A B S T R A C T

As responsibility for health funding shifts from central to local governments, providers find themselves in decision-making roles or asked to give guidance in allocation of resources. To develop a picture of a population's health, data are needed about the effects that illness and disability have on a person's ability to function and thus on quality of life. This study assessed the validity in a Canadian city, of a Health-related Quality of Life (HRQoL) instrument developed by the US Centers for Disease Control and used in the US Behavioral Risk Factor Surveillance System. The HRQoL was administered to a random sample of 1,042 adults. The patterns of association among the HRQoL questions, and the direction of the relationships among independent variables and HRQoL were consistent with those hypothesized. The accumulating evidence for validity of the HRQoL support its use in monitoring the performance of local health initiatives in Canada.

A B R É G É

La responsabilité du financement des soins de santé passant des gouvernements centraux aux gouvernements locaux, les prestateurs de soins se retrouvent dans la situation où il leur incombe de décider ou d'offrir des conseils quant à la façon d'allouer les ressources. Pour dresser un tableau de la santé de la population, il faut disposer de données sur les effets qu'une maladie et une incapacité ont sur l'aptitude à fonctionner d'une personne et, par voie de conséquence, sur sa qualité de vie. Cette étude a cherché à évaluer l'utilité dans une ville canadienne de recourir à un instrument mis au point par les US Centers for Disease Control, à savoir le HRQoL (mesure de la qualité de la vie en fonction de la santé), qui est utilisé par le système américain de surveillance des facteurs de risques comportementaux. Le HRQoL a été administré à un échantillon aléatoire de 1 042 adultes. Les schémas d'association entre les questions et l'orientation des relations entre les variables indépendantes et le HRQoL sont apparus conformes aux hypothèses. L'accumulation de preuves de la validité du HRQoL justifie son utilisation pour surveiller les résultats des initiatives locales en matière de santé au Canada.

Using the U.S. Behavior Risk Factor Surveillance System's Health Related Quality of Life Survey Tool in a Canadian City

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Measurement of health in population surveys has challenged investigators because of the absence of consensus on what it is and the best way to measure it.[1] Medically oriented measures such as mortality and morbidity rates provide only a partial picture of public health needs and program outcomes. Their use as an indicator for health care need has been criticized,[2,3] and a consensus is developing that broader measures of *health* are required.[4] A clear picture of a population's health requires data about the measurable effects that illness and disability have on an individual's ability to function and thus on his/her perceived well-being or quality of life. These measures must be appropriate for varying situations and subgroups, and be able to be used with limited resources. Health Surveys such as Canada's National Population Health Survey (NPHS),[5] which are repeated at regular time intervals, permit monitoring of trends.

The balancing exercise in terms of measurement of *health* has been two dimensional: 1) the potential greater sensitivity and specificity of more detailed assessments which are relatively cumbersome compared to short, compact survey instruments; and 2) the suitability of instruments designed for population versus individual assessment. Several studies have examined the validity of brief measures of self-rated health by assessing the relationship between, for instance, single-item measures of self-rated health and an external measure such as physician assessments,[6] reports of self-rated health problems, diagnoses of chronic disease,[7,8] individual health practices,[9] mortality,[10] and composite measures of health status.[2] It is unclear, however, whether single-item self-rated health questions are able to capture both perceived health and functional status, which reflect both physiologic and psychological states, and are therefore more consistent with the commonly employed definition of health as "a state of complete physical, mental and social well-being, and not merely the absence of disease or injury."[11]

Investigators at the Centers for Disease Control and Prevention (CDC) in the United States recently reported on the development of a brief survey tool to identify health-related quality of life in adult populations. This tool is currently being used in the Behavior Risk Factor Surveillance System (BRFSS), a state-based telephone survey now covering all 50 states with over 100,000 interviews conducted annually. The Health Related Quality of Life (HRQoL) core module was developed through expert discussions convened by the CDC. The core module has four items that measure self-perceived health, recent physical and mental health, and recent

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activity limitation (Figure 1). Rationale for, and criteria employed for inclusion of each dimension are provided elsewhere.[12] The HRQoL questions are clear, result in few cognitive difficulties, and when compared to the more lengthy and standardized health measures such as the SF36, appear to have acceptable construct, criterion and known-groups validity.[13,14]

The Institute of Medicine has recently recommended that the HRQoL be included as a Community Profile Indicator.[4] The power of this brief survey instrument is that it can be used in surveillance programs to provide insights into health trends, and to identify relationships between health and its determinants. This information may then be used both to inform local health planning priorities, and to justify more detailed studies of health in specific groups.

