1, and the gap to the next feasible value, and it is capable of approximating skewness as well as multimodality. The flexibility of mixture models is increasingly recognized as useful in modeling health utility data. Dakin et al.[59] reported an increase in the use of mixture models in statistical models of EQ-5D in recent years.

An additional problematic feature due to the underlying assumptions of linear models, which has been overlooked in the literature but is crucial in this context, is that the expected decrease in EQ-5D due to developing a chronic condition, also known as disutility or marginal effect (ME), is the same for every individual regardless of, for instance, the presence or absence of other chronic diseases or age. This is a very restrictive and unrealistic assumption as it implies that the disutility of developing a chronic disease is assumed to be the same in a completely healthy population and in populations where several other comorbidities are often present. In the ALDVMM, the MEs are a function of all the other covariates included in the model, such as age, gender, and the presence of other chronic conditions. The implication is that the expected reduction in EQ-5D when developing a new chronic disease will differ for individuals with no previous chronic conditions and individuals with multimorbidity or populations with different age distributions. This is an advantage for economic modeling, as the decrease in utility can be tailored to the specific population of the trial, who typically tend to have a higher prevalence of multimorbidity and for whom the general population ME might not be appropriate.

Estimating mixture models is challenging, even more so for large models such as those estimated here. As the likelihood of the model is not globally concave, a thorough search procedure is needed to find the global maximum. In addition, the optimal number of components in the mixture also needs to be selected. This involves estimating models with an increasing number of components and using standard fit statistics and graphical methods to select the optimal model.[58] Note that a 1-component ALDVMM is a generalization of a Tobit model to include the gap below 1 typical of utility data. Further details of the model can be found elsewhere; here, we use the community-contributed Stata command published in the *Stata Journal* and available for free download within Stata.[32,33]

Two different specifications of the ALDVMM regression model were estimated as follows[i]:

- Base model: In this model, EQ-5D-3L is a function of the 199 chronic conditions and controls for age, gender, and number of comorbidities. This model is useful for economic evaluations in which the additional controls included in the full model are not required or available.
- Full model: As above but also includes a full set of controls for many socioeconomic variables and common health risks. The additional variables included in this model are education (no education/training, students or in training, short education, middle education, bachelor's equivalent, higher education such as master's degree or above), ethnicity (Danish,

Western or non-Western), family equalized income (in DKK), the status of partnership (partner or not), children living at home (yes/no), social network (often feeling lonely or not), stress (Cohens Perceived Stress Scale, 20% most stressed or not), BMI groups (<18.5, 18.5–25, $>25 < 30$, $\geq 30 < 35$, ≥ 35), smoking daily (yes/no), alcohol intake excess national recommendations (yes/no), exercise and fruit intake as nationally recommended (yes/no), SF-12 self-reported general health[60] (1: excellent, 2: very good, 3: good, 4: fair, 5: poor; 999: missing), and self-reported long-term illness or disability (0: none, 1: yes). See Appendix 1 for model variable notations and detailed model specifications and Hernández and Wailoo[32] for details on how to fit the ALDVMM.

Quadratic terms for age and family-equalized income were included in all models. A dummy variable indicating North Denmark Region was used in the regression analysis to adjust for possible sample differences. The estimated regression models did not use weights but included controls for variables like those used in the weighting procedure. After the estimation of the models and to provide comparisons across chronic diseases, average MEs for each variable, in turn, were calculated based on representative 50-y-old males and females with no chronic conditions.

All initial data management of surveys and registers was conducted in SAS 9.4. All subsequent data analysis was done in STATA15. The online Supplemental Material provides documentation, relevant Stata user programs, and .ster files for analysts to predict MEs and utilities for any chronic diseases of interest. The parameter estimates and the variance-covariance matrices of the models are also provided to allow the use of probabilistic sensitivity analysis in economic evaluations.[61]

Results

The samples have relatively high response rates and low missingness and were almost identical to the national population proportions and averages regarding gender, age, and educational levels (Table 1). Moreover, the 3 subsamples were equal in mean utility by gender and educational level. Altogether, the combined sample showed national representativeness on these key socioeconomic variables.

Danish Population-Based Estimates of EQ-5D-3L

Table 2 provides a Danish population catalog of EQ-5D-3L for individual chronic diseases, socioeconomic variables, and health risks. The table includes weighted sample utility estimates, percentiles, average age, and number of chronic conditions of the 199 chronic conditions, overall disease groups, socioeconomic variables, and health risks (catalog 1).[ii] The most prevalent disease groups were those in the circulatory system (group I; $n = 16{,}990$), respiratory system (group J; $n = 14{,}087$), musculoskeletal system (group M; $n = 13{,}163$), and endocrine, nutritional, and metabolic disorders (group E; $n = 12{,}412$).

The sample average EQ-5D score is 0.852. For the abovementioned prevalent disease groups, the mean EQ-5D scores are highest for J: score = 0.810, I: score = 0.783, and E: score = 0.783 but less for musculoskeletal diseases (group M: score = 0.755). The mean sample EQ-5D scores are lower for less prevalent groups of diseases such as genitourinary conditions (group N; score = 0.698), mental and behavioral disorders (group F: score = 0.703), benign neoplasm and diseases of the blood (group D: score = 0.744), diseases of the digestive system (group K: score = 0.744), and diseases of the nervous system (group G: score = 0.747).

There is a large variation in the mean EQ-5D scores within and across the 199 individual disease groups. Diseases with the lowest mean EQ-5D score are systemic sclerosis (M34: score = 0.432), fibromyalgia (M797: score = 0.490), unspecified rheumatism (M790: score = 0.515), dementia (F00, G30, F01, F02.0, F03.9, G31.8B, G31.8E, G31.9, G31.0B: score = 0.546), posttraumatic stress syndrome (F431: score = 0.557), systemic atrophies primarily affecting the central nervous system (G10-G14, G30-G32: score = 0.583), cerebral palsy (G80-G83: score = 0.6), and phobic anxiety disorders (F40: score = 0.611).

Furthermore, the sample mean of EQ-5D-3L estimates decline as the number of comorbidities increases, declines with lower educational levels except for students, and is lower for immigrants and people without children. Across lifestyle factors, mean EQ-5D-3L scores are also lower for people indicating loneliness and perceived stress, those with large BMIs, daily smokers, those who exercise the least, and individuals with a large alcohol intake and lowest fruit intake. Men and women, as well as people with or without a partner, exhibit similar EQ-5D-3L scores.

Model-Based Estimates of EQ-5D-3L and Disutilities

Figure 1 plots the distribution of EQ-5D-3L utilities in the sample. It shows the typical features of EQ-5D-3L,

Table 2 Nationally Representative Sample EQ-5D-3L Mean Scores, Percentiles, *n*, Mean Number Chronic Conditions (NCC), and Percentiles for the 199 + Chronic Conditions, Socioeconomic Variables, and Health Risks[a]

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
	B: Viral hepatitis and human immunodeficiency virus [HIV] disease	B18, B20-B24	31	43.5	2.9	1	3	4	0.760	0.0573	0.708	0.771	1
1	Chronic viral hepatitis	B18	17	44.7	2.9	1	3	4	0.790	0.0371	0.708	0.756	1
2	Human immunodeficiency virus [HIV] disease	B20-24	14	42.4	2.8	2	3	3	0.731	0.1192	0.655	0.838	1
	C: Malignant neoplasms	C00-C99; D32-D33; D35. 2-D35.4; D42-D44	2,947	64.7	5.3	3	4	7	0.780	0.0045	0.708	0.818	1
3	Malignant neoplasms of other and unspecified localizations	C00-C14; C30-C33; C37-C42; C45-C49; C69; C73-74; C754-C759	248	61.2	6.0	3	5	8	0.774	0.0165	0.708	0.776	1
4	Malignant neoplasms of digestive organs	C15-C17; C22-C26	64	68.4	5.5	3	5	7	0.683	0.0419	0.627	0.713	0.824
5	Malignant neoplasm of colon	C18	262	71.3	5.8	3	5	7	0.770	0.0130	0.680	0.776	1
6	Malignant neoplasms of rectosigmoid junction, rectum, anus and anal canal	C19-C21	174	70.6	5.8	3	5	8	0.785	0.0192	0.708	0.824	1
7	Malignant neoplasm of bronchus and lung	C34	159	67.9	7.1	4	7	10	0.684	0.0250	0.627	0.723	0.824
8	Malignant melanoma of skin	C43	220	58.4	4.5	2	4	6	0.838	0.0128	0.771	0.824	1
9	Other malignant neoplasms of skin	C44	122	71.5	6.4	4	6	9	0.785	0.0206	0.723	0.785	1
10	Malignant neoplasm of breast	C50	681	64.5	4.9	3	4	7	0.758	0.0091	0.708	0.776	0.824
11	Malignant neoplasms of female genital organs	C51-C52; C56-C58	113	63.1	5.2	3	5	7	0.764	0.0236	0.708	0.776	1
12	Malignant neoplasm of cervix uteri, corpus uteri and part unspecified	C53-C55	140	62.6	5.0	3	4	7	0.783	0.0189	0.723	0.818	1
13	Malignant tumor of the male genitalia	C60, C62-C63	54	46.3	3.0	1	2	4	0.858	0.0253	0.756	1	1
14	Malignant neoplasm of prostate	C61	440	72.4	5.6	3	5	7	0.796	0.0107	0.723	0.824	1
15	Malignant neoplasms of urinary tract	C64-C68	166	71.5	5.9	3	5	8	0.755	0.0228	0.660	0.776	1
16	Brain cancer[b]	C71, C75.1-C75.3, D33.0-D33.2, D35.2-D35.4, D43.0-D43.2, D44.3-D44.5 (brain). C70, D32, D42 (brain membrane). C72, D33.3-D33.9, D43.3-D43.9 (cranial nerve, spinal cord)	202	54.4	5.8	3	5	8	0.799	0.0183	0.708	0.824	1

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
17	Malignant neoplasms of ill-defined, secondary, and unspecified sites and of independent (primary) multiple sites	C76-C80, C97	326	64.0	5.9	4	5	7	0.754	0.0135	0.680	0.776	0.824
18	Malignant neoplasms, stated or presumed to be primary, of lymphoid, hematopoietic, and related tissue	C81-C96	213	62.3	5.7	3	5	8	0.770	0.0146	0.660	0.818	0.838
	D: In situ, benign and neoplasms of uncertain or unknown behavior and diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	D00-D09; D55-D59; D60-D67; D80-D89	1,254	59.2	6.0	3	5	8	0.744	0.0078	0.655	0.776	1
19	In situ neoplasms	D00-D09	289	55.3	4.3	2	3	6	0.820	0.0114	0.723	0.824	1
20	Hemolytic anemias	D55-D59	20	52.6	6.4	3	5	10	0.798	0.0418	0.776	0.824	0.838
21	Aplastic and other anemias	D60-D63	167	64.6	7.7	5	7	11	0.670	0.0229	0.559	0.723	0.824
22	Other anemias	D64	463	67.3	7.5	4	7	10	0.672	0.0148	0.592	0.723	0.824
23	Coagulation defects, purpura, and other hemorrhagic conditions	D65-D69	216	50.9	5.4	2	5	8	0.783	0.0182	0.708	0.824	1
24	Other diseases of blood and blood-forming organs	D70-D77	81	56.0	5.9	4	5	8	0.753	0.0220	0.655	0.723	0.824
25	Certain disorders involving the immune mechanism	D80-D89	102	50.2	5.4	3	5	7	0.770	0.0267	0.708	0.818	1
	E: Endocrine, nutritional, and metabolic diseases	E00–E14; E20-E29; E31-35; E70-E78; E84-E85; E88-E89	12,412	63.5	4.9	3	4	7	0.783	0.0023	0.723	0.818	1
26	Diseases of the thyroid[b]	E00–E04, E06, E07	1,515	60.1	4.9	2	4	7	0.780	0.0065	0.708	0.818	1
27	Thyrotoxicosis[b]	E05	714	61.0	4.6	3	4	6	0.772	0.0104	0.708	0.818	1
28	Diabetes type 1[b]	E10	284	45.1	4.4	2	3	6	0.801	0.0154	0.708	0.824	1
29	Diabetes type 2[b]	E11	3,253	65.6	5.8	4	5	7	0.752	0.0048	0.660	0.776	0.838
30	Diabetes others[b]	E12–E14	18	59.5	5.4	3	4	8	0.748	0.0417	0.592	0.723	0.838
31	Disorders of other endocrine glands	E20-E35, except E30	252	44.9	5.0	2	4	8	0.740	0.0174	0.660	0.776	0.838
32	Metabolic disorders	E70-E77; E79-E83; E85, E88-E89;	224	56.8	6.2	3	5	9	0.741	0.0176	0.655	0.776	0.824
33	Disturbances in lipoprotein circulation and other lipids[b]	E78	9,685	65.8	5.2	3	5	7	0.784	0.0025	0.723	0.818	1
34	Cystic fibrosis[b]	E84	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	G: Diseases of the nervous system	G00-G14; G20-G32; G35-G37; G40-47; G50-64; G70-73; G80-G83; G90-G99	6,698	55.1	4.8	2	4	7	0.747	0.0035	0.689	0.776	0.838
35	Inflammatory diseases of the central nervous system	G00-G09	66	52.0	5.0	2	4	7	0.746	0.0334	0.592	0.776	1

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
36	Systemic atrophies primarily affecting the central nervous system and other degenerative diseases	G10-G14, G30-G32	70	69.6	6.4	3	6	10	0.583	0.0473	0.519	0.655	0.785
37	Parkinson's disease[b]	G20, G21, G22, F02.3	611	62.8	6.6	4	6	9	0.660	0.0125	0.564	0.723	0.824
38	Extrapyramidal and movement disorders	G23-G26	107	60.1	7.0	4	7	9	0.703	0.0279	0.655	0.756	0.824
39	Sclerosis	G35	155	49.1	4.4	2	4	5	0.651	0.0246	0.592	0.723	0.785
40	Demyelinating diseases of the central nervous system	G36-G37	62	49.0	4.5	2	4	6	0.675	0.0400	0.655	0.771	0.824
41	Epilepsy[b]	G40–G41	585	51.9	5.8	3	5	8	0.708	0.0127	0.655	0.756	0.833
42	Migraine[b]	G43	2,042	49.2	4.0	2	3	5	0.747	0.0035	0.708	0.818	1
43	Other headache syndromes	G44	143	44.8	5.1	2	4	7	0.700	0.0265	0.655	0.756	0.824
44	Transient cerebral ischemic attacks and related syndromes and vascular syndromes of brain in cerebrovascular diseases	G45-G46	623	68.0	6.6	4	6	9	0.746	0.0112	0.674	0.776	1
45	Sleep disorders	G47	453	53.7	5.2	3	4	7	0.766	0.0127	0.708	0.776	1
46	Disorders of trigeminal nerve and facial nerve disorders	G50-G51	207	56.3	5.2	3	5	7	0.753	0.0223	0.708	0.776	1
47	Disorders of other cranial nerves, cranial nerve disorders in diseases classified elsewhere, nerve root and plexus disorders, and nerve root and plexus compressions in diseases classified elsewhere	G52-G55	109	59.1	5.6	3	5	8	0.687	0.0343	0.655	0.723	0.824
48	Mononeuropathies of upper limb	G56	1,460	57.4	5.0	2	4	7	0.762	0.0070	0.708	0.776	0.838
49	Mononeuropathies of lower limb, other mononeuropathies, and mononeuropathy in diseases classified elsewhere	G57-G59	193	56.9	4.9	2	4	6	0.739	0.0207	0.655	0.771	0.833
50	Polyneuropathies and other disorders of the peripheral nervous system	G60-G64	296	61.5	6.4	3	6	9	0.672	0.0186	0.592	0.723	0.824
51	Diseases of myoneural junction and muscle	G70-G73	56	50.9	4.8	3	5	7	0.685	0.0399	0.626	0.756	0.824
52	Cerebral palsy and other paralytic syndromes	G80-G83	113	47.9	5.0	3	5	7	0.600	0.0328	0.389	0.722	0.818
53	Other disorders of the nervous system	G90-G99	257	53.8	5.7	3	5	8	0.713	0.0189	0.655	0.770	0.824

