Age- and sex-specific Canadian utility norms, based on the 2013–2014 Canadian Community Health Survey

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ABSTRACT

BACKGROUND: Although many Canadian studies have provided disease-specific or patient group–specific utility scores, the utility score norms currently available for the general Canadian population are outdated. Canadian guideline recommendations for the economic evaluation of health technologies advocate for utilities reflecting those of the general population and for stratified analyses when results are heterogeneous; as such, there is also a need for age-, sex- and jurisdiction-specific utility score norms.

METHODS: We used data from the 2013–2014 Canadian Community Health Survey. We used the Health Utilities Index Mark 3 to calculate utility scores. We estimated means (with 95% confidence intervals [CIs]) and medians (with interquartile ranges [IQRs]) for utility scores. In addition to Canadian-level measures, we stratified all utility score norms by respondents’ age, sex, and province or territory of residence. We weighted respondents’ answers and computed 95% CIs using sampling weights and bootstrap weights provided by Statistics Canada to extrapolate the study findings to the Canadian population.

RESULTS: Respondents to the 2013–2014 Canadian Community Health Survey represented 30,014,589 community-dwelling Canadians 12 years of age and older (98% of the Canadian population); half of the respondents were female (50.6%), and the weighted average age was 44.8 (95% CI 44.7–44.9) years. The mean and median self-reported utility scores for Canadians were estimated at 0.863 (95% CI 0.861–0.865) and 0.927 (IQR 0.838–0.972), respectively.

INTERPRETATION: This study provides utility score norms for several age-, sex- and jurisdiction-specific strata in Canada. These results will be useful for future cost–utility analyses and could serve as benchmark values for comparisons with future studies.
utility score inputs than what is currently available to produce age- or sex-stratified analyses at the provincial or territorial level.

One way of obtaining Canadian and stratum-specific utility score norms is to examine the utility score measures obtained through use of a generic, multi-attribute health status classification system administered to a representative sample of the current Canadian population. One such system, the Health Utilities Index Mark 3 (generally referred to as the HUI3),17–19 has been administered to representative samples of the community-dwelling Canadian population within multiple versions of the Canadian Community Health Survey since its inception in 2002.20 However, utility score norms based on these data have yet to be produced. Therefore, using the most recently released Canadian Community Health Survey data, we aimed to produce age- and sex-specific Canadian, provincial and territorial utility score norms, which can be used to conduct Canadian economic evaluations, monitor the health-related quality of life of the Canadian population and interpret utility scores generated in various studies. Furthermore, because the Canadian Community Health Survey also examines respondents’ self-rated health, a metric that has been shown to predict morbidity and mortality,17 we also aimed to determine Canadian utility score norms corresponding to respondents’ self-rated health.

Methods

Survey design

For this study, we used 2-year combined data from the 2013–2014 Canadian Community Health Survey. A detailed description of this survey can be found elsewhere.18 Briefly, Statistics Canada selects a representative sample of the Canadian population living in the 10 provinces and 3 territories aged 12 years or older to whom the questionnaire is to be administered. Individuals living on Indian Reserves and on Crown lands, Canadian residents of institutions, full-time members of the Canadian Forces and residents of certain remote regions are excluded. Statistics Canada estimates that the Canadian Community Health Survey covers about 98% of the Canadian population.19 Interviews were conducted in person using computer-assisted personal interviewing or by phone using computer-assisted telephone interviewing.19

Health Utilities Index Mark 3

Respondents’ utility scores were assessed using the HUI3 instrument of the HUI system.20–22 The HUI3 combines a generic comprehensive health status classification system and a generic health-related quality-of-life utility scoring system. It examines 8 health attributes (i.e., vision, hearing, speech, ambulation, dexterity, emotion, cognition and pain/discomfort), with each attribute having 5 or 6 levels; the combination of the various attributes and their levels creates 972 000 unique health states. Utility scores for the HUI3 range from −0.36 to 1.00, with “perfect health” having a utility score of 1.00, “dead” having a utility score of 0.00 and “states worse than death” having utility scores less than 0.00. The minimum clinically important difference for the HUI3 has been estimated at 0.03.21,22 In population health applications, some analysts use a minimum clinically important difference of 0.01.23 Similar to respondents’ self-rated health,17 HUI3 scores have also been shown to be predictive of mortality and morbidity.24 In addition to providing utility scores reflective of Canadian community health preferences,21 it was the sole utility score instrument administered to respondents of the 2013–2014 Canadian Community Health Survey.25,26