In a regional municipality in Ontario (population 400,000), we were able to include the HRQoL in a telephone survey of a stratified probability sample of 1,042 citizens conducted in December 1995. We report here our experience with the questions, and comparability with the CDC findings.

METHODS

The Health survey was commissioned by the local municipal health department to measure general health habits (smoking, physical activity and alcohol consumption) and concerns (primarily attitudes towards local smoking by-laws) of local citizens. The sample for the health survey was designed to represent the adult population (18 years of age or older) living independently in the regional municipality. A two-stage probability sampling procedure was used for recruitment. First, households were randomly selected within each municipality using random digit dialing. Second, random selection within each household was achieved by selecting the eligible household member who had the most recent birthday. Data were later weighted to correct for disproportionate sampling in municipalities and households. All interviews were conducted by trained interviewers at the Institute for Social Research, York University.

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1. **Self-Perceived Health**
   Would you say that in general your health is:
   a. Excellent
   b. Very good
   c. Good
   d. Fair, or
   e. Poor?

2. **Recent Physical Health**
   Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?
   _____ days

3. **Recent Mental Health**
   Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?
   _____ days

4. **Recent Activity Limitation**
   During the past 30 days for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?
   _____ days

Figure 1. Health-related quality of life: core module questions included in the health survey of the regional municipality and taken from the US Behavioral Risk Factor Surveillance System
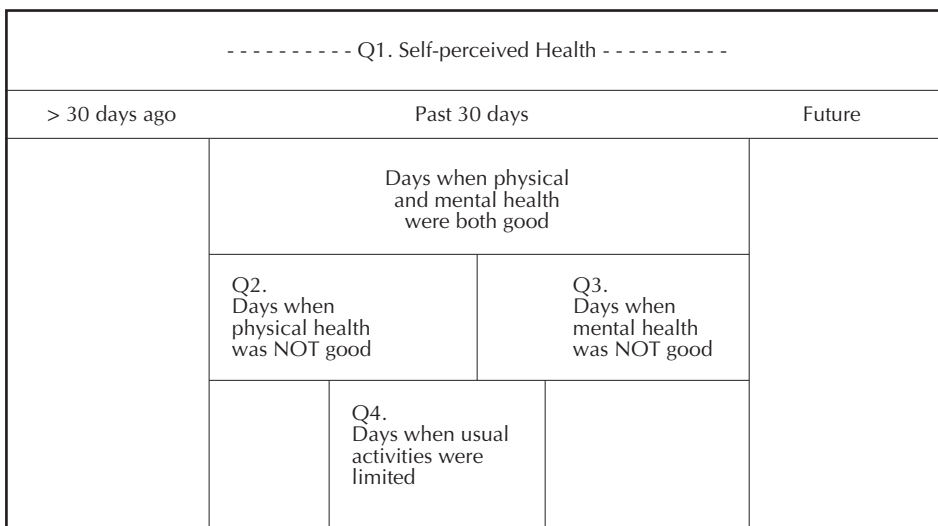

Figure 2. Conceptual Relationship of Health-related Quality of Life Core Module Questions
Source: Reference 12.

The conceptual relationship among the HRQoL core module questions is presented in Figure 2. Question 1 focusses on self-perceived health, a well-studied global health item that encapsulates present, past and anticipated health.[2,6-10] Questions 2 and 3 relate to recent physical and mental health symptoms and are considered mutually independent. Together they are hypothesized to explain the recent health aspects of question 1. Question 4 is included as a global measure of disability that explicitly incorporates both physical and mental health. The "healthy days index" (HDI), defined as the number of recent days with no reported physical or mental dysfunction, was calculated by subtracting the total number of "*not good*" days reported for recent physical and mental health from 30 days, with 0 days as the lowest possible value.[14,15]

A series of analyses were conducted to determine whether the HRQoL is valid in a primarily urban Ontario population.