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
	H: Diseases of the eye and adnexa and diseases of the ear and mastoid process	H02-H06; H17-H18; H25-H28; H31-H32; H34-H36; H40-55; H57; H80,H810; H93, H90-H93	6,309	65.8	5.2	3	5	7	0.779	0.0034	0.708	0.818	1
54	Disorders of eyelid, lacrimal system, and orbit	H02-H06	257	62.3	5.5	3	5	7	0.783	0.0151	0.708	0.818	1
55	Corneal scars and opacities	H17	34	60.6	5.8	2	6	7	0.796	0.0467	0.723	0.776	1
56	Other disorders of cornea	H18	132	60.1	5.1	2	4	7	0.805	0.0213	0.708	0.824	1
57	Diseases of the eye lens (cataracts)	H25-H28	928	73.5	6.1	4	5	8	0.761	0.0086	0.680	0.776	1
58	Disorders of the choroid and retina	H31-H32	36	59.1	6.5	3	5	8	0.707	0.0938	0.708	0.818	1
59	Retinal vascular occlusions	H34	115	73.2	6.4	4	6	8	0.763	0.0295	0.722	0.824	1
60	Other retinal disorders	H35	749	72.0	6.2	3	5	8	0.747	0.0115	0.660	0.771	1
61	Retinal disorders in diseases classified elsewhere	H36	175	58.5	7.1	5	6	9	0.735	0.0275	0.708	0.776	0.824
62	Glaucoma[b]	H40–H42	858	70.8	5.4	3	5	7	0.777	0.0082	0.708	0.776	1
63	Disorders of the vitreous body and globe	H43-H45	136	56.7	5.4	2	5	8	0.734	0.0267	0.655	0.771	0.824
64	Disorders of optic nerve and visual pathways	H46-H48	74	53.1	5.7	4	5	7	0.714	0.0397	0.645	0.771	0.838
65	Disorders of ocular muscles, binocular movement, accommodation, and refraction	H49-H52	294	43.9	3.4	1	2	5	0.856	0.0112	0.770	0.824	1
66	Visual disturbances	H53	360	55.8	5.9	3	5	8	0.760	0.0152	0.708	0.818	1
67	Blindness and partial sight	H54	58	60.9	5.8	3	6	8	0.748	0.0398	0.621	0.824	1
68	Nystagmus and other irregular eye movements and other disorders of eye and adnexa	H55, H57	80	54.9	4.8	2	5	7	0.793	0.0295	0.708	0.824	1
69	Otosclerosis	H80	161	61.5	4.9	2	4	7	0.828	0.0167	0.756	0.824	1
70	Ménière's disease[b]	H810	143	66.4	6.2	4	6	8	0.766	0.0189	0.708	0.824	0.833
71	Other diseases of the inner ear	H83	882	68.3	6.0	4	5	8	0.790	0.0084	0.723	0.824	1
72	Conductive and sensorineural hearing loss	H90	566	64.5	6.0	3	5	8	0.782	0.0112	0.723	0.818	1
73	Other hearing loss and other disorders of ear, not elsewhere classified	H910, H912, H913, H918, H930, H932, H933	114	61.5	6.1	4	5	9	0.770	0.0221	0.708	0.818	1
74	Presbycusis (age-related hearing loss)	H911	1,477	79.3	6.4	4	6	8	0.751	0.0068	0.660	0.776	0.838
75	Hearing loss, unspecified	H919	1,149	66.7	6.0	3	5	8	0.774	0.0085	0.708	0.818	1
76	Tinnitus	H931	769	63.6	5.8	3	5	8	0.778	0.0091	0.723	0.824	1
77	Other specified disorders of ear	H938	350	66.6	5.9	3	5	8	0.776	0.0139	0.708	0.818	1
	I: Diseases of the circulatory system	I05-I06; I10-28; I30-33; I36-141; I44-I52; I60-I88; I90-I94; I96-I99	16,990	62.9	4.6	2	4	6	0.783	0.0019	0.717	0.818	1

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
78	Aortic and mitral valve disease[b]	I05, I06, I34, I35	426	72.3	7.5	5	7	10	0.741	0.0109	0.655	0.771	0.824
79	Hypertensive diseases[b]	I10-I15	14,504	64.8	4.8	3	4	6	0.776	0.0021	0.708	0.818	1
80	Heart failure[b]	I11.0, I13.0, I13.2, I42.0, I42.6, I42.7, I42.9, I50.0, I50.1, I50.9	369	72.4	8.4	6	8	11	0.678	0.0151	0.592	0.723	0.824
80A	Ischemic heart diseases	I20-I25	2,017	67.9	7.5	5	7	9	0.719	0.0066	0.655	0.756	0.824
81	Angina pectoris	I20	1,253	66.3	7.3	5	7	9	0.725	0.0078	0.655	0.756	0.824
82	Acute myocardial infarction and subsequent myocardial infarction	I21-I22	494	68.0	7.9	5	7	9	0.739	0.0130	0.655	0.771	1
83	AMI complex/other	I23-I24	28	67.8	8.6	6	8	11	0.664	0.0591	0.627	0.723	0.824
84	Chronic ischemic heart disease	I25	1,234	69.7	8.3	6	8	10	0.711	0.0082	0.655	0.723	0.824
85	Pulmonary heart disease and diseases of pulmonary circulation	I26-I28	154	67.9	7.3	5	7	10	0.680	0.0232	0.592	0.723	0.824
86	Acute pericarditis	I30	53	53.8	4.9	3	4	7	0.860	0.0266	0.756	0.824	1
87	Other forms of heart disease	I31-I43, except I34-I35 and I42	85	58.8	7.2	4	7	10	0.766	0.0204	0.703	0.776	0.838
88	Atrioventricular and left bundle-branch block	I44	178	71.0	7.0	4	6	10	0.765	0.0251	0.708	0.776	1
89	Other conduction disorders	I45-46	129	62.7	6.4	3	6	9	0.795	0.0166	0.708	0.818	1
90	Paroxysmal tachycardia	I47	593	63.4	6.4	4	6	9	0.767	0.0098	0.708	0.776	1
91	Atrial fibrillation and flutter	I48	1,480	71.9	6.9	4	6	9	0.745	0.0069	0.655	0.771	0.838
92	Other cardiac arrhythmias	I49	423	67.3	6.9	4	6	9	0.759	0.0130	0.708	0.776	0.824
93	Complications and ill-defined descriptions of heart disease and other heart disorders in diseases classified elsewhere	I51-52	50	71.1	8.9	5	9	12	0.670	0.0297	0.592	0.708	0.776
94	Stroke	I60, I61, I63-I64, Z501 (rehabilitation)	812	68.6	7.0	4	6	9	0.707	0.0093	0.627	0.723	0.824
95	Cerebrovascular diseases	I62, I65-I68	180	63.8	7.4	5	7	10	0.675	0.0215	0.627	0.723	0.824
96	Sequelae of cerebrovascular disease	I69	513	70.0	8.3	6	8	10	0.645	0.0128	0.558	0.708	0.785
97	Atherosclerosis	I70	397	71.2	8.6	6	8	11	0.645	0.0160	0.559	0.723	0.785
98	Aortic aneurysm and aortic dissection	I71	121	70.7	7.5	5	7	10	0.748	0.0178	0.660	0.723	0.824
99	Diseases of arteries, arterioles, and capillaries	I72, I74, I77-I79	142	61.2	6.6	3	6	9	0.776	0.0193	0.723	0.776	1
100	Other peripheral vascular diseases	I73	391	68.3	7.7	5	7	10	0.683	0.0145	0.645	0.723	0.824
101	Phlebitis, thrombosis of the portal vein, and others	I80-I82	439	60.9	5.8	3	5	8	0.750	0.0136	0.708	0.776	0.838
102	Varicose veins of lower extremities	I83	494	55.2	3.7	2	3	5	0.837	0.0107	0.770	0.824	1
103	Hemorrhoids[b]	I84	1,048	50.7	4.0	2	3	5	0.795	0.0081	0.723	0.824	1

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
104	Esophageal varices (chronic), varicose veins of other sites, other disorders of veins, nonspecific lymphadenitis, other noninfective disorders of lymphatic vessels, and lymph nodes and other, and unspecified disorders of the circulatory system	I85-I99, except I89 and I95	145	50.0	4.8	2	4	7	0.784	0.0176	0.708	0.776	1
	J: Diseases of the respiratory system	J30.1; J40-J47; J60-J84; J95, J97-J99	14,087	51.5	4.0	2	3	5	0.810	0.0021	0.723	0.824	1
105	Respiratory allergy[b]	J30, except J30.0	9,792	50.2	3.8	2	3	5	0.819	0.0024	0.756	0.824	1
105A	Chronic lower respiratory diseases[b]	J40-J43, J47	5,046	55.0	5.2	3	4	7	0.782	0.0036	0.708	0.818	1
106	Bronchitis, not specified as acute or chronic, simple and mucopurulent chronic bronchitis, and unspecified chronic bronchitis	J40-J42	182	67.3	8.9	6	8	11	0.641	0.0292	0.592	0.723	0.824
107	Emphysema	J43	76	62.9	7.6	5	7	9	0.706	0.0266	0.564	0.723	0.824
108	Chronic obstructive lung disease (COPD)[b]	J44, J96, J13-J18	2,435	61.3	6.4	4	6	8	0.733	0.0060	0.655	0.771	0.824
109	Asthma, status asthmaticus[b]	J45-J46	4,107	52.3	5.3	3	4	7	0.779	0.0042	0.708	0.818	1
110	Bronchiectasis	J47	52	58.6	6.8	4	6	9	0.769	0.0409	0.612	0.824	1
111	Other diseases of the respiratory system	J60-J84; J95, J97-J99	217	62.2	7.1	4	7	10	0.694	0.0204	0.626	0.723	0.824
	K: Diseases of the digestive system	K25-K27; K40, K43, K50-52; K58-K59; K71-K77; K86-K87	4,462	56.8	5.2	2	4	7	0.744	0.0042	0.66	0.776	0.838
112	Ulcers[b]	K25-K27	2,245	59.6	5.8	3	5	8	0.707	0.0061	0.655	0.756	0.824
113	Inguinal hernia	K40	480	58.1	4.0	2	3	6	0.839	0.0099	0.756	0.824	1
114	Ventral hernia	K43	134	60.4	5.7	3	5	7	0.749	0.0211	0.660	0.776	0.824
115	Crohn's diease	K50	212	47.2	4.6	2	3	6	0.758	0.0205	0.660	0.776	0.824
116	Ulcerative colitis	K51	371	50.9	4.7	2	4	7	0.773	0.0155	0.708	0.818	1
117	Other noninfective gastroenteritis and colitis	K52	209	61.8	6.9	4	6	10	0.687	0.0208	0.640	0.723	0.824
118	Irritable bowel syndrome (IBS)	K58	566	49.3	5.1	2	4	7	0.766	0.0107	0.708	0.818	1
119	Other functional intestinal disorders	K59	542	58.8	6.3	3	6	8	0.698	0.0139	0.655	0.756	0.824
120	Diseases of liver, biliary tract, and pancreas	K71-K77; K86-K87	274	57.3	6.0	3	5	8	0.729	0.0147	0.655	0.756	0.824
	L: Diseases of the skin and subcutaneous tissue	L40	722	56.0	4.3	2	3	6	0.789	0.0094	0.723	0.824	1
121	Psoriasis[b]	L40	722	56.0	4.3	2	3	6	0.789	0.0094	0.723	0.824	1
	M: Diseases of the musculoskeletal system and connective tissue	M01–M25: M30-M36; M40-M54; M60.1-M99	13,163	57.0	4.4	2	4	6	0.755	0.0023	0.708	0.776	0.833

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
122	Infectious arthropathies	M01-M03	101	47.6	4.7	2	3	6	0.779	0.0271	0.708	0.818	1
122A	Inflammatory polyarthropathies and ankylosing spondylitis[b]	M05–M14, M45	2,008	60.3	5.7	3	5	8	0.726	0.0057	0.66	0.771	0.824
123	Rheumatoid arthritis[b]	M05, M06, M07.1, M07.2, M07.3, M08, M09	919	56.8	5.7	3	5	8	0.710	0.0088	0.655	0.756	0.824
124	Inflammatory polyarthropathies, except rheumatoid arthritis[b]	M074–M079, M10–M14, M45	1,478	61.3	5.9	3	5	8	0.724	0.0068	0.655	0.770	0.824
125	Polyarthrosis [arthrosis]	M15	169	67.5	7.4	4	7	10	0.629	0.0239	0.496	0.723	0.824
126	Coxarthrosis [arthrosis of hip]	M16	1,458	70.7	5.8	3	5	8	0.723	0.0062	0.655	0.723	0.824
127	Gonarthrosis [arthrosis of knee]	M17	2,590	63.3	5.2	3	5	7	0.742	0.0050	0.66	0.771	0.824
128	Arthrosis of first carpometacarpal joint and other arthrosis	M18-M19	1,036	61.2	5.7	3	5	7	0.730	0.0078	0.66	0.771	0.824
129	Acquired deformities of fingers and toes	M20	616	56.1	5.0	2	4	7	0.779	0.0097	0.708	0.824	1
130	Other acquired deformities of limbs	M21	275	52.5	5.5	3	5	7	0.749	0.0181	0.708	0.776	0.838
131	Disorders of patella (kneecap)	M22	496	36.0	3.3	1	3	4	0.787	0.0124	0.723	0.824	1
132	Internal derangement of knee	M230, M231, M233, M235, M236, M238	128	44.5	4.0	2	3	5	0.766	0.0183	0.723	0.824	0.824
133	Derangement of meniscus due to old tear or injury	M232	497	48.3	3.8	2	3	5	0.811	0.0101	0.723	0.824	1
134	Internal derangement of knee, unspecified	M239	382	44.3	3.3	1	3	4	0.822	0.0098	0.756	0.824	1
135	Other specific joint derangements	M24, except M240-M241	58	40.3	3.7	2	3	5	0.773	0.0313	0.655	0.776	1
136	Other joint disorders, not elsewhere classified	M25	193	48.6	4.6	2	4	6	0.723	0.0202	0.660	0.776	0.824
137	Systemic connective tissue disorders	M30-M36, except M32, M34	463	61.5	6.4	3	6	9	0.703	0.0136	0.654	0.771	0.824
138	Systemic lupus erythematosus	M32	45	51.5	7.2	5	7	9	0.665	0.0500	0.592	0.723	0.824
139	Dermatopolymyositis	M33	15	60.0	7.1	4	7	9	0.731	0.0628	0.655	0.776	0.833
140	Systemic sclerosis	M34	13	62.4	8.9	5	6	17	0.432	0.2273	-0.196	0.660	0.824
141	Kyphosis, lordosis	M40	54	53.2	5.3	2	4	7	0.697	0.0388	0.655	0.723	0.824
142	Scoliosis	M41	164	40.8	4.3	1	3	6	0.732	0.0244	0.655	0.776	1
143	Spinal osteochondrosis	M42	69	47.7	4.7	2	4	6	0.664	0.0437	0.627	0.723	0.824
144	Other deforming dorsopathies	M43	275	56.8	5.8	3	5	8	0.658	0.0168	0.457	0.723	0.824
145	Other inflammatory spondylopathies	M46	62	53.5	6.7	3	6	9	0.618	0.0446	0.389	0.66	0.824
146	Spondylosis	M47	924	63.3	6.5	3	6	9	0.629	0.0091	0.490	0.713	0.776
147	Other spondylopathies and spondylopathies in diseases classified elsewhere	M48, M49	483	67.7	7.5	4	7	10	0.633	0.0121	0.496	0.708	0.776
148	Cervical disc disorders	M50	131	50.8	4.7	2	4	6	0.691	0.0207	0.592	0.723	0.824
149	Other intervertebral disc disorders	M51	501	51.3	5.0	2	4	7	0.646	0.0122	0.442	0.723	0.824