Self-rated health

Respondents’ self-rated health was examined using an ordered categorical scale (i.e., excellent, very good, good, fair or poor).25,26

Statistical analysis

We used descriptive statistics to summarize the sociodemographic characteristics of respondents. We examined results at the national level, with further stratification by the province or territory in which respondents resided. To preserve confidentiality, respondents from the Yukon, Northwest Territories and Nunavut were grouped, whereas respondents from all other provinces were analyzed separately. We presented descriptive statistics as absolute and relative frequencies, with the exception of respondents’ age at the time of answering the survey, which we presented as the average age (with 95% confidence interval [CI]) within the Canadian and provincial or territorial populations and as the absolute and relative frequencies of mutually exclusive age categories.

For a small proportion of individuals, we could not estimate utility scores because they refused to answer key HUI3 questions; HUI3 data for these individuals were classified as missing, and they were excluded from the analysis. We used a multivariable logistic regression model that included all examined sociodemographic characteristics to identify predictors of nonresponse. We estimated utility scores from variables derived by Statistics Canada for those who completed the 30 HUI3 questions. In addition to the population-level norms, all utility scores were stratified by age (by 5-year increment), sex and jurisdiction (with our stratification approach creating 575 distinct strata). We then examined mean (95% CI) and median (interquartile range [IQR]) utility scores for all of the examined strata. In addition, we cross-tabulated utility scores and respondents’ self-rated health (excellent, very good, good, fair, poor).

We weighted all descriptive statistics to comply with Statistics Canada vetting rules; the sampling weights and bootstrapped weights used to estimate bootstrapped 95% CIs were provided by Statistics Canada and were used to extrapolate the results to the Canadian population covered by the Canadian Community Health Survey. We conducted all analyses with SAS version 9.3 software (SAS Institute Inc.), using survey-specific procedures (e.g., PROC SURVEYMEANS) when appropriate.

Ethics approval

We accessed the data through approved research data centres at McMaster University and Université Laval, following approval of the proposed research by Statistics Canada. All data were deidentified, and vetting procedures were applied to ensure confidentiality and protection of the respondents.
Sociodemographic characteristics of weighted sample

For the 2013–2014 Canadian Community Health Survey, 147,009 households agreed to participate in the survey, and 128,310 individuals responded (response rate of 87.3%). These respondents were weighted to represent a weighted sample of 30,014,589 Canadians (about 98% of the Canadian population). Table 1 provides the sociodemographic characteristics of these respondents, and Appendix 1 (available at www.cmaj.ca/lookup/suppl/doi:10.1503/cmaj.170317/-/DC1) provides the sociodemographic characteristics for each of the stratified jurisdictions. Just over half of the weighted sample were female (weighted frequency count 15,199,574 [50.6%]), and the average age in the weighted sample was estimated at 44.8 years.