TABLE I
Comparison of Health Survey Sample with 1991 Census Data for the Regional Municipality[17]

Characteristic	1991 Census Data for Study Population* (n=358,045)	Health Survey (n=1,042)
Population (years)	%	%
18-19	–	4
20-44	54	53
45-64	27	31
65+	18	12
Sex		
Males	49	43
Females	51	57
Marital Status		
Ever married	72	71
Single/never married	28	22
Living with a partner	–	7
Highest Level of Education		
No formal schooling, completed primary school	14	3
Some secondary or high school	27	16
Completed secondary or high school	15	31
Some community college, technical college, CEGEP, or nursing program	7	7
Completed community college, CEGEP, or nursing program	20	18
Some university	8	8
University degree	10	17
Born in Canada	75	80
Household Income		
<$20,000	23	16
$20,000-29,999	14	14
$30,000-39,999	13	13
$40,000-49,999	12	14
≥$50,000	38	43

* Study population includes individuals aged 15+.

TABLE II
Recent Physical Health by Self-perceived Health Status* in the Health Survey of the Regional Municipality

| Number of Days with Poor Physical Health | Self-Perceived Health Status | | | | | |
| | Excellent-Very Good | | Good | | Fair-Poor | |
	Number	(%)	Number	(%)	Number	(%)
None	458	(73.8)	135	(21.7)	28	(4.5)
1-2	103	(67.8)	34	(22.4)	15	(9.9)
3-7	89	(61.0)	40	(27.4)	17	(11.6)
≥8 days in the past 30 days	34	(35.1)	22	(22.7)	41	(42.3)
Total	684		231		101	

* Chi-square = 142.2, degrees of freedom = 6, p<0.001

TABLE III
Recent Mental Health by Self-perceived Health Status* in the Health Survey of the Regional Municipality

| Number of Days with Poor Mental Health | Self-Perceived Health Status | | | | | |
| | Excellent-Very Good | | Good | | Fair-Poor | |
	Number	(%)	Number	(%)	Number	(%)
None	384	(68.1)	117	(20.7)	63	(11.2)
1-2	96	(70.1)	33	(24.1)	8	(5.8)
3-7	123	(75.0)	34	(20.7)	7	(4.3)
≥8 days in the past 30 days	72	(50.3)	45	(31.5)	26	(18.2)
Total	675		229		104	

* Chi-square = 31.4, degrees of freedom = 6, p<0.001

Construct validity was assessed using a series of chi-square and correlation analyses (Spearman rank order) to examine the relationship between self-perceived health, the HDI, and each of the three impairment measures. It was hypothesized that the rela-

tionships observed among the four variables would replicate those observed elsewhere,[12] and would reflect the conceptual model described above. In order to assess concurrent validity, four logistic regression models were used to examine the association between responses to each of the HRQoL core module questions and sociodemographic and independent health practice variables. Responses to each of the four self-rated health variables were categorized into dichotomous dependent variables: self-rated health (excellent/very good/good and fair/poor); days of physical activity limitation, poor mental health and poor physical health (0 and ≥1 days in past 30). The independent variables for the analyses included: self-reported smoking status (daily/occasional and not at all), alcohol use (≤7; 8-14; ≥15 drinks per week), physical activity (active and inactive), age (continuous variable) and household income (< $30,000; $30-$49,999; $50-$69,999; ≥ $70,000). Separate logistic regression analyses were conducted for each of the four dependent variables. The Statistical Package for the Social Sciences version 6.1.3[16] was used to complete the analyses. A criterion of p<0.05 was set *a priori* to indicate statistical significance.

RESULTS

Of the 5,581 telephone numbers sampled, 2,002 represented eligible households. Non-eligible households (business telephones, not-in-service and eligibility-unknown numbers, respondent unable to speak English) accounted for the remaining 3,579 numbers sampled. Businesses and not-in-service numbers made up 36%, and no contact was made with 25% of those sampled. Two percent of households were ineligible due to language barriers, 1% were ineligible due to health problems/infirmity and absence from the home. The response rate was calculated as the number of completions (1,042) divided by the number of eligible households (2,002). The response rate for the health survey was 52%. The health survey sample compared favourably with the 1991 Census data on most variables (Table I).

The median number of healthy days observed for the health survey sample was

28, with 43% of the sample reporting the maximum possible number of healthy days. Forty-nine percent of