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
150	Other dorsopathies, not elsewhere classified	M53	92	49.4	4.9	2	4	6	0.653	0.0310	0.490	0.723	0.776
151	Dorsalgia	M54	621	50.6	5.3	2	4	7	0.619	0.0123	0.442	0.708	0.776
152	Soft tissue disorders	M60-M63, except M60.0	133	48.2	5.2	2	4	7	0.714	0.0272	0.703	0.776	0.824
153	Synovitis and tenosynovitis	M65	270	50.8	4.4	2	4	6	0.773	0.0169	0.723	0.776	1
154	Disorders of synovium and tendon	M66-68	238	43.6	3.8	2	3	5	0.790	0.0160	0.723	0.824	1
155	Soft tissue disorders related to use, overuse and pressure	M70	175	53.2	5.2	2	4	7	0.725	0.0211	0.655	0.771	0.824
156	Fibroblastic disorders	M72	521	62.1	4.6	2	4	6	0.798	0.0119	0.723	0.824	1
157	Shoulder lesions	M75	899	52.3	4.3	2	4	6	0.749	0.0089	0.708	0.776	0.824
158	Enthesopathies of lower limb, excluding foot	M76	111	43.9	3.4	2	3	4	0.769	0.0209	0.703	0.771	0.833
159	Other enthesopathies	M77	156	47.7	4.1	2	3	6	0.725	0.0212	0.655	0.771	0.824
160	Rheumatism, unspecified	M790	113	53.3	6.4	4	6	8	0.515	0.0302	0.321	0.592	0.723
161	Myalgia	M791	107	53.6	5.6	2	4	8	0.702	0.0236	0.592	0.776	0.824
162	Other soft tissue disorders, not elsewhere classified	M792- M794; M798-M799	81	53.0	5.4	3	5	7	0.656	0.0321	0.442	0.723	0.824
163	Other soft tissue disorders, not elsewhere classified: pain in limb	M796	250	50.8	5.1	2	4	7	0.717	0.0179	0.655	0.776	0.824
164	Fibromyalgia	M797	36	48.4	7.8	5	8	10	0.490	0.0490	0.293	0.592	0.723
165	Osteoporosis[b]	M80–M81	1,817	71.8	6.1	3	5	8	0.710	0.0066	0.655	0.756	0.824
166	Osteoporosis in diseases classified elsewhere	M82	16	61.4	9.9	7	11	14	0.636	0.0855	0.311	0.723	0.824
167	Adult osteomalacia and other disorders of bone density and structure	M83, M85, except M833	582	62.6	5.4	3	5	7	0.758	0.0106	0.708	0.776	0.824
168	Disorders of continuity of bone	M84	29	44.5	5.0	2	3	7	0.718	0.0543	0.496	0.776	1
169	Other osteopathies	M86-M90	160	56.7	5.6	2	5	8	0.711	0.0232	0.655	0.776	0.824
170	Other disorders of the musculoskeletal system and connective tissue	M95-M99	253	52.2	5.3	2	4	8	0.731	0.0168	0.660	0.776	0.824
	N: Diseases of the genitourinary system	N18	224	66.3	8.1	5	8	11	0.698	0.0173	0.627	0.723	0.824
171	Chronic renal failure (CRF)[b]	N18	224	66.3	8.1	5	8	11	0.698	0.0173	0.627	0.723	0.824
	Q: Congenital malformations, deformations, and chromosomal abnormalities	Q00-Q56; Q60-Q99	1,323	44.1	3.7	2	3	5	0.814	0.0069	0.723	0.824	1

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
172	Congenital malformations: of the nervous, circulatory, respiratory system; cleft palate and cleft lip, urinary tract, bones, and muscles, other; and chromosomal abnormalities not elsewhere classified	Q00-Q07; Q20-Q37; Q60-Q99	863	43.6	3.9	2	3	5	0.795	0.0093	0.723	0.824	1
173	Congenital malformations of eye, ear, face, and neck	Q10-Q18	205	37.9	2.8	1	2	4	0.862	0.0119	0.776	0.824	1
174	Other congenital malformations of the digestive system	Q38-Q45	80	57.3	4.8	2	4	6	0.812	0.0251	0.723	0.824	1
175	Congenital malformations of the sexual organs	Q50-Q56	198	47.2	3.3	1	2	5	0.837	0.0143	0.756	0.824	1
	F: Mental and behavioral disorders	F00-99	6,106	50.7	4.6	2	4	6	0.703	0.0037	0.655	0.756	0.824
176	Dementia[b]	F00, G30, F01, F02.0, F03.9, G31.8B, G31.8E, G31.9, G31.0B	179	80.9	6.9	4	6	9	0.546	0.0260	0.429	0.592	0.723
177	Organic, including symptomatic, mental disorders	F04-F09	160	60.1	6.8	4	6	9	0.672	0.0257	0.592	0.723	0.824
178	Mental and behavioral disorders due to use of alcohol	F10	382	47.5	5.4	3	4	7	0.693	0.0147	0.592	0.723	0.824
179	Mental and behavioral disorders due to psychoactive substance use	F11-F19	368	48.0	5.1	3	4	7	0.715	0.0147	0.655	0.77	0.824
180	Schizophrenia[b]	F20	143	44.7	5.6	3	5	7	0.662	0.0257	0.525	0.723	0.818
181	Schizotypal and delusional disorders	F21-F29	193	48.2	6.7	4	6	9	0.693	0.0199	0.592	0.756	0.824
182	Bipolar affective disorder[b]	F30-F31	132	52.8	6.5	4	5	9	0.659	0.0256	0.559	0.708	0.818
183	Depression[b]	F32, F33, F34.1, F06.32	4,619	52.5	4.9	2	4	7	0.686	0.0043	0.645	0.756	0.818
184	Mood (affective) disorders	F340, F348-F349, F38-F39	44	48.5	7.4	5	7	10	0.666	0.0440	0.496	0.693	0.818
185	Phobic anxiety disorders	F40	78	36.8	4.7	3	4	6	0.611	0.0293	0.409	0.708	0.770
186	Other anxiety disorders	F41	226	43.5	5.9	3	5	8	0.631	0.0194	0.409	0.708	0.818
187	Obsessive compulsive disorder (OCD)[b]	F42	70	34.2	5.1	3	4	7	0.723	0.0276	0.655	0.756	0.818
188	Posttraumatic stress disorder	F431	73	45.4	5.1	3	4	7	0.557	0.0393	0.356	0.655	0.756
189	Reactions to severe stress and adjustment disorders	F432-F439	386	39.7	5.1	3	4	7	0.687	0.0148	0.645	0.756	0.818
190	Dissociative (conversion) disorders, somatoform disorders, and other neurotic disorders	F44, F45, F48	170	49.2	6.4	3	6	9	0.644	0.0269	0.559	0.713	0.824
191	Eating disorders	F50	54	27.5	4.5	2	3	5	0.712	0.0352	0.703	0.771	0.818

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
192	Behavioral syndromes associated with physiological disturbances and physical factors	F51-F59	58	41.9	4.6	2	3	6	0.753	0.0401	0.708	0.776	1
193	Emotionally unstable personality disorder	F603	112	39.3	6.1	4	5	8	0.655	0.0225	0.525	0.708	0.770
194	Specific personality disorders	F602, F604-F609	363	43.1	5.6	3	5	7	0.645	0.0160	0.496	0.708	0.818
195	Disorders of adult personality and behavior	F61-F69	119	43.9	6.1	3	6	8	0.652	0.0254	0.496	0.708	0.818
196	Mental retardation	F70-F79	44	38.8	5.4	2	4	6	0.745	0.0391	0.645	0.818	1
197	Disorders of psychological development	F80-F89	44	24.1	3.7	2	3	5	0.720	0.0448	0.708	0.770	0.818
198	Hyperkinetic disorders (ADHD)[b]	F90	193	31.7	4.0	2	3	5	0.733	0.0163	0.660	0.770	0.824
199	Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	F91-F99	244	38.4	5.7	3	5	8	0.678	0.0197	0.519	0.723	0.824
	Extra conditions												
	Ischemic heart diseases broad	I05-I06; I11-I13; I20-I28; I30-I52	4,221	67.5	6.5	4	6	8	0.746	0.0042	0.66	0.776	0.838
	Arthritis	M01-M03; M5-M9; M7-M14; M15-M20; M45	6,612	61.9	5.1	3	4	7	0.747	0.0031	0.703	0.776	0.824
	Arthrosis	M15-M19	4,589	64.2	5.2	3	5	7	0.739	0.0037	0.660	0.771	0.824
	Back conditions	M32-34; M41-M43; M46-49; M50-51; M53-M54	2,620	55.4	5.3	2	4	7	0.667	0.0057	0.592	0.723	0.824
	Overweight, clinical diagnosed (BMI $>$ 35)	E66	2,761	46.2	3.6	1	3	5	0.770	0.0053	0.708	0.818	1
	Endometriosis	N80	428	44.7	2.7	1	2	4	0.771	0.0122	0.713	0.818	1
	NCCs												
	Having no chronic conditions		18,136	37.7	0.0	0	0	0	0.917	0.0012	0.824	1	1
	Having 1 chronic condition		11,303	44.4	1.0	1	1	1	0.882	0.0016	0.818	1	1
	Comorbidity: 2 conditions		7,657	50.1	2.0	2	2	2	0.848	0.0023	0.771	0.824	1
	Comorbidity: 3 conditions		5,698	54.6	3.0	3	3	3	0.820	0.0030	0.756	0.824	1
	Comorbidity: 4 conditions		3,959	58.7	4.0	4	4	4	0.789	0.0035	0.723	0.818	1
	Comorbidity: 5 conditions		2,805	61.8	5.0	5	5	5	0.754	0.0047	0.708	0.776	0.824
	Comorbidity: 6 conditions		1,915	63.8	6.0	6	6	6	0.732	0.0061	0.660	0.770	0.824
	Comorbidity: 7 or more conditions		4,143	67.1	9.0	7	8	10	0.641	0.0048	0.564	0.713	0.776
	One or more chronic conditions		37,480	53.2	3.2	1	2	4	0.815	0.0012	0.723	0.824	1
	Gender												
	Women		29,268	48.2	2.3	0	1	3	0.835	0.0025	0.756	0.824	1
	Men		26,348	47.0	1.8	0	1	3	0.869	0.0022	0.776	1	1
	Age, y												
	16–24		5,993	19.9	0.6	0	0	1	0.902	0.0024	0.818	1	1
	25–34		5,388	29.7	1.0	0	0	1	0.893	0.0024	0.818	1	1

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
	35–44		8,516	39.8	1.3	0	1	2	0.871	0.0022	0.785	1	1
	45–54		10,657	49.6	1.9	0	1	3	0.839	0.0023	0.756	0.824	1
	55–64		11,198	59.8	2.6	1	2	4	0.833	0.0021	0.756	0.824	1
	65–74		8,840	69.1	3.6	1	3	5	0.832	0.0022	0.756	0.824	1
	75 +		5,024	81.3	4.9	3	4	7	0.749	0.0037	0.66	0.771	0.838
	Education												
	No education/training		14,603	58.2	3.1	1	2	5	0.790	0.0021	0.723	0.824	1
	Students or in training		4,968	21.8	0.7	0	0	1	0.901	0.0024	0.818	1	1
	Short education		24,455	48.7	2.0	0	1	3	0.857	0.0013	0.776	0.824	1
	Middle education (bachelor etc.)		8,315	47.5	1.8	0	1	3	0.882	0.0020	0.818	1	1
	High education (master's degree or above)		3,028	45.0	1.4	0	1	2	0.909	0.0029	0.824	1	1
	Missing		247	56.8	2.5	0	1	4	0.718	0.0197	0.655	0.771	0.833
	Ethnicity												
	Danish		53,268	48.1	2.1	0	1	3	0.855	0.0009	0.775	0.824	1
	Other Western		1,144	44.0	1.4	0	0	2	0.838	0.0068	0.756	0.824	1
	Non-Western		1,204	38.4	1.5	0	1	2	0.791	0.0083	0.723	0.824	1
	Family equalized income	March 2020: 1 US dollar = 6.89 DKr											
	100.000 kr (<$14,500)		2,452	32.4	1.1	0	0	1	0.858	0.0045	0.771	0.838	1
	100.000–199.999 kr ($14,500–$29,000)		22,137	51.2	2.6	0	2	4	0.815	0.0017	0.723	0.824	1
	200.000–299.999 kr ($29,000–$43,500)		21,633	45.3	1.7	0	1	3	0.877	0.0012	0.818	1	1
	300.000–399.999 kr ($43,500–$58,000)		6,930	49.3	1.7	0	1	3	0.892	0.0019	0.824	1	1
	400.000 + kr (>$58,000)		2,464	52.2	1.8	0	1	3	0.894	0.0032	0.824	1	1
	Family equalized income quartiles												
	First quartile		14.248	50.5	2.7	0	2	4	0.804	0.0022	0.723	0.824	1
	Second quartile		14.244	47.4	2.1	0	1	3	0.843	0.0018	0.770	0.824	1
	Third quartile		14.247	44.3	1.6	0	1	2	0.878	0.0015	0.818	1	1
	Fourth quartile		14.247	47.6	1.6	0	1	2	0.894	0.0013	0.824	1	1
	Socioeconomic position												
	Retired, age		12,408	74.9	4.3	2	4	6	0.791	0.0027	0.723	0.824	1
	Retirement, free		2,414	63.1	2.7	1	2	4	0.858	0.0035	0.776	0.824	1
	Early retirement, health reasons		2,227	52.1	4.7	2	4	7	0.629	0.0062	0.471	0.708	0.776
	Sick leave and other leave		507	39.1	2.6	1	2	4	0.712	0.0132	0.627	0.770	0.824
	Unemployed, social benefits longer term		555	37.3	2.8	1	2	4	0.624	0.0131	0.409	0.708	0.785
	Unemployed minimum 6 mo, ordinary		673	43.3	1.6	0	1	2	0.854	0.0076	0.756	0.824	1