| Variable | Weighted frequency† | | Relative, % (95% CI) |
|----------|---------------------|-----------------|
| Overall  | 30,014,589          | 100             |
| Sex      |                     |                 |
| Male     | 14,815,015          | 49.4 (49.4–49.4)|
| Female   | 15,199,574          | 50.6 (50.6–50.6)|
| Age, yr, mean (95% CI) | 44.8 (44.7–44.9) |
| Age group, yr | | |
| 12–19    | 3,180,697           | 10.6 (10.6–10.6)|
| 20–24    | 2,419,203           | 8.1 (7.8–8.3)   |
| 25–29    | 2,373,260           | 7.9 (7.7–8.1)   |
| 30–34    | 2,321,576           | 7.7 (7.4–8.0)   |
| 35–39    | 2,296,321           | 7.7 (7.4–7.9)   |
| 40–44    | 2,415,306           | 8.0 (7.8–8.3)   |
| 45–49    | 2,334,694           | 7.8 (7.4–8.2)   |
| 50–54    | 2,708,861           | 9.0 (8.7–9.4)   |
| 55–59    | 2,576,617           | 8.6 (8.3–8.9)   |
| 60–64    | 2,184,281           | 7.3 (6.9–7.6)   |
| 65–69    | 1,822,033           | 6.1 (5.9–6.2)   |
| 70–74    | 1,301,405           | 4.3 (4.2–4.5)   |
| 75–79    | 946,319             | 3.2 (3.0–3.3)   |
| 80–84    | 656,358             | 2.2 (2.1–2.3)   |
| ≥ 85     | 477,658             | 1.6 (1.5–1.7)   |
| Province or territory | | |
| British Columbia | 3,978,590       | 13.3 (13.3–13.3)|
| Alberta   | 3,358,681           | 11.2 (11.2–11.2)|
| Saskatchewan | 875,543             | 2.9 (2.9–2.9)   |
| Manitoba  | 1,018,598           | 3.4 (3.4–3.4)   |
| Ontario   | 11,682,112          | 38.9 (38.9–38.9)|
| Quebec    | 6,976,483           | 23.2 (23.2–23.2)|
| New Brunswick | 643,833           | 2.1 (2.1–2.1)   |
| Nova Scotia | 810,032             | 2.7 (2.7–2.7)   |
| Prince Edward Island | 125,591         | 0.4 (0.4–0.4)   |
| Newfoundland and Labrador | 452,485      | 1.5 (1.5–1.5)   |
| Yukon     | 31,174              | 0.1 (0.1–0.1)   |
| Northwest Territories | 35,230        | 0.1 (0.1–0.1)   |
| Nunavut   | 26,237              | 0.1 (0.1–0.1)   |
| Residence, urban v. rural | | |
| Population centre | 24,564,540     | 81.8 (81.4–82.3)|
| Rural     | 5,450,048           | 18.2 (17.7–18.6)|

Note: CI = confidence interval.
*A total of 128,310 Canadian respondents answered the questionnaire.
†Except where indicated otherwise.
(95% CI 44.7–44.9) years. More than half of the weighted sample rated their health as either excellent (weighted frequency count 6206931 [20.7%]) or very good (weighted frequency count 11550461 [38.5%]).

Health Utilities Index Mark 3
Of the 128310 respondents to the 2013–2014 Canadian Community Health Survey, 4656 (3.6%) did not provide full responses to the HUI3 questions, which prevented us from estimating their utility scores. Results of a multivariable regression model comparing these individuals with those who provided complete responses to the HUI3 questions are shown in Table 2. According to this model, respondents who were women, who were more educated, who had a higher household income and who resided in the province of Quebec were more likely to answer all of the HUI3 questions. By contrast, respondents who were older, who were single and who resided in Alberta, British Columbia, Manitoba, Newfoundland and Labrador, or Saskatchewan were more likely not to answer all of the HUI3 questions.

A histogram of the utility score distribution for the remaining 123654 respondents (96.4%) is presented in Figure 1. As expected, the distribution was not normal. The upper bound for utility scores was 1.00, and the lower bound, involving a small proportion of the sample, was less than zero.

Table 3 provides the age- and sex-stratified utility scores for the Canadian population; jurisdiction-stratified tables are provided in Appendix 2 (available at www.cmaj.ca/lookup/suppl/doi:10.1503/cmaj.170317/-/DC1). The mean and median utility scores for all Canadians within the 2013–2014 period were estimated at 0.863 (95% CI 0.861–0.865) and 0.927 (IQR 0.838–0.972), respectively.

Cross-tabulation of utility score measures with respondents’ self-rated health was possible for the majority of respondents for whom utility scores were provided (weighted frequency count 29313389 [99.9%]). Average and median utility scores for each of the 5 levels of self-reported health are shown in Table 4. As expected, utility scores decreased with worsening self-rated health, from a high of 0.942 (95% CI 0.940–0.944) for respondents who reported that their health was “excellent” to a low of 0.399 (95% CI 0.378–0.421) for respondents who reported that their health was “poor.”

Interpretation
We estimated that the average utility score for the 2013–2014 Canadian population was 0.863 (95% CI 0.861–0.865). Slight variations in the average utility score were observed among the provinces or territories of residence.