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
	In training or education		3,472	19.8	0.5	0	0	1	0.908	0.0030	0.824	1	1
	Employed		32,262	42.2	1.3	0	1	2	0.892	0.0009	0.818	1	1
	Others not in workforce		1,098	36.1	1.4	0	1	2	0.822	0.0073	0.756	0.824	1
	Partnership												
	Having a partner		28,055	50.1	2.1	0	1	3	0.853	0.0013	0.771	0.824	1
	Not married/not in a relationship		27,561	45.3	2.0	0	1	3	0.851	0.0013	0.771	0.824	1
	Children home												
	No children home		41,004	51.7	2.4	0	1	4	0.841	0.0011	0.756	0.824	1
	Having children living home under 15 y		13,959	37.1	1.2	0	1	2	0.883	0.0016	0.818	1	1
	Missing		653	41.3	2.0	0	1	3	0.795	0.0123	0.723	0.824	1
	Social network–loneliness												
	Not lonely or seldom lonely		52,523	47.3	2.0	0	1	3	0.862	0.0009	0.776	0.824	1
	Often lonely, self reported		2,407	49.0	3.2	0	2	5	0.686	0.0065	0.612	0.756	0.824
	Missing		686	59.3	3.5	1	3	5	0.808	0.0096	0.723	0.824	1
	Stress: Cohen's Perceived Stress Scale												
	80% least stressed		43,466	47.1	1.8	0	1	3	0.896	0.0007	0.824	1	1
	20% most stressed (=cutpoint 18)		9,851	47.0	3.0	0	2	4	0.692	0.0028	0.655	0.756	0.818
	Missing		2,299	57.8	3.0	0	2	5	0.802	0.0058	0.723	0.824	1
	BMI, kg/m^2												
	< 18.5		1,193	39.9	1.9	0	1	3	0.813	0.0081	0.756	0.824	1
	$> 18 < 25$		25,087	44.4	1.7	0	1	2	0.873	0.0013	0.776	1	1
	$> 25 < 30$		19,387	50.6	2.2	0	1	3	0.854	0.0015	0.771	0.824	1
	$\geq 30 < 35$		6,317	50.3	2.7	0	2	4	0.812	0.0031	0.723	0.824	1
	≥ 35		2,015	47.9	3.2	1	2	5	0.754	0.0061	0.708	0.776	0.838
	Missing		1,617	58.5	3.2	1	2	5	0.790	0.0069	0.708	0.824	1
	Daily smoker												
	Do not smoke daily		45,779	47.3	2.0	0	1	3	0.863	0.0010	0.776	0.824	1
	Smoking daily		8,968	47.6	2.2	0	1	3	0.807	0.0026	0.723	0.824	1
	Missing		869	59.7	3.4	1	3	5	0.792	0.0087	0.723	0.824	1
	Alcohol intake												
	Do not exceed National Board of Health's recommendations		46,937	47.4	2.0	0	1	3	0.857	0.0010	0.776	0.824	1
	Exceed recommendations with more than 7 drinks/wk for women or 14 drinks/wk for men		4,274	43.9	1.9	0	1	3	0.837	0.0036	0.756	0.824	1
	Missing		4,405	52.7	2.9	0	2	4	0.814	0.0038	0.723	0.824	1
	Exercise												
	Exercise at least 4 h a week		45,913	46.2	1.8	0	1	3	0.875	0.0009	0.776	1	1
	Do not exercise during the week		8,457	52.4	3.1	0	2	5	0.743	0.0032	0.655	0.776	1
	Missing		1,246	62.3	3.6	1	3	5	0.779	0.0083	0.708	0.824	1

(continued)

Table 2 (continued)

No.	Name of Chronic Condition or Variables	ICD-10 Code	*n*	Mean Age	Number Chronic Conditions (NCC)				EQ-5D-3L Sample Utility				
					Mean NCC	NCC 25%	NCC 50%	NCC 75%	EQ-5D Utility	EQ-5D SE	EQ-5D 25%	EQ-5D 50%	EQ-5D 75%
	Fruit intake												
	Do not meet National Board of Health's recommendations		50,958	47.3	2.0	0	1	3	0.852	0.0010	0.771	0.824	1
	5 or more portions of fruit a day as recommended		3,486	47.0	2.0	0	1	3	0.867	0.0035	0.776	1	1
	Missing		1,172	58.8	3.3	1	3	5	0.806	0.0072	0.723	0.824	1
	SF-12 general health (self-reported)												
	Excellent		6,231	37.9	0.7	0	0	1	0.974	0.0011	1	1	1
	Very Good		20,840	42.7	1.2	0	1	2	0.930	0.0009	0.824	1	1
	Good (base)		21,183	51.8	2.3	0	2	4	0.837	0.0011	0.756	0.824	1
	Fair		6,846	56.7	4.4	2	4	6	0.635	0.0028	0.592	0.708	0.756
	Poor		1,341	56.8	5.8	3	5	8	0.371	0.0090	0.225	0.367	0.612
	Missing		547	60.7	3.3	1	3	5	0.787	0.0182	0.723	.818	1
	Long-term illness or disability (self-reported)												
	No long-term illness (base)		36,747	44.4	1.2	0	1	2	0.913	0.0008	0.824	1	1
	Long-term illness		18,488	52.6	3.6	1	3	5	0.729	0.0019	0.660	0.771	0.824
	Missing		1,753	63.5	3.6	1	3	5	0.792	0.0070	0.723	0.818	1
	Samples												
	NDR sample		40,816	47.6	2.1	0	1	3	0.850	0.0011	0.771	0.824	1
	DK sample		14,800	47.6	2.0	0	1	3	0.857	0.0016	0.776	0.824	1
	All	—	**55,616**	47.6	2.1	0	1	3	**0.852**	**0.0009**	**0.771**	**0.824**	**1**

ADHD, attention-deficit/hyperactivity disorder; AMI, acute myocardial infarction; BMI, body mass index; ICD-10, International Classification of Diseases, 10th Revision; n/a, not available; NDR, North Denmark Region. Bold entries represent overall disease groups.

[a]$N = 55{,}616$ in all models. All NCC means and unadjusted EQ-5D estimates are weighted. Frequencies (*n*) are not weighted. Conditions marked with "A" are overlapping other conditions, usually due to complex register definition. For interest, see Hvidberg (2016, p 67–68)[40] for health-related quality-of-life (HRQoL) sample means of 17 common self-reported chronic conditions in comparison with the HRQoL of the above register-based chronic conditions.

[b]Complex defined conditions.

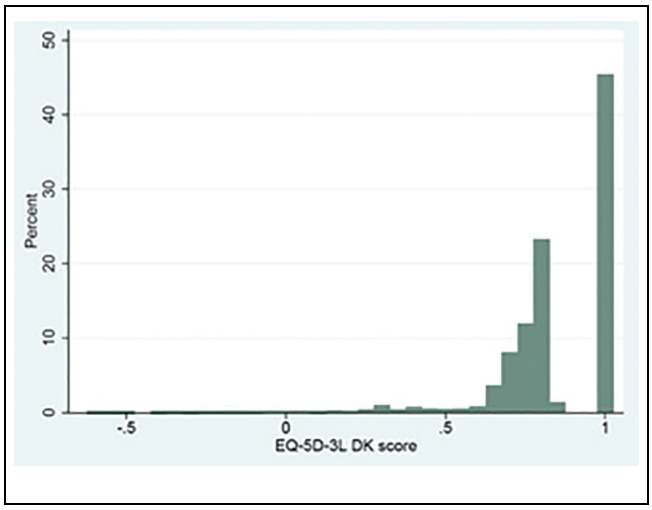

Figure 1 Histogram of the EQ-5D-3L DK, National Health Profiles 2010/2013. $N = 55{,}616$.

which linear regression models cannot capture: bounded utilities, a large mass of observations at 1, a large gap to the utility value immediately before 1, 2 modes, and a large degree of skewness within each of the modes.

Models with 2 components were selected. Searches for 3-component models did not yield any improvement in fit over the 2-component models, and a large proportion of the 3-component models did not converge, indicating that models with 3 components for this large number of covariates were weakly identified. Table 3 presents measures of fit for 1- and 2-component ALDVMMs for the base and full models. The reductions in Akaike information criterion (AIC) and Bayesian information criterion (BIC) are very large in both the base and full models when moving from 1 to 2 components, confirming that the 2-component models are a better fit for the data. The mean absolute error (MAE) and the root mean squared error (RMSE) also favor the 2-component models. Figure 2 compares the cumulative distribution of the EQ-5D-3L utility data with that implied by the estimated models showing that the estimated 2-component models reproduce the characteristics of the data quite well and better than the 1-component models do and that the full model specification shows a better fit in terms of AIC, BIC, MAE, and RMSE. This highlights the importance of the additional variables overall, although the improvement is not so pronounced when looking at the cumulative percentage plots in Figure 2.[iii]

Tables 4 and 5[iv] (catalog 2) present the MEs or disutilities for the 199 chronic conditions calculated based on the base and full regression models for representative 50-y-old men and women with no chronic disease. These regression-based estimates calculated for representative individuals allow us to compare directly across chronic diseases by adjusting for the additional effects that may arise due to the difference in sample composition across chronic conditions presented in Table 1.[v] For the full model, the conditions are followed by the MEs of the socioeconomic variables and health risks, including stress and loneliness, in Table 5. Diseases from groups M, G, and F have the largest estimated marginal disutility. Fibromyalgia (M797), cerebral palsy (G80-G83), sclerosis (G35), other dorsopathies (M53), depression (F32, F33, F34.1, F06.32), dementia (F01, etc.), posttraumatic stress disorder (F431), systemic atrophies (G10-G14, G30-G32), dorsalgia (M54), and rheumatism, unspecified (M790) are some important examples.

Focusing on the full model (model including socioeconomic variables, lifestyle, and health risks), it is evident that lifestyle and health risk factors are substantially associated with EQ-5D-3L based HRQoL (Table 5). Particularly, perceived stress has a relatively sizeable marginal disutility, followed by loneliness. A large ME is also found for individuals with BMIs greater than 35 kg/m^2, people not exercising, other Western immigrants, participants with 4 or more comorbidities, high alcohol intake, and current smokers.

Table 3 Summary Measures of Fit for the Base and Full Adjusted Limited Dependent Variable Mixture Models

	AIC	BIC	Mean Absolute Error	Root Mean Squared Error
Base model				
1 component	5,456.93	7,349.29	0.1165378	0.1517262
2 components	−16,263.95	−12,381.04	0.1160281	0.1518493
Full model				
1 component	−4,102.49	−1,951.27	0.1052836	0.1371734
2 components	−33,560.73	−29,035.14	0.0949804	0.1207545

AIC, Akaike information criterion; BIC, Bayesian information criterion.

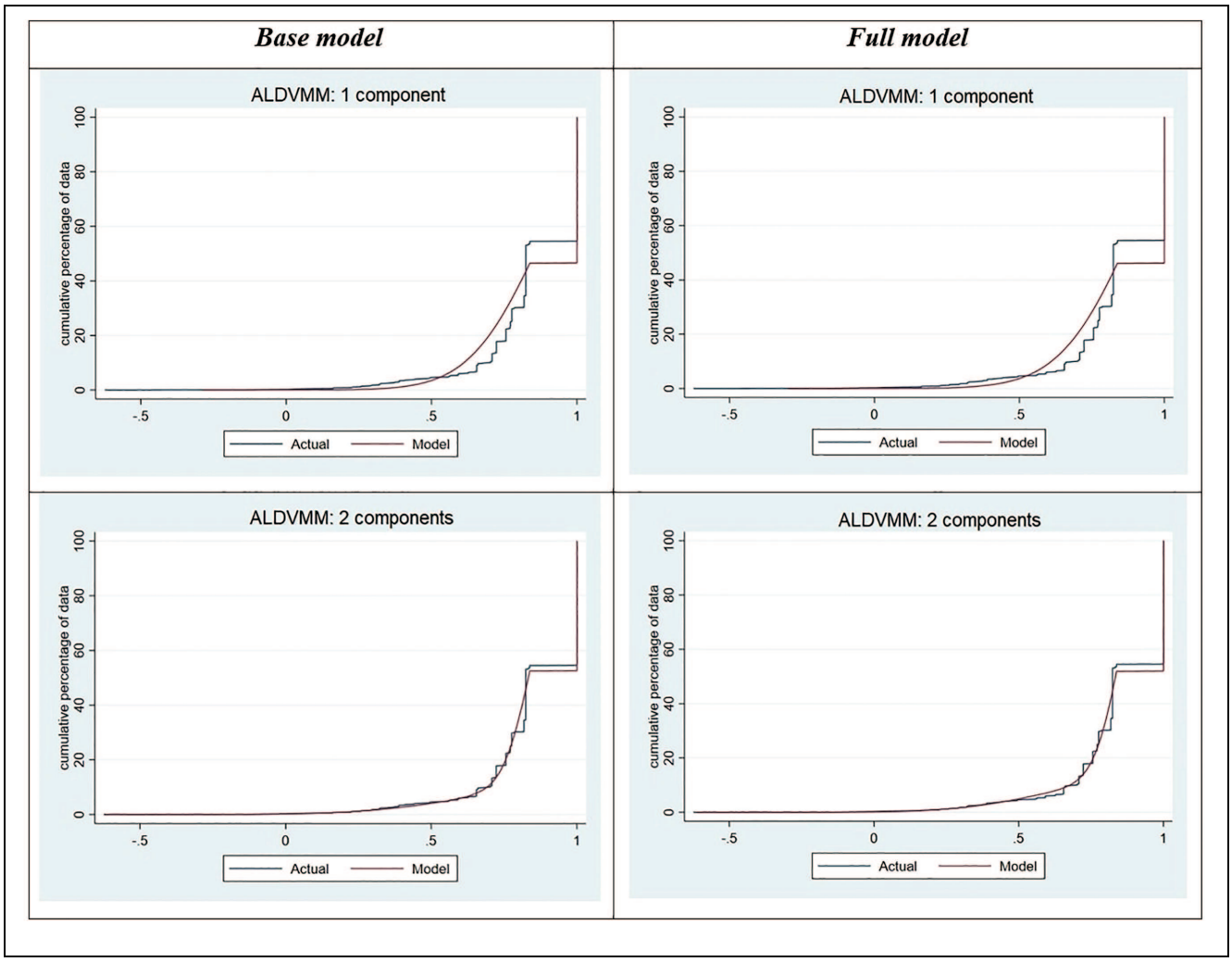

Figure 2 Cumulative percentage plots.

How to Use the Estimates

We have presented unadjusted and adjusted regression utility estimates. The unadjusted estimates (catalog 1) can be used when interest lies in general population estimates. Adjusted regression estimates (catalog 2) can be used when predictions need to be made in samples that are very different from the general population sample used in the estimation. This will typically be the case when using them to evaluate interventions in which the population is not as healthy as the general population or has a different age and gender distribution.

Below, we provide simplified hypothetical examples for illustration to show how analysts can use the adjusted regression utility estimates (Stata code to reproduce the calculations is included in the online Supplemental Material 2): Assume that we need to calculate EQ-5D scores for a population subgroup with type 2 diabetes who also suffer from hypertension. We also expect they will develop heart failure after 3 y. For this example, we simulate 1,000 patients' age (a normal distribution with a mean of 45 and standard deviation of 5) and gender (0.75 proportion of females), although analysts should use the age and gender distribution of their population of interest. Table 6 presents the average EQ-5D-3L prediction at baseline and 5 subsequent years (the time horizon and frequency would depend on the analysis). If the analyst has no information about other comorbidities, some reasonable assumptions based on the data need to be made. The average utilities can be easily calculated under the assumption of no other comorbidities (see

Table 4 EQ-5D-3L Regression Marginal Effects (MEs) for the 199 Chronic Conditions for the Base and Full Models: Example of MEs Based on a Representative 50-y-Old[a]

			Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
No.	Name of Chronic Conditions	ICD-10 Code	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
	Reference: Predictions of representative 50-y-old male/female with no chronic conditions		—	—	—	—	—	—	—	—	—	—	—	—
1	Chronic viral hepatitis	B18	–0.1119	0.0397	0.005	–0.1115	0.0417	0.007	–0.0614	0.0456	0.179	–0.0581	0.0449	0.196
2	Human immunodeficiency virus (HIV) disease	B20-24	–0.0440	0.0692	0.525	–0.0412	0.0657	0.53	0.0505	0.0081	0.000	0.0432	0.0065	0.000
3	Malignant neoplasms of other and unspecified localizations	C00-C14; C30-C33; C37-C42; C45-C49; C69; C73-74; C754-C759	–0.0087	0.0080	0.279	–0.0076	0.0075	0.31	0.0011	0.0072	0.883	0.0011	0.0065	0.87
4	Malignant neoplasms of digestive organs	C15-C17; C22-C26	–0.0781	0.0215	0.000	–0.0747	0.0216	0.001	–0.0390	0.0193	0.043	–0.0365	0.0185	0.048
5	Malignant neoplasm of colon	C18	–0.0200	0.0098	0.041	–0.0184	0.0093	0.049	–0.0047	0.0078	0.55	–0.0041	0.0072	0.57
6	Malignant neoplasms of rectosigmoid junction, rectum, anus, and anal canal	C19-C21	–0.0030	0.0115	0.797	–0.0023	0.0107	0.83	0.0064	0.0087	0.46	0.0060	0.0079	0.45
7	Malignant neoplasm of bronchus and lung	C34	–0.0360	0.0138	0.009	–0.0336	0.0133	0.012	–0.0150	0.0103	0.145	–0.0137	0.0096	0.153
8	Malignant melanoma of skin	C43	–0.0010	0.0073	0.893	–0.0005	0.0067	0.94	–0.0029	0.0061	0.63	–0.0026	0.0056	0.64
9	Other malignant neoplasms of skin	C44	0.0031	0.0091	0.730	0.0033	0.0083	0.69	0.0143	0.0073	0.049	0.0131	0.0065	0.044
10	Malignant neoplasm of breast	C50	–0.0249	0.0052	0.000	–0.0229	0.0049	0.000	–0.0096	0.0044	0.028	–0.0087	0.0041	0.031
11	Malignant neoplasms of female genital organs	C51-C52; C56-C58	–0.0142	0.0129	0.272	–0.0128	0.0121	0.29	–0.0005	0.0104	0.96	–0.0005	0.0095	0.96
12	Malignant neoplasm of cervix uteri, corpus uteri, and part unspecified	C53-C55	–0.0116	0.0090	0.200	–0.0103	0.0084	0.22	–0.0024	0.0072	0.74	–0.0022	0.0066	0.74
13	Malignant tumor of the male genitalia	C60, C62-C63	–0.0105	0.0242	0.666	–0.0095	0.0229	0.68	0.0123	0.0117	0.29	0.0114	0.0105	0.28
14	Malignant neoplasm of prostate	C61	–0.0084	0.0065	0.195	–0.0073	0.0060	0.22	0.0022	0.0051	0.66	0.0021	0.0046	0.65

(continued)

Table 4 (continued)

No.	Name of Chronic Conditions	ICD-10 Code	Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
			ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
15	Malignant neoplasms of urinary tract	C64-C68	–0.0204	0.0102	0.046	–0.0187	0.0097	0.054	–0.0030	0.0080	0.71	–0.0026	0.0074	0.72
16	Brain cancer[b]	C71, C75.1-C75.3, D33.0-D33.2, D35.2-D35.4, D43.0-D43.2, D44.3-D44.5 (brain). C70, D32, D42 (brain membrane). C72, D33.3-D33.9, D43.3-D43.9 (cranial nerve, spinal cord)	–0.0031	0.0092	0.738	–0.0024	0.0085	0.78	0.0080	0.0080	0.32	0.0075	0.0072	0.30
17	Malignant neoplasms of ill-defined, secondary, and unspecified sites and of independent (primary) multiple sites	C76-C80, C97	–0.0234	0.0088	0.008	–0.0214	0.0083	0.010	–0.0058	0.0066	0.38	–0.0052	0.0061	0.39
18	Malignant neoplasms, stated or presumed to be primary, of lymphoid, hematopoietic, and related tissue	C81-C96	–0.0168	0.0104	0.105	–0.0152	0.0097	0.118	–0.0074	0.0083	0.37	–0.0066	0.0077	0.39
19	In situ neoplasms	D00-D09	–0.0090	0.0064	0.160	–0.0080	0.0060	0.182	–0.0049	0.0056	0.38	–0.0043	0.0051	0.41
20	Hemolytic anemias	D55-D59	0.0346	0.0186	0.063	0.0316	0.0162	0.052	0.0292	0.0146	0.046	0.0261	0.0127	0.039
21	Aplastic and other anemias	D60-D63	–0.0156	0.0134	0.246	–0.0141	0.0126	0.26	–0.0174	0.0119	0.143	–0.0162	0.0111	0.146
22	Other anemias	D64	–0.0324	0.0083	0.000	–0.0300	0.0079	0.000	–0.0106	0.0063	0.089	–0.0097	0.0058	0.094
23	Coagulation defects, purpura, and other hemorrhagic conditions	D65-D69	0.0073	0.0071	0.307	0.0071	0.0065	0.27	0.0107	0.0057	0.062	0.0099	0.0052	0.055
24	Other diseases of blood and blood-forming organs	D70-D77	–0.0460	0.0181	0.011	–0.0436	0.0178	0.015	–0.0151	0.0137	0.27	–0.0137	0.0128	0.29
25	Certain disorders involving the immune mechanism	D80-D89	–0.0247	0.0130	0.058	–0.0227	0.0123	0.066	–0.0138	0.0116	0.23	–0.0126	0.0108	0.24
26	Diseases of the thyroid[b]	E00–E04, E06, E07	–0.0154	0.0035	0.000	–0.0139	0.0033	0.000	–0.0066	0.0029	0.023	–0.0060	0.0027	0.026
27	Thyrotoxicosis[b]	E05	–0.0112	0.0049	0.022	–0.0100	0.0046	0.029	–0.0043	0.0041	0.29	–0.0039	0.0037	0.30
28	Diabetes type 1[b]	E10	–0.0303	0.0087	0.001	–0.0282	0.0084	0.001	–0.0121	0.0071	0.089	–0.0109	0.0066	0.099
29	Diabetes type 2[b]	E11	–0.0259	0.0031	0.000	–0.0238	0.0029	0.000	–0.0051	0.0024	0.035	–0.0046	0.0022	0.039
30	Diabetes others[b]	E12–E14	–0.1081	0.0578	0.062	–0.1063	0.0600	0.076	–0.0172	0.0326	0.60	–0.0156	0.0306	0.61
31	Disorders of other endocrine glands	E20-E35, except E30	–0.0358	0.0082	0.000	–0.0333	0.0079	0.000	–0.0159	0.0069	0.020	–0.0146	0.0064	0.023

(continued)

Table 4 (continued)

No.	Name of Chronic Conditions	ICD-10 Code	Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
			ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
32	Metabolic disorders	E70-E77; E79-E83; E85, E88-E89;	–0.0303	0.0086	0.000	–0.0281	0.0082	0.001	–0.0223	0.0081	0.006	–0.0206	0.0076	0.007
33	Disturbances in lipoprotein circulation and other lipids[b]	E78	–0.0032	0.0021	0.130	–0.0026	0.0019	0.187	0.0026	0.0017	0.114	0.0025	0.0015	0.098
34	Cystic fibrosis[b]	E84	–0.0439	0.0365	0.23	–0.0417	0.0340	0.22	–0.0283	0.0333	0.40	–0.0272	0.0312	0.38
35	Inflammatory diseases of the central nervous system	G00-G09	–0.0268	0.0268	0.32	–0.0249	0.0258	0.33	0.0051	0.0158	0.75	0.0049	0.0144	0.73
36	Systemic atrophies primarily affecting the central nervous system and other degenerative diseases	G10-G14, G30-G32	–0.0637	0.0352	0.070	–0.0604	0.0347	0.082	–0.0316	0.0185	0.088	–0.0294	0.0176	0.095
37	Parkinson's disease[b]	G20, G21, G22, F02.3	–0.0420	0.0072	0.000	–0.0392	0.0069	0.000	–0.0148	0.0058	0.010	–0.0137	0.0054	0.011
38	Extrapyramidal and movement disorders	G23-G26	–0.0271	0.0137	0.048	–0.0250	0.0130	0.055	–0.0224	0.0141	0.112	–0.0207	0.0133	0.119
39	Sclerosis	G35	–0.1030	0.0132	0.000	–0.0991	0.0132	0.000	–0.0560	0.0123	0.000	–0.0530	0.0120	0.000
40	Demyelinating diseases of the central nervous system	G36-G37	–0.0236	0.0157	0.133	–0.0216	0.0148	0.145	–0.0207	0.0146	0.156	–0.0194	0.0136	0.154
41	Epilepsy[b]	G40–G41	–0.0299	0.0064	0.000	–0.0276	0.0061	0.000	–0.0085	0.0049	0.084	–0.0078	0.0046	0.086
42	Migraine[b]	G43	–0.0264	0.0031	0.000	–0.0243	0.0029	0.000	–0.0149	0.0025	0.000	–0.0137	0.0024	0.000
43	Other headache syndromes	G44	–0.0241	0.0100	0.016	–0.0222	0.0094	0.019	–0.0115	0.0085	0.175	–0.0108	0.0079	0.173
44	Transient cerebral ischemic attacks and related syndromes and vascular syndromes of brain in cerebrovascular diseases	G45-G46	–0.0052	0.0052	0.32	–0.0044	0.0048	0.37	0.0040	0.0042	0.34	0.0037	0.0038	0.33
45	Sleep disorders	G47	–0.0314	0.0064	0.000	–0.0291	0.0061	0.000	–0.0074	0.0049	0.135	–0.0066	0.0046	0.146
46	Disorders of trigeminal nerve and facial nerve disorders	G50-G51	–0.0174	0.0082	0.035	–0.0158	0.0077	0.041	–0.0083	0.0076	0.28	–0.0075	0.0070	0.28

(continued)

Table 4 (continued)

No.	Name of Chronic Conditions	ICD-10 Code	Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
			ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
47	Disorders of other cranial nerves, cranial nerve disorders in diseases classified elsewhere, nerve root and plexus disorders, and nerve root and plexus compressions in diseases classified elsewhere	G52-G55	–0.0396	0.0151	0.009	–0.0369	0.0145	0.011	–0.0183	0.0125	0.144	–0.0170	0.0117	0.148
48	Mononeuropathies of upper limb	G56	–0.0213	0.0036	0.000	–0.0194	0.0034	0.000	–0.0064	0.0029	0.029	–0.0059	0.0027	0.032
49	Mononeuropathies of lower limb, other mononeuropathies, and mononeuropathy in diseases classified elsewhere	G57-G59	–0.0290	0.0100	0.004	–0.0267	0.0095	0.005	–0.0146	0.0078	0.061	–0.0135	0.0072	0.063
50	Polyneuropathies and other disorders of the peripheral nervous system	G60-G64	–0.0402	0.0096	0.000	–0.0374	0.0092	0.000	–0.0266	0.0081	0.001	–0.0247	0.0077	0.001
51	Diseases of myoneural junction and muscle	G70-G73	–0.0751	0.0283	0.008	–0.0719	0.0284	0.011	–0.0296	0.0215	0.169	–0.0276	0.0205	0.178
52	Cerebral palsy and other paralytic syndromes	G80-G83	–0.0745	0.0159	0.000	–0.0708	0.0157	0.000	–0.0615	0.0149	0.000	–0.0585	0.0145	0.000
53	Other disorders of the nervous system	G90-G99	–0.0433	0.0092	0.000	–0.0405	0.0088	0.000	–0.0208	0.0075	0.005	–0.0193	0.0070	0.006
54	Disorders of eyelid, lacrimal system, and orbit	H02-H06	–0.0061	0.0074	0.41	–0.0052	0.0069	0.45	0.0036	0.0059	0.55	0.0033	0.0054	0.55
55	Corneal scars and opacities	H17	–0.0178	0.0209	0.39	–0.0163	0.0198	0.41	–0.0115	0.0197	0.56	–0.0104	0.0183	0.57
56	Other disorders of cornea	H18	0.0091	0.0126	0.47	0.0087	0.0116	0.45	0.0158	0.0101	0.120	0.0144	0.0090	0.110
57	Diseases of the eye lens (cataracts)	H25-H28	–0.0082	0.0049	0.095	–0.0072	0.0045	0.115	–0.0009	0.0040	0.83	–0.0007	0.0037	0.85
58	Disorders of the choroid and retina	H31-H32	–0.0302	0.0245	0.22	–0.0279	0.023	0.232	–0.0118	0.0209	0.57	–0.0110	0.0194	0.57
59	Retinal vascular occlusions	H34	0.0119	0.0096	0.22	0.0112	0.0087	0.20	0.0188	0.0085	0.027	0.0168	0.0075	0.026
60	Other retinal disorders	H35	–0.0139	0.0053	0.009	–0.0125	0.0050	0.012	–0.0045	0.0044	0.31	–0.0040	0.0041	0.33

(continued)

Table 4 (continued)