Table 2: Predictors of nonresponse to the Health Utilities Index Mark 3 questions within the 2013–2014 Canadian Community Health Survey

| Variable                                      | OR (95% CI)       |
|-----------------------------------------------|-------------------|
| Sex, female                                   | 0.872 (0.819–0.928) |
| Age, per year                                 | 1.037 (1.034–1.039) |
| Marital status                                |                   |
| Married or common-law                         | 1.000 (ref)       |
| Single                                        | 1.310 (1.192–1.440) |
| Separated or divorced                         | 1.030 (0.931–1.139) |
| Widowed                                       | 0.998 (0.913–1.090) |
| Don’t know, refusal, not stated               | 1.545 (0.909–2.627) |
| Education                                     |                   |
| Less than secondary school graduation         | 1.000 (ref)       |
| Secondary school graduation                   | 0.789 (0.723–0.861) |
| Some postsecondary education                  | 0.871 (0.741–1.023) |
| Postsecondary graduation                     | 0.686 (0.637–0.739) |
| Not stated                                    | 1.714 (1.446–2.032) |
| Gross household income, $                     |                   |
| < 30 000                                      | 1.000 (ref)       |
| 30 000–59 999                                 | 0.809 (0.750–0.873) |
| 60 000–89 999                                 | 0.706 (0.639–0.780) |
| ≥ 90 000                                      | 0.573 (0.515–0.637) |
| Province or territory of residence           |                   |
| Ontario                                       | 1.000 (ref)       |
| British Columbia                              | 1.116 (1.011–1.232) |
| Alberta                                       | 1.479 (1.333–1.642) |
| Saskatchewan                                  | 1.478 (1.313–1.663) |
| Manitoba                                      | 1.616 (1.442–1.812) |
| Quebec                                        | 0.594 (0.536–0.658) |
| New Brunswick                                 | 1.011 (0.864–1.184) |
| Nova Scotia                                   | 1.141 (0.986–1.321) |
| Prince Edward Island                          | 1.121 (0.890–1.412) |
| Newfoundland and Labrador                    | 1.277 (1.084–1.505) |
| Yukon, Northwest Territories, Nunavut         | 1.237 (0.996–1.535) |
| Residing in a population centre               | 0.988 (0.924–1.057) |

Note: CI = confidence interval, OR = odds ratio, ref = reference category.

Figure 1: Utility score distribution among respondents to the 2013–2014 Canadian Community Health Survey. The histogram has been truncated to comply with Statistics Canada’s vetting rules.
We also provided reference utility scores for individuals, which can be used when researchers have collected only respondents’ self-rated health. Similar to what had been shown by others, our results highlight that any variation in self-reported health was associated with a utility score difference extending beyond the minimum clinically important difference. Such results emphasize the importance for researchers, clinicians and decision-makers of recognizing the value of changes in an individual’s self-rated health.

Our study updates and extends out-of-date age- and sex-specific utility score norms at the Canadian, provincial and territorial levels using a representative sample of the current Canadian population. In 1999, using data from the 1994 National Population Health Survey, Mittmann and colleagues published Canadian utility norms for individuals as a function of the number (i.e., ranging from none to 11) and type of chronic diseases they reported experiencing. The average score for individuals with no chronic diseases (i.e., 0.93) has been recently cited by others as the Canadian HUI3 norm. Another set of estimates was reported by Kopec and colleagues, who used the same 1994 National Population Health Survey data to estimate that the average utility norms for Canadian men and women were 0.906 and 0.887, respectively. Although our sex-specific estimates for the Canadian population are closer to those reported

Table 3 (part 1 of 2): Age- and sex-stratified utility norms of the Canadian population*