No.	Name of Chronic Conditions	ICD-10 Code	Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
			ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
61	Retinal disorders in diseases classified elsewhere	H36	–0.0114	0.0096	0.24	–0.0101	0.0089	0.26	–0.0003	0.0082	0.97	–0.0003	0.0075	0.97
62	Glaucoma[c]	H40–H42	–0.0153	0.0047	0.001	–0.0138	0.0044	0.002	–0.0069	0.0039	0.076	–0.0063	0.0036	0.079
63	Disorders of the vitreous body and globe	H43-H45	–0.0382	0.0126	0.003	–0.0355	0.0121	0.003	–0.0249	0.0117	0.034	–0.0232	0.0111	0.036
64	Disorders of optic nerve and visual pathways	H46-H48	–0.0179	0.0181	0.32	–0.0163	0.0170	0.34	0.0007	0.0150	0.961	0.0007	0.0137	0.96
65	Disorders of ocular muscles, binocular movement, accommodation, and refraction	H49-H52	–0.0038	0.0068	0.57	–0.0034	0.0064	0.56	0.0026	0.0055	0.639	0.0026	0.0050	0.597
66	Visual disturbances	H53	0.0004	0.0071	0.96	0.0007	0.0065	0.92	0.0105	0.0058	0.068	0.0094	0.0052	0.070
67	Blindness and partial sight	H54	–0.0057	0.0157	0.71	–0.0053	0.0144	0.72	0.0180	0.0117	0.123	0.0160	0.0104	0.122
68	Nystagmus and other irregular eye movements and other disorders of eye and adnexa	H55, H57	–0.0012	0.0130	0.929	–0.0007	0.0120	0.95	0.0068	0.0102	0.508	0.0061	0.0092	0.507
69	Otosclerosis	H80	0.0059	0.0087	0.49	0.0059	0.0079	0.46	0.0084	0.0070	0.228	0.0077	0.0063	0.22
70	Ménière's disease[b]	H810	–0.0284	0.0105	0.007	–0.0263	0.0100	0.009	–0.0163	0.0099	0.101	–0.0149	0.0093	0.109
71	Other diseases of the inner ear	H83	–0.0103	0.0050	0.037	–0.0092	0.0046	0.047	0.0014	0.0041	0.73	0.0014	0.0037	0.71
72	Conductive and sensorineural hearing loss	H90	–0.0083	0.0054	0.123	–0.0072	0.0050	0.146	0.0010	0.0044	0.81	0.0010	0.0040	0.80
73	Other hearing loss and other disorders of ear, not elsewhere classified	H910, H912, H913, H918, H930, H932, H933	–0.0249	0.0120	0.037	–0.0229	0.0113	0.043	–0.0059	0.0107	0.58	–0.0054	0.0099	0.58
74	Presbycusis (age-related hearing loss)	H911	–0.0079	0.0040	0.048	–0.0069	0.0037	0.063	–0.0019	0.0034	0.59	–0.0016	0.0031	0.59
75	Hearing loss, unspecified	H919	–0.0082	0.0042	0.053	–0.0072	0.0039	0.068	0.0034	0.0034	0.32	0.0032	0.0031	0.31
76	Tinnitus	H931	–0.0149	0.0049	0.002	–0.0135	0.0046	0.003	–0.0076	0.0044	0.079	–0.0069	0.0040	0.086
77	Other specified disorders of ear	H938	–0.0098	0.0069	0.155	–0.0087	0.0064	0.178	–0.0045	0.0065	0.49	–0.0040	0.0060	0.50
78	Aortic and mitral valve disease[b]	I05, I06, I34, I35	–0.0177	0.0075	0.018	–0.0162	0.0071	0.022	–0.0064	0.0058	0.27	–0.0057	0.0054	0.29
79	Hypertensive diseases[b]	I10-I15	–0.0189	0.0020	0.000	–0.0172	0.0019	0.000	–0.0053	0.0015	0.001	–0.0047	0.0014	0.001

(continued)

Table 4 (continued)

			Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
No.	Name of Chronic Conditions	ICD-10 Code	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
80	Heart failure[b]	I11.0, I13.0, I13.2, I42.0, I42.6, I42.7, I42.9, I50.0, I50.1, I50.9	–0.0296	0.0110	0.007	–0.0273	0.0104	0.009	–0.0079	0.0081	0.33	–0.0073	0.0075	0.33
81	Angina pectoris	I20	–0.0223	0.0049	0.000	–0.0204	0.0047	0.000	–0.0102	0.0040	0.010	–0.0093	0.0037	0.011
82	Acute myocardial infarction and subsequent myocardial infarction	I21-I22	–0.0011	0.0075	0.89	–0.0006	0.0069	0.93	0.0106	0.0054	0.049	0.0096	0.0048	0.048
83	AMI complex/other	I23-I24	–0.0482	0.0237	0.042	–0.0451	0.0228	0.048	–0.0346	0.0192	0.072	–0.0323	0.0183	0.078
84	Chronic ischemic heart disease	I25	–0.0235	0.0062	0.000	–0.0216	0.0059	0.000	–0.0075	0.0045	0.094	–0.0068	0.0041	0.102
85	Pulmonary heart disease and diseases of pulmonary circulation	I26-I28	–0.0233	0.0138	0.092	–0.0214	0.0130	0.101	–0.0024	0.0102	0.81	–0.0022	0.0093	0.81
86	Acute pericarditis	I30	–0.0023	0.0169	0.89	–0.0019	0.0158	0.91	0.0113	0.0130	0.38	0.0104	0.0117	0.37
87	Other forms of heart disease	I31-I43, except I34-I35 and I42	–0.0266	0.0181	0.142	–0.0248	0.0174	0.155	–0.0223	0.0139	0.109	–0.0204	0.0131	0.121
88	Atrioventricular and left bundle-branch block	I44	–0.0036	0.0092	0.69	–0.0029	0.0085	0.73	0.0013	0.0075	0.87	0.0013	0.0069	0.86
89	Other conduction disorders	I45-46	–0.0220	0.0128	0.085	–0.0204	0.0122	0.095	–0.0048	0.0105	0.65	–0.0042	0.0097	0.67
90	Paroxysmal tachycardia	I47	–0.0140	0.0059	0.018	–0.0126	0.0056	0.023	–0.0077	0.0048	0.107	–0.0070	0.0044	0.109
91	Atrial fibrillation and flutter	I48	–0.0229	0.0047	0.000	–0.0210	0.0045	0.000	–0.0061	0.0036	0.093	–0.0054	0.0034	0.106
92	Other cardiac arrhythmias	I49	–0.0122	0.0066	0.064	–0.0109	0.0061	0.076	–0.0100	0.0055	0.070	–0.0090	0.0051	0.077
93	Complications and ill-defined descriptions of heart disease and other heart disorders in diseases classified elsewhere	I51-52	–0.0396	0.0255	0.120	–0.0369	0.0246	0.133	–0.0242	0.0232	0.30	–0.0223	0.0218	0.31
94	Stroke	I60, I61, I63-I64, Z501 (rehabilitation)	–0.0331	0.0068	0.000	–0.0307	0.0065	0.000	–0.0125	0.0057	0.028	–0.0114	0.0053	0.031
95	Cerebrovascular diseases	I62, I65-I68	–0.0363	0.0105	0.001	–0.0337	0.0101	0.001	–0.0215	0.0097	0.027	–0.0200	0.0092	0.029
96	Sequelae of cerebrovascular disease	I69	–0.0458	0.0099	0.000	–0.0429	0.0096	0.000	–0.0139	0.0076	0.067	–0.0127	0.0071	0.071
97	Atherosclerosis	I70	–0.0308	0.0101	0.002	–0.0285	0.0096	0.003	–0.0164	0.0078	0.034	–0.0151	0.0073	0.037
98	Aortic aneurysm and aortic dissection	I71	–0.0378	0.0140	0.007	–0.0354	0.0136	0.009	–0.0247	0.0112	0.028	–0.0228	0.0106	0.032

(continued)

Table 4 (continued)

No.	Name of Chronic Conditions	ICD-10 Code	Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
			ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
99	Diseases of arteries, arterioles, and capillaries	I72, I74, I77-I79	–0.0075	0.0099	0.45	–0.0065	0.0092	0.47	0.0042	0.0069	0.54	0.0039	0.0062	0.53
100	Other peripheral vascular diseases	I73	–0.0422	0.0089	0.000	–0.0394	0.0086	0.000	–0.0291	0.0076	0.000	–0.0271	0.0073	0.000
101	Phlebitis, thrombosis of the portal vein, and others	I80-I82	–0.0175	0.0070	0.013	–0.0158	0.0066	0.016	–0.0075	0.0055	0.177	–0.0067	0.0051	0.187
102	Varicose veins of lower extremities	I83	0.0046	0.0049	0.35	0.0046	0.0045	0.30	0.0068	0.0041	0.098	0.0063	0.0038	0.093
103	Hemorrhoids[b]	I84	–0.0147	0.0040	0.000	–0.0133	0.0038	0.000	–0.0062	0.0032	0.056	–0.0058	0.0030	0.054
104	Esophageal varices (chronic), varicose veins of other sites, other disorders of veins, nonspecific lymphadenitis, other noninfective disorders of lymphatic vessels and lymph nodes and other, and unspecified disorders of the circulatory system	I85-I99, except I89 and I95	–0.0115	0.0117	0.33	–0.0103	0.0110	0.35	0.0008	0.0086	0.930	0.0008	0.0079	0.92
105	Respiratory allergy[b]	J30, except J30.0	–0.0087	0.0018	0.000	–0.0076	0.0016	0.000	–0.0038	0.0014	0.006	–0.0034	0.0013	0.008
105A	Chronic lower respiratory diseases[b]	J40-J43, J47	–0.0136	0.0027	0.000	–0.0122	0.0025	0.000	–0.0026	0.0022	0.227	–0.0023	0.0020	0.24
106	Bronchitis, not specified as acute or chronic, simple and mucopurulent chronic bronchitis, and unspecified chronic bronchitis	J40-J42	–0.0233	0.0117	0.046	–0.0214	0.0111	0.053	–0.0067	0.0097	0.49	–0.0062	0.0089	0.49
107	Emphysema	J43	–0.0208	0.0181	0.25	–0.0190	0.0171	0.27	0.0008	0.0178	0.96	0.0010	0.0162	0.95
108	Chronic obstructive lung disease (COPD)[b]	J44, J96, J13-J18	–0.0309	0.0036	0.000	–0.0286	0.0035	0.000	–0.0069	0.0028	0.014	–0.0062	0.0026	0.018
109	Asthma, status asthmaticus[b]	J45-J46	–0.0152	0.0030	0.000	–0.0137	0.0028	0.000	–0.0046	0.0024	0.057	–0.0041	0.0022	0.064
110	Bronchiectasis	J47	0.0266	0.0175	0.129	0.0245	0.0155	0.114	0.0236	0.0115	0.041	0.0214	0.0101	0.035
111	Other diseases of the respiratory system	J60-J84; J95, J97-J99	–0.0235	0.0103	0.023	–0.0215	0.0098	0.028	–0.0010	0.0077	0.90	–0.0008	0.0070	0.91

(continued)

Table 4 (continued)

			Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
No.	Name of Chronic Conditions	ICD-10 Code	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
112	Ulcers[b]	K25-K27	–0.0377	0.0034	0.000	–0.0351	0.0032	0.000	–0.0171	0.0027	0.000	–0.0158	0.0026	0.000
113	Inguinal hernia	K40	–0.0066	0.0052	0.20	–0.0057	0.0048	0.24	–0.0063	0.0047	0.177	–0.0056	0.0043	0.192
114	Ventral hernia	K43	–0.0168	0.0128	0.188	–0.0153	0.0119	0.20	0.0081	0.0097	0.40	0.0073	0.0087	0.40
115	Crohn's diease	K50	–0.0357	0.0098	0.000	–0.0333	0.0094	0.000	–0.0217	0.0086	0.012	–0.0200	0.0081	0.014
116	Ulcerative colitis	K51	–0.0255	0.0071	0.000	–0.0234	0.0067	0.001	–0.0092	0.0059	0.122	–0.0084	0.0055	0.127
117	Other noninfective gastroenteritis and colitis	K52	–0.0213	0.0093	0.022	–0.0195	0.0088	0.027	–0.0042	0.0074	0.57	–0.0038	0.0068	0.58
118	Irritable bowel syndrome (IBS)	K58	–0.0200	0.0054	0.000	–0.0182	0.0051	0.000	–0.0089	0.0044	0.046	–0.0080	0.0041	0.052
119	Other functional intestinal disorders	K59	–0.0262	0.0063	0.000	–0.0241	0.0060	0.000	–0.0130	0.0053	0.014	–0.0120	0.0049	0.015
120	Diseases of liver, biliary tract, and pancreas	K71-K77; K86-K87	–0.0365	0.0091	0.000	–0.0340	0.0087	0.000	–0.0207	0.0071	0.003	–0.0191	0.0066	0.004
121	Psoriasis[b]	L40	–0.0147	0.0048	0.002	–0.0132	0.0044	0.003	–0.0017	0.0038	0.66	–0.0016	0.0035	0.65
122	Infectious arthropathies	M01-M03	–0.0209	0.0121	0.085	–0.0191	0.0114	0.095	–0.0113	0.0118	0.34	–0.0104	0.0109	0.342
123	Rheumatoid arthritis[b]	M05, M06, M07.1, M07.2, M07.3, M08, M09	–0.0484	0.0052	0.000	–0.0455	0.0050	0.000	–0.0269	0.0046	0.000	–0.0250	0.0044	0.000
124	Inflammatory polyarthropathies, except rheumatoid arthritis[b]	M074–M079, M10–M14, M45	–0.0324	0.0043	0.000	–0.0300	0.0041	0.000	–0.0152	0.0036	0.000	–0.0140	0.0034	0.000
125	Polyarthrosis [arthrosis]	M15	–0.0359	0.0114	0.002	–0.0334	0.0109	0.002	–0.0272	0.0106	0.011	–0.0254	0.0100	0.012
126	Coxarthrosis [arthrosis of hip]	M16	–0.0404	0.0045	0.000	–0.0378	0.0043	0.000	–0.0272	0.0038	0.000	–0.0253	0.0036	0.000
127	Gonarthrosis [arthrosis of knee]	M17	–0.0392	0.0031	0.000	–0.0365	0.0029	0.000	–0.0276	0.0027	0.000	–0.0256	0.0026	0.000
128	Arthrosis of first carpometacarpal joint and other arthrosis	M18-M19	–0.0336	0.0046	0.000	–0.0312	0.0044	0.000	–0.0183	0.0038	0.000	–0.0169	0.0036	0.000
129	Acquired deformities of fingers and toes	M20	–0.0080	0.0049	0.106	–0.0070	0.0046	0.128	–0.0076	0.0044	0.085	–0.0069	0.0041	0.092
130	Other acquired deformities of limbs	M21	–0.0319	0.0083	0.000	–0.0295	0.0079	0.000	–0.0166	0.0069	0.017	–0.0153	0.0065	0.018
131	Disorders of patella (kneecap)	M22	–0.0290	0.0057	0.000	–0.0268	0.0054	0.000	–0.0153	0.0047	0.001	–0.0142	0.0044	0.001
132	Internal derangement of knee	M230, M231, M233, M235, M236, M238	–0.0459	0.0115	0.000	–0.0429	0.0111	0.000	–0.0354	0.0096	0.000	–0.0332	0.0092	0.000

(continued)

Table 4 (continued)

No.	Name of Chronic Conditions	ICD-10 Code	Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
			ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
133	Derangement of meniscus due to old tear or injury	M232	–0.0145	0.0058	0.012	–0.0131	0.0054	0.015	–0.0116	0.0051	0.022	–0.0106	0.0047	0.024
134	Internal derangement of knee, unspecified	M239	–0.0319	0.0063	0.000	–0.0298	0.0061	0.000	–0.0262	0.0058	0.000	–0.0242	0.0055	0.000
135	Other specific joint derangements	M24, except M240-M241	–0.0615	0.0237	0.010	–0.0582	0.0234	0.013	–0.0390	0.0199	0.050	–0.0364	0.0191	0.057
136	Other joint disorders, not elsewhere classified	M25	–0.0563	0.0090	0.000	–0.0531	0.0088	0.000	–0.0407	0.0079	0.000	–0.0381	0.0076	0.000
137	Systemic connective tissue disorders	M30-M36, except M32, M34	–0.0259	0.0065	0.000	–0.0238	0.0061	0.000	–0.0086	0.0053	0.100	–0.0079	0.0049	0.106
138	Systemic lupus erythematosus	M32	0.0025	0.0144	0.864	0.0020	0.0131	0.88	0.0080	0.0136	0.56	0.0070	0.0123	0.57
139	Dermatopolymyositis	M33	0.0002	0.0604	1.0	0.0004	0.0567	1.0	0.0217	0.0228	0.34	0.0199	0.0201	0.32
140	Systemic sclerosis	M34	–0.0405	0.0308	0.189	–0.0381	0.0290	0.189	–0.0341	0.0270	0.21	–0.0322	0.0256	0.21
141	Kyphosis, lordosis	M40	–0.0573	0.0196	0.003	–0.0542	0.0192	0.005	–0.0304	0.0156	0.051	–0.0282	0.0148	0.057
142	Scoliosis	M41	–0.0512	0.0107	0.000	–0.0481	0.0104	0.000	–0.0358	0.0100	0.000	–0.0334	0.0095	0.001
143	Spinal osteochondrosis	M42	–0.0585	0.0190	0.002	–0.0551	0.0185	0.003	–0.0452	0.0167	0.007	–0.0426	0.0162	0.008
144	Other deforming dorsopathies	M43	–0.0560	0.0091	0.000	–0.0529	0.0089	0.000	–0.0403	0.0084	0.000	–0.0377	0.0080	0.000
145	Other inflammatory spondylopathies	M46	–0.0364	0.0242	0.132	–0.0338	0.0232	0.145	–0.0295	0.0195	0.131	–0.0274	0.0185	0.140
146	Spondylosis	M47	–0.0638	0.0055	0.000	–0.0604	0.0054	0.000	–0.0362	0.0049	0.000	–0.0339	0.0046	0.000
147	Other spondylopathies and spondylopathies in diseases classified elsewhere	M48, M49	–0.0387	0.0074	0.000	–0.0361	0.0072	0.000	–0.0238	0.0066	0.000	–0.0220	0.0062	0.000
148	Cervical disc disorders	M50	–0.0488	0.0123	0.000	–0.0459	0.0119	0.000	–0.0242	0.0110	0.029	–0.0224	0.0104	0.032
149	Other intervertebral disc disorders	M51	–0.0704	0.0081	0.000	–0.0668	0.0080	0.000	–0.0440	0.0072	0.000	–0.0413	0.0070	0.000
150	Other dorsopathies, not elsewhere classified	M53	–0.0808	0.0191	0.000	–0.0773	0.0191	0.000	–0.0481	0.0138	0.001	–0.0452	0.0134	0.001
151	Dorsalgia	M54	–0.0901	0.0066	0.000	–0.0865	0.0066	0.000	–0.0609	0.0063	0.000	–0.0578	0.0062	0.000
152	Soft tissue disorders	M60-M63, except M60.0	–0.0350	0.0110	0.002	–0.0324	0.0105	0.002	–0.0161	0.0093	0.084	–0.0150	0.0087	0.086
153	Synovitis and tenosynovitis	M65	–0.0220	0.0076	0.004	–0.0201	0.0072	0.005	–0.0185	0.0069	0.008	–0.0172	0.0065	0.008
154	Disorders of synovium and tendon	M66-68	–0.0279	0.0083	0.001	–0.0259	0.0079	0.001	–0.0136	0.0074	0.068	–0.0124	0.0069	0.075

(continued)

Table 4 (continued)

No.	Name of Chronic Conditions	ICD-10 Code	Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
			ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
155	Soft tissue disorders related to use, overuse, and pressure	M70	–0.0440	0.0107	0.000	–0.0412	0.0103	0.000	–0.0266	0.0084	0.002	–0.0246	0.0080	0.002
156	Fibroblastic disorders	M72	–0.0064	0.0054	0.24	–0.0055	0.0050	0.27	–0.0034	0.0046	0.46	–0.0032	0.0042	0.45
157	Shoulder lesions	M75	–0.0462	0.0044	0.000	–0.0433	0.0042	0.000	–0.0303	0.0038	0.000	–0.0283	0.0036	0.000
158	Enthesopathies of lower limb, excluding foot	M76	–0.0396	0.0131	0.003	–0.0369	0.0126	0.003	–0.0188	0.0117	0.108	–0.0173	0.0109	0.112
159	Other enthesopathies	M77	–0.0623	0.0106	0.000	–0.0589	0.0104	0.000	–0.0330	0.0091	0.000	–0.0310	0.0087	0.000
160	Rheumatism, unspecified	M790	–0.0815	0.0184	0.000	–0.0781	0.0184	0.000	–0.0436	0.0161	0.007	–0.0409	0.0155	0.009
161	Myalgia	M791	–0.0331	0.0120	0.006	–0.0307	0.0114	0.007	–0.0250	0.0111	0.024	–0.0232	0.0105	0.027
162	Other soft tissue disorders, not elsewhere classified	M792- M794; M798-M799	–0.0343	0.0134	0.010	–0.0318	0.0128	0.013	–0.0241	0.0125	0.054	–0.0223	0.0118	0.059
163	Other soft tissue disorders, not elsewhere classified: pain in limb	M796	–0.0414	0.0083	0.000	–0.0387	0.0080	0.000	–0.0292	0.0072	0.000	–0.0272	0.0069	0.000
164	Fibromyalgia	M797	–0.0784	0.0363	0.031	–0.0747	0.0361	0.038	–0.0626	0.0287	0.029	–0.0595	0.0281	0.034
165	Osteoporosis[b]	M80–M81	–0.0282	0.0037	0.000	–0.0260	0.0035	0.000	–0.0163	0.0032	0.000	–0.0150	0.0030	0.000
166	Osteoporosis in diseases classified elsewhere	M82	0.0308	0.0211	0.145	0.0282	0.0186	0.130	0.0198	0.0215	0.36	0.0178	0.0189	0.35
167	Adult osteomalacia and other disorders of bone density and structure	M83, M85, except M833	–0.0194	0.0057	0.001	–0.0177	0.0054	0.001	–0.0072	0.0046	0.118	–0.0065	0.0042	0.126
168	Disorders of continuity of bone	M84	–0.0302	0.0288	0.29	–0.0279	0.0275	0.31	–0.0154	0.0242	0.52	–0.0141	0.0225	0.53
169	Other osteopathies	M86-M90	–0.0275	0.0090	0.002	–0.0253	0.0086	0.003	–0.0103	0.0088	0.24	–0.0094	0.0081	0.25
170	Other disorders of the musculoskeletal system and connective tissue	M95-M99	–0.0292	0.0084	0.001	–0.0270	0.0079	0.001	–0.0123	0.0073	0.093	–0.0113	0.0068	0.096
171	Chronic renal failure (CRF)[b]	N18	–0.0158	0.0104	0.129	–0.0143	0.0097	0.142	–0.0016	0.0097	0.87	–0.0013	0.0089	0.88
172	Congenital malformations: of the nervous, circulatory, respiratory system; cleft palate and cleft lip; urinary tract; bones and muscles; other and chromosomal abnormalities not elsewhere classified	Q00-Q07; Q20-Q37; Q60-Q99	–0.0138	0.0046	0.003	–0.0124	0.0043	0.004	–0.0060	0.0040	0.135	–0.0055	0.0037	0.138

(continued)

Table 4 (continued)

No.	Name of Chronic Conditions	ICD-10 Code	Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
			ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
173	Congenital malformations of eye, ear, face, and neck	Q10-Q18	–0.0172	0.0076	0.024	–0.0157	0.0072	0.029	0.0006	0.0059	0.92	0.0007	0.0054	0.90
174	Other congenital malformations of the digestive system	Q38-Q45	–0.0150	0.0146	0.31	–0.0136	0.0138	0.33	–0.0052	0.0121	0.67	–0.0048	0.0112	0.67
175	Congenital malformations of the sexual organs	Q50-Q56	–0.0134	0.0091	0.139	–0.0121	0.0085	0.155	–0.0031	0.0070	0.66	–0.0027	0.0064	0.67
176	Dementia[b]	F00, G30, F01, F02.0, F03.9, G31.8B, G31.8E, G31.9, G31.0B	–0.0894	0.0378	0.018	–0.0858	0.0380	0.024	–0.0138	0.0173	0.43	–0.0128	0.0161	0.43
177	Organic, including symptomatic, mental disorders	F04-F09	–0.0354	0.0206	0.087	–0.0329	0.0199	0.098	–0.0132	0.0121	0.27	–0.0121	0.0112	0.28
178	Mental and behavioral disorders due to use of alcohol	F10	–0.0398	0.0084	0.000	–0.0371	0.0080	0.000	–0.0126	0.0071	0.076	–0.0116	0.0066	0.081
179	Mental and behavioral disorders due to psychoactive substance use	F11-F19	–0.0255	0.0077	0.001	–0.0234	0.0073	0.001	–0.0012	0.0055	0.82	–0.0012	0.0051	0.81
180	Schizophrenia[b]	F20	–0.0499	0.0129	0.000	–0.0468	0.0125	0.000	–0.0175	0.0110	0.113	–0.0162	0.0103	0.115
181	Schizotypal and delusional disorders	F21-F29.	0.0074	0.0111	0.51	0.0072	0.0102	0.48	0.0236	0.0071	0.001	0.0213	0.0062	0.001
182	Bipolar affective disorder[b]	F30-F31	–0.0246	0.0169	0.146	–0.0226	0.0161	0.160	–0.0072	0.0125	0.57	–0.0064	0.0115	0.58
183	Depression[b]	F32, F33, F34.1, F06.32	–0.0857	0.0029	0.000	–0.0821	0.0028	0.000	–0.0464	0.0024	0.000	–0.0436	0.0023	0.000
184	Mood (affective) disorders	F340, F348-F349, F38-F39	–0.0194	0.0263	0.46	–0.0182	0.0252	0.47	0.0101	0.0160	0.53	0.0095	0.0144	0.51
185	Phobic anxiety disorders	F40	–0.0595	0.0189	0.002	–0.0563	0.0186	0.002	–0.0283	0.0154	0.066	–0.0263	0.0146	0.071
186	Other anxiety disorders	F41	–0.0306	0.0097	0.002	–0.0283	0.0092	0.002	–0.0055	0.0080	0.49	–0.0052	0.0073	0.48
187	Obsessive compulsive disorder (OCD)[b]	F42	–0.0309	0.0176	0.080	–0.0286	0.0169	0.090	–0.0150	0.0136	0.270	–0.0137	0.0127	0.283
188	Posttraumatic stress disorder	F431	–0.0987	0.0269	0.000	–0.0948	0.0270	0.000	–0.0435	0.0280	0.121	–0.0408	0.0271	0.132
189	Reactions to severe stress and adjustment disorders	F432-F439	–0.0262	0.0078	0.001	–0.0241	0.0074	0.001	0.0025	0.0055	0.66	0.0023	0.0050	0.65

(continued)

Table 4 (continued)

			Average MEs of Disease Populations											
			ALDVMM: Base Model						ALDVMM: Full Model					
			Male			Female			Male			Female		
No.	Name of Chronic Conditions	ICD-10 Code	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value	ME	SE	*P* Value
190	Dissociative (conversion) disorders, somatoform disorders, and other neurotic disorders	F44, F45, F48	–0.0254	0.0113	0.025	–0.0233	0.0107	0.029	–0.0233	0.0099	0.018	–0.0216	0.0093	0.020
191	Eating disorders	F50	–0.0025	0.0153	0.87	–0.0020	0.0140	0.89	0.0071	0.0107	0.51	0.0063	0.0097	0.52
192	Behavioral syndromes associated with physiological disturbances and physical factors	F51-F59	–0.0199	0.0161	0.22	–0.0185	0.0153	0.228	–0.0067	0.0162	0.68	–0.0058	0.0150	0.70
193	Emotionally unstable personality disorder	F603	–0.0534	0.0170	0.002	–0.0505	0.0167	0.003	–0.0079	0.0116	0.50	–0.0070	0.0107	0.51
194	Specific personality disorders	F602, F604-F609	–0.0462	0.0083	0.000	–0.0432	0.0081	0.000	–0.0173	0.0066	0.009	–0.0160	0.0062	0.010
195	Disorders of adult personality and behavior	F61-F69	–0.0105	0.0154	0.50	–0.0093	0.0143	0.52	0.0030	0.0100	0.77	0.0028	0.0091	0.76
196	Mental retardation	F70-F79	0.0001	0.0282	1.0	0.0004	0.0257	0.99	0.0061	0.0207	0.77	0.0057	0.0188	0.76
197	Disorders of psychological development	F80-F89	–0.0390	0.0200	0.051	–0.0363	0.0192	0.059	–0.0086	0.0150	0.57	–0.0078	0.0138	0.57
198	Hyperkinetic disorders (ADHD)[b]	F90	–0.0524	0.0103	0.000	–0.0493	0.0101	0.000	–0.0159	0.0081	0.048	–0.0145	0.0075	0.055
199	Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	F91-F99	–0.0138	0.0101	0.170	–0.0124	0.0094	0.188	–0.0038	0.0077	0.62	–0.0034	0.0071	0.63

ADHD, attention-deficit/hyperactivity disorder; ALDVMM, adjusted limited dependent mixture model; AMI, acute myocardial infarction; ICD-10, International Classification of Diseases, 10th revision; n/a, not available; SE, Standard Error. Conditions marked with "A" are overlapping other conditions, usually due to complex register definition.

[a] $N = 55{,}616$ in all models. Other types of MEs can be predicted using the provided Stata .Ster files in the Supplemental Material 2.

[b] Complex defined conditions.

Table 5 EQ-5D-3L Regression Marginal Effects (MEs) for the Socioeconomic Variables and Health Risks of the Base and Full Model: Example of MEs Based on a Representative 50-y-Old[a]

	Average MEs of Disease Populations											
	ALDVMM: Base Model						ALDVMM: Full Model					
Variables	**Male ME**	**SE**	***P* Value**	**Female ME**	**SE**	***P* Value**	**Male ME**	**SE**	***P* Value**	**Female ME**	**SE**	***P* Value**
Denmark sample (base)	—	—	—	—	—	—	—	—	—	—	—	—
North Denmark Region (samples 2–3)	–0.0037	0.0011	0.001	–0.0034	0.0010	0.001	–0.0018	0.0009	0.055	–0.0017	0.0009	0.048
Specific ages, y (dydx)[b]												
16	0.0004	0.0001	0.003	0.0003	0.0001	0.006	0.0008	0.0003	0.016	0.0008	0.0003	0.010
20	0.0002	0.0001	0.031	0.0002	0.0001	0.052	0.0004	0.0002	0.079	0.0004	0.0002	0.046
25	0.0001	0.0001	0.41	0.0000	0.0001	0.53	0.0000	0.0001	0.80	0.0001	0.0001	0.52
30	–0.0001	0.0001	0.34	–0.0001	0.0001	0.26	–0.0002	0.0001	0.045	–0.0001	0.0001	0.137
35	–0.0002	0.0001	0.001	–0.0002	0.0000	0.000	–0.0003	0.0001	0.000	–0.0003	0.0001	0.000
40	–0.0003	0.0000	0.000	–0.0003	0.0000	0.000	–0.0004	0.0001	0.000	–0.0003	0.0000	0.000
45	–0.0004	0.0000	0.000	–0.0004	0.0000	0.000	–0.0004	0.0000	0.000	–0.0004	0.0000	0.000
50	–0.0005	0.0000	0.000	–0.0004	0.0000	0.000	–0.0005	0.0000	0.000	–0.0004	0.0000	0.000
55	–0.0006	0.0000	0.000	–0.0005	0.0000	0.000	–0.0005	0.0000	0.000	–0.0004	0.0000	0.000
60	–0.0007	0.0001	0.000	–0.0006	0.0001	0.000	–0.0005	0.0001	0.000	–0.0005	0.0001	0.000
65	–0.0008	0.0001	0.000	–0.0007	0.0001	0.000	–0.0006	0.0001	0.000	–0.0005	0.0001	0.000
70	–0.0009	0.0001	0.000	–0.0008	0.0001	0.000	–0.0007	0.0001	0.000	–0.0006	0.0001	0.000
75	–0.0010	0.0001	0.000	–0.0010	0.0001	0.000	–0.0008	0.0001	0.000	–0.0008	0.0001	0.000
80	–0.0012	0.0001	0.000	–0.0011	0.0001	0.000	–0.0011	0.0002	0.000	–0.0011	0.0002	0.000
85	–0.0014	0.0002	0.000	–0.0013	0.0002	0.000	–0.0015	0.0003	0.000	–0.0014	0.0003	0.000
Education (base = no education/ training)							—	—	—	—	—	—
Students or in training							0.0071	0.0022	0.001	0.0066	0.0020	0.001
Short education							0.0032	0.0011	0.003	0.0030	0.0010	0.003
Middle education (bachelor, etc.)							0.0094	0.0014	0.000	0.0087	0.0013	0.000
High education (master's degree or higher)							0.0158	0.0018	0.000	0.0145	0.0017	0.000
Missing							–0.0239	0.0105	0.023	–0.0224	0.0098	0.023
Ethnicity (base = Danish)							—	—	—	—	—	—
Other Western							–0.0168	0.0033	0.000	–0.0156	0.0031	0.000
Non-Western							–0.0186	0.0038	0.000	–0.0176	0.0036	0.000
Family equalized income quartiles (dydx)												
0.20 (25%)							0.0012	0.0004	0.001	0.0011	0.0003	0.001
0.26 (50%)							0.0011	0.0003	0.001	0.0011	0.0003	0.001
0.33 (75%)							0.0011	0.0003	0.001	0.0010	0.0003	0.001
Partnership (base = having a partner)							—	—	—	—	—	—
Not married/not in a relationship							–0.0018	0.0009	0.030	–0.0017	0.0008	0.035