| Variable | Utility score norm | Mean (95% CI) | Median (IQR) |
|----------|-------------------|---------------|--------------|
| Males    |                   |               |              |
| Age group, yr | Weighted frequency = 14 486 976 |
| 12–19   | 0.892 (0.886–0.897) | 0.927 (0.864–0.981) |
| 20–24   | 0.892 (0.883–0.900) | 0.928 (0.866–0.981) |
| 25–29   | 0.902 (0.894–0.911) | 0.947 (0.880–0.983) |
| 30–34   | 0.899 (0.888–0.909) | 0.943 (0.883–0.983) |
| 35–39   | 0.898 (0.889–0.908) | 0.950 (0.879–0.983) |
| 40–44   | 0.901 (0.892–0.909) | 0.948 (0.904–0.981) |
| 45–49   | 0.873 (0.862–0.885) | 0.930 (0.859–0.971) |
| 50–54   | 0.856 (0.841–0.870) | 0.925 (0.846–0.965) |
| 55–59   | 0.850 (0.840–0.860) | 0.929 (0.833–0.964) |
| 60–64   | 0.842 (0.833–0.852) | 0.919 (0.828–0.962) |
| 65–69   | 0.848 (0.839–0.856) | 0.919 (0.814–0.961) |
| 70–74   | 0.841 (0.829–0.852) | 0.906 (0.800–0.961) |
| 75–79   | 0.809 (0.794–0.823) | 0.904 (0.726–0.958) |
| 80–84   | 0.748 (0.727–0.768) | 0.848 (0.648–0.950) |
| ≥85     | 0.682 (0.655–0.708) | 0.777 (0.540–0.905) |
| All ages| 0.871 (0.868–0.874) | 0.928 (0.849–0.974) |

| Females | Utility score norm | Mean (95% CI) | Median (IQR) |
|---------|-------------------|---------------|--------------|
| Age group, yr | Weighted frequency = 14 850 394 |
| 12–19   | 0.879 (0.873–0.886) | 0.927 (0.827–0.980) |
| 20–24   | 0.890 (0.880–0.899) | 0.931 (0.865–0.977) |
| 25–29   | 0.902 (0.895–0.910) | 0.948 (0.891–0.980) |
| 30–34   | 0.893 (0.884–0.903) | 0.948 (0.872–0.981) |
| 35–39   | 0.890 (0.882–0.898) | 0.943 (0.866–0.981) |
| 40–44   | 0.874 (0.862–0.886) | 0.946 (0.861–0.977) |
| 45–49   | 0.862 (0.851–0.873) | 0.923 (0.837–0.966) |
| 50–54   | 0.842 (0.830–0.854) | 0.919 (0.830–0.963) |
| 55–59   | 0.830 (0.821–0.840) | 0.905 (0.777–0.959) |
| 60–64   | 0.841 (0.833–0.849) | 0.915 (0.792–0.961) |
| 65–69   | 0.837 (0.829–0.845) | 0.907 (0.778–0.960) |
| 70–74   | 0.831 (0.821–0.840) | 0.905 (0.778–0.959) |
| 75–79   | 0.778 (0.764–0.792) | 0.904 (0.668–0.954) |
| 80–84   | 0.736 (0.719–0.754) | 0.853 (0.612–0.951) |
| ≥85     | 0.616 (0.592–0.641) | 0.688 (0.375–0.905) |
| All ages| 0.856 (0.853–0.859) | 0.926 (0.829–0.969) |

Table 3 (part 2 of 2): Age- and sex-stratified utility norms of the Canadian population*

| Variable | Utility score norm | Mean (95% CI) | Median (IQR) |
|----------|-------------------|---------------|--------------|
| Total population | Weighted frequency = 29 337 370 |
| Age group, yr | | |
| 12–19   | 0.886 (0.881–0.890) | 0.927 (0.842–0.980) |
| 20–24   | 0.891 (0.884–0.897) | 0.929 (0.866–0.979) |
| 25–29   | 0.902 (0.897–0.908) | 0.948 (0.890–0.981) |
| 30–34   | 0.896 (0.889–0.903) | 0.946 (0.879–0.982) |
| 35–39   | 0.894 (0.888–0.900) | 0.947 (0.870–0.982) |
| 40–44   | 0.887 (0.880–0.895) | 0.947 (0.866–0.979) |
| 45–49   | 0.868 (0.860–0.876) | 0.927 (0.842–0.968) |
| 50–54   | 0.849 (0.840–0.858) | 0.923 (0.835–0.964) |
| 55–59   | 0.840 (0.833–0.847) | 0.919 (0.791–0.962) |
| 60–64   | 0.842 (0.836–0.848) | 0.919 (0.803–0.962) |
| 65–69   | 0.842 (0.836–0.848) | 0.918 (0.792–0.961) |
| 70–74   | 0.835 (0.828–0.842) | 0.905 (0.782–0.960) |
| 75–79   | 0.792 (0.782–0.803) | 0.904 (0.698–0.956) |
| 80–84   | 0.741 (0.728–0.755) | 0.853 (0.623–0.950) |
| ≥85     | 0.640 (0.621–0.658) | 0.727 (0.419–0.905) |
| All ages| 0.863 (0.861–0.865) | 0.927 (0.838–0.972) |

Note: CI = confidence interval, IQR = interquartile range.