(continued)

Table 5 (continued)

Variables	Average MEs of Disease Populations											
	ALDVMM: Base Model						ALDVMM: Full Model					
	Male ME	SE	*P* Value	Female ME	SE	*P* Value	Male ME	SE	*P* Value	Female ME	SE	*P* Value
Children home (base = no children living home)							—	—	—	—	—	—
Having children living home under 15 y							0.0018	0.0011	0.095	0.0016	0.0010	0.111
Missing							–0.0073	0.0040	0.069	–0.0068	0.0037	0.067
Social network – loneliness (base = not lonely or seldom lonely)							—	—	—	—	—	—
Often lonely							–0.0337	0.0029	0.000	–0.0317	0.0028	0.000
Missing							0.0032	0.0040	0.42	0.0028	0.0037	0.45
Stress – Cohens Perceived Stress Scale (base = 80% least stressed)							—	—	—	—	—	—
20% most stressed (=cutpoint 18)							–0.0967	0.0017	0.000	–0.0934	0.0018	0.000
Missing							–0.0094	0.0026	0.000	–0.0089	0.0024	0.000
Body mass index, kg/m^2 (base = BMI 18.5–25)							—	—	—	—	—	—
>18.5							–0.0061	0.0033	0.064	–0.0057	0.0030	0.058
>25 <30							–0.0058	0.0010	0.000	–0.0052	0.0009	0.000
≤30 < 35							–0.0153	0.0016	0.000	–0.0141	0.0014	0.000
≤35							–0.0321	0.0028	0.000	–0.0299	0.0026	0.000
Missing							–0.0051	0.0030	0.087	–0.0047	0.0027	0.091
Daily smoke (base = do not smoke daily)							—	—	—	—	—	—
Smoking daily							–0.0094	0.0012	0.000	–0.0086	0.0012	0.000
Missing							0.0054	0.0036	0.136	0.0049	0.0033	0.140
Alcohol intake (base = do not exceed National Board of Health's recommendations)							—	—	—	—	—	—
Exceed recommendation with more than 7 drinks/wk for women or 14 drinks/wk for men							–0.0090	0.0016	0.000	–0.0083	0.0015	0.000
Missing							0.0007	0.0017	0.68	0.0006	0.0015	0.69
Exercise (base = exercise at least 4?h a week)							—	—	—	—	—	—
Do not exercise during the week							–0.0216	0.0015	0.000	–0.0202	0.0014	0.000
Missing							–0.0033	0.0032	0.301	–0.0034	0.0029	0.253
Fruit intake (base = do not meet National Board of Health's recommendations)							—	—	—	—	—	—

(continued)

Table 5 (continued)

Variables	Average MEs of Disease Populations											
	ALDVMM: Base Model						ALDVMM: Full Model					
	Male ME	SE	*P* Value	Female ME	SE	*P* Value	Male ME	SE	*P* Value	Female ME	SE	*P* Value
5 or more portions of fruit a day as recommended							0.0026	0.0017	0.111	0.0023	0.0015	0.126
Missing							0.0054	0.0031	0.089	0.0050	0.0029	0.082
SF-12 General Health (self-reported, base = good)												
Excellent							0.0073	0.0008	0.0000	0.0071	0.0007	0.0000
Very Good							0.0069	0.0007	0.0000	0.0067	0.0007	0.0000
Good (base)							—	—	—	—	—	—
Fair							–0.0588	0.0047	0.0000	–0.0572	0.0045	0.0000
Poor							–0.1641	0.0095	0.0000	–0.1577	0.0089	0.0000
Missing							–0.0131	0.0037	0.0004	–0.0129	0.0036	0.0004
Long-term illness or disability (self-reported)												
No long-term illness (base)							—	—	—	—	—	—
Long-term illness							–0.0348	0.0032	0.0000	–0.0340	0.0030	0.0000
Missing							–0.0135	0.0029	0.0000	–0.0132	0.0028	0.0000

ALDVMM, Adjusted Limited Dependent Mixture Model; ICD-10, International Classification of Diseases, 10th Revision, n/a, not available; SE, Standard Error.

[a] $N = 55{,}616$ in all models.

[b] The marginal effects are calculated at each age point illustrated in the table maintaining the rest of the representative individual characteristics. They represent the expected change in EQ-5D-3L for individuals of the specified age as age increases. For example, for a 40-y-old, EQ-5D-3L is expected to decrease by 0.0003 after 1 y, whereas the expected decrease after 1 y for a 60-y-old would be 0.0007.

Table 6 Predicting EQ-5D-3L for a Hypothetical Example

	No Other Comorbidities	Three Additional Comorbidities[a]
Baseline: type 2 diabetes and hypertension	0.870	0.769
Year 1: age increase	0.869	0.769
Year 2: age increase	0.869	0.769
Year 3: age increase and heart failure	0.834	0.731
Year 4: age increase	0.833	0.731
Year 5: age increase	0.833	0.730

[a]Additional comorbidities are disturbances in lipoprotein circulation and other lipids, respiratory allergy, and depression.

Table 6, column 1), but if the population of type 2 diabetes tends to also have other comorbidities, then the utility estimates presented in column 1 would be too high. Table 2 shows that the average number of comorbidities in the type 2 diabetes group is 5.8, confirming that the utilities reported in column 1 are unlikely to be representative of this group. Furthermore, the mean utility for the Danish type 2 diabetes group is reported in that same table at 0.752, which is much lower than the 0.870 mean utility calculated for our sample with no additional comorbidities. Table S5 in the Supplementary Material of Hvidberg et al.[66] provides the prevalence of other chronic conditions within each of the 199 chronic diseases, which can be used to select the comorbidities that are most likely to be seen in the population of type 2 diabetes. We find that disturbances in lipoprotein circulation and other lipids, respiratory allergy, and depression are quite prevalent among the population with type 2 diabetes (71.6%, 24.7%, and 17.3%, respectively). Thus, analysts could use this information to construct predictions for more representative populations and use them for sensitivity analyses.

We give a simple alternative example in column 3 of Table 6. We assume that those 3 chronic conditions are present in all individuals in the sample. Using the provided example Stata .do file in Supplemental Material 2, the model predicts an average EQ-5D-3L of 0.922 for the sample with no chronic conditions and this age and sex distribution. The mean predicted EQ-5D-3L scores at baseline for the sample with type 2 diabetes and hypertension decreases from 0.870 to 0.769 when we assume 3 additional comorbidities. One year later, as the age of the sample increases, the average expected EQ-5D-3L decreases to 0.869 and 0.769 for the no and 3 additional comorbidities, respectively. Three years after baseline, the combined effect of heart failure and the increase in age reduces average predicted EQ-5D-3L to 0.834 and 0.731. These average predicted EQ-5D-3L values would then be discounted and used to construct QALYs. For a more detailed, technical guide on how to use the regression estimates, see the full guide and documentation in online Supplementary Material 2.

Discussion

This catalog presents a comprehensive list of EQ-5D-3L scores for 199 chronic conditions and health risks based on Danish preference weights and a national representative sample of 55,616 respondents. The results revealed that EQ-5D-3L scores, on average, are lowest for genitourinary disease, mental and behavioral disorders, benign neoplasm and diseases of the blood, diseases in the digestive system, and the nervous system, while they are higher for the more prevalent diseases. However, there was considerable variation within and between groups. Lifestyle and health risks strongly correlate with EQ-5D-3L scores by their large, significant estimates of marginal disutility. Particularly, perceived stress, loneliness, and high BMIs were important.

This study has some limitations. First, the EQ-5D might be less sensitive to milder diseases,[12,67–70] a case that can be exacerbated by applying the EQ-5D-3L version instead of the EQ-5D-5L that has been developed after this study began. Second, a few estimates of disutility had positive values. There were 14 chronic conditions in the base model with small disutility values above zero for a representative 50-y-old male/female. Nevertheless, 13 of those 14 were not statistically significant, and only hemolytic anemias (D55-D59) were significant at a 10% significance level. The same pattern can be seen in the full model, although the number of positive and insignificant coefficients increases with the additional control variables. This is most likely the effect of the correlation patterns between socioeconomic variables and chronic diseases. Thus, all conditions, including those associated with positive values, were kept in the models given their small number and statistical insignificance, as their exclusion could unintendedly suppress combined effects. EQ-5D-3L sensitivity limitations could also explain positive values, or, underlined, some conditions might be truly less severe and not have a large effect on HRQoL in general.

Third, some register-based definitions might be less sensitive to less severe conditions, as the doctor reported that ICD-10 discharge codes are based on hospital-treated patients and, thus, more severely ill patients.

Fourth, we cannot exclude that the timing of the survey affects the burden of some of the respondents' conditions, which could mean that the EQ-5D-3L score is either over- or underreported. The survey was conducted in the early spring, and, for example, respiratory allergies are mostly present during the summer. Similarly, some of the chronic conditions included could have been treated after respondents had completed surveys (e.g., some eye conditions, hernias, ulcers, and limbs can be partially or fully cured).

Fifth, although no exact gold standard exists for the sample size of individual conditions, 18 of nearly 200 conditions had frequencies with less than 50 respondents and should be interpreted cautiously. However, some diseases in nature are rare, and the number of observations will be relatively small in a general population data set. The only way to increase the number of observations would be to oversample that specific population and then arbitrarily combine utility estimates for individual chronic conditions calculated in different samples, an issue that we are trying to avoid.

Sixth, since our design is cross-sectional, we can make only weak assumptions regarding causality; therefore, the main focus is to describe associations between EQ-5D scores and covariates.

Seventh, although the possibility of measurement error in the covariates still exists, it has been minimized as far as possible because we do not rely on self-reports but use conditions reported by physicians.

Finally, the models include a large number of conditioning variables that can be used to predict a variety of subgroups. The downside of this is that the analyst might not have all the covariates available for prediction. In this case, reasonable assumptions about those variables could be made and the sensitivity of the results to those assumptions checked. We consider this a more transparent practice than assuming that the distribution of those covariates is the same in the general population and the trial population in which the predictions are to be made.

Regarding strengths, the current catalog of EQ-5D-3L preference scores differs from existing catalogs in several ways. First, it is the first ICD-10–based catalog and the first using conditions reported by physicians. Second, the study is based on a larger sample size and includes more conditions than existing catalogues. Third, the study also uses a regression model designed to deal appropriately with the distribution of the EQ-5D-3L. The ALDVMM model allows the average MEs to be a function of other included covariates (e.g., other comorbidities, age, and gender distribution). This feature is useful when predicting outside the population sample in which the model is estimated and to estimate the effect of combinations of comorbidities appropriately considering nonlinearities and interactions, without the need to combine separate estimates based on controversial methodology, as commonly done previously.[35–38] Finally, it includes 2 separate regression models: a base model, which controls for the age and gender distribution in the sample, which is useful for economic evaluations in which additional variables are not required, and a full model, which includes additional important controls.

Future research could investigate the potential of including different clinical severity levels of the conditions, for instance, in COPD or other conditions with well-described clinical severity levels. This would allow the calculation of EQ-5D scores of potential health gains for clinically defined mild health states. Moreover, even though there is no final agreement on defining and handling multimorbidity,[71–74] the importance is well documented.[35,66,63,75] Hence, common clusters of conditions, such as COPD and heart failure, could generate unique interaction effects, which is why research to identify such conditions is important. Likewise, interactions between conditions, socioeconomic factors, social factors, and health risks in a health equality view could be investigated further using the current catalog and, for example, using related research on the patterns of multimorbidity[66] and socioeconomic inequalities[62] of the 199 chronic conditions. This could help identify further complex, real-world, critical factors for treating individual conditions and improving the HRQoL of patients with chronic conditions.

Acknowledgments

We sincerely appreciate and thank the reviewers and editor for their valuable comments and suggestions in reviewing the work, which has significantly improved the quality of the article. The authors also thank specialists Ole Schou Rasmussen and Thomas Mulvad Larsen from the North Denmark Region, Denmark, for constructive suggestions and assistance with the comprehensive SAS programming for the chronic conditions.

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Data Availability Statement

All data are kept on a secure server at Statistics Denmark, and due to legal requirements, the micro data underlying the present study cannot be made freely available. However, the

estimated regression models are made freely available for analysts through Stata .do and .ster files. This will enable others not only to reproduce the results of the current study on legal aggregated level but also to predict EQ-5D-3L for any combination of health conditions

Supplemental Material

Supplementary material for this article is available on the *MDM Policy & Practice* website at https://journals.sagepub.com/home/mpp.

Notes

i. A third model including similar covariates to those in by Sullivan et al.,[12,13] but fewer than the full model, was also estimated. The model fits better than the base model but worse that the full model, and thus, it is not reported in this article but can be obtained from the authors on request.

ii. An additional table is included in the online Appendix 2, which presents an overview of the EQ-5D-3L sample average scores across the 20 overall chronic disease groups and prescribed medicines separated by gender and age groups.

iii. Parameter estimates and covariance matrices of the 2 models are provided in the Supplemental Material as Excel files.

iv. Appendices 3 and 4 in the online Supplementary Material 1 provide the average estimated utilities instead of the disutilities for the same representative individuals. In addition, Appendices 5 and 6 provides sample transparency and basic off-the-shelf sample and distribution estimates of all chronic conditions by including frequencies for each of the 5 dimensions and all 3 response categories of the EQ-5D-3L. This will enable modelers, researchers, and health care professionals to obtain, use, communicate, and present the full and underlying EQ-5D response details of a selected chronic condition of interest. Furthermore, estimates of socioeconomic differences provide potential health improvements and have become increasingly important to public health assessments, interventions, health care decision makers, researchers, and the industry.[62–65] Hence, Appendix 7 presents easily accessible off-the-shelf health inequality EQ-5D-3L sample mean scores of subgroups from educational, income, socioeconomic, gender, age, BMI, and regional variables, across the chronic conditions and covariates.

v. The online Supplemental Material provides Stata programs and documentation that allow for calculations for different age groups.

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