*Utility scores were estimated for 123 654 respondents.
by Kopec and colleagues than to those reported by Mittmann and colleagues, differences with our estimates remain greater than the minimum clinically important difference for HUI3. Although these differences could highlight a potential for utility norms to vary over time, the lack of a minimum clinically important difference between our estimates and those reported by Pohar and Jones (i.e., 0.87) does not support this hypothesis. Future work is needed to examine whether Canadian utility score norms vary over time.

Limitations

Our work does have limitations. We could not estimate utility scores for a small proportion of respondents (4656 [3.6%]). The health-related quality of life of nonrespondents may differ from that of respondents. As such, the norms we present may be biased by nonresponse. Furthermore, specific subgroups of Canadians are not covered by the Canadian Community Health Survey (i.e., individuals on Indian Reserves and on Crown Lands, those who are residents of institutions, full-time members of the Canadian Forces and residents of certain remote regions). Although we cannot assume that our estimates extend to these excluded subgroups, the exclusions represent only about 2% of the Canadian population aged 12 years or older.

The utility scores that we present were estimated using the HUI3 scoring algorithm. Although the HUI3 is one of the most commonly used generic utility instruments and is recommended for economic evaluations by Canadian guidelines, Short Form 6-Dimensions health status classification system (SF-6D). Previous work has shown that using different approaches to assess individuals’ utility scores and using different scoring algorithms may yield different results. Alternatively, given that the EuroQol-5 Dimensions is the most frequently used instrument and that a Canadian algorithm for the 5-level version has recently been published, we could have considered estimating Canadian utility norms using this instrument. However, unlike the HUI3 instrument, which is currently administered within the Canadian Community Health Survey, the EuroQol-5 Dimensions 5-level instrument has yet to be administered to a large representative sample of all Canadians.

Differences in terms of classification systems, scoring algorithms or sociodemographic characteristics of respondents may hinder comparison of our results with those obtained within other jurisdictions.

Finally, beyond the reporting of results specific to age, sex, jurisdiction and self-rated health, we did not examine the effect of any other sociodemographic characteristics or of the presence of any comorbidity reported in the Canadian Community Health Survey. Previous work has shown that sociodemographic characteristics and comorbidity status can influence respondents’ utility scores. Future work is required to examine the effect of specific sociodemographic characteristics and of the presence of comorbidities on the current Canadian population with regard to their health-related quality of life and to determine whether previously identified effects still apply.

Table 4: Utility norms for the Canadian population in relation to self-rated health

| Self-rated health | Utility score norm Mean (95% CI) | Median (IQR) |
|-------------------|----------------------------------|--------------|
| Excellent         | 0.942 (0.940–0.944)              | 0.962 (0.922–0.982) |
| Very good         | 0.910 (0.908–0.912)              | 0.947 (0.904–0.975) |
| Good              | 0.842 (0.839–0.846)              | 0.905 (0.777–0.960) |
| Fair              | 0.664 (0.654–0.673)              | 0.743 (0.446–0.905) |
| Poor              | 0.399 (0.378–0.421)              | 0.344 (0.116–0.700) |

Note: CI = confidence interval, IQR = interquartile range.

*Utility scores were estimated for 123 654 respondents. The weighted frequency of responses was 29 313 389.

Conclusion

In this study, we have estimated Canada-wide utility score norms pertinent to the current Canadian population aged 12 years or older. These benchmark values can be used for comparisons of results obtained within a Canadian study or clinical population and the general Canadian population. Given that we conducted several age, sex and jurisdiction stratifications, these norms may favour the planning and creation of future stratified Canadian economic models, as well as their subsequent evaluation by Canadian outcome researchers and decision-makers.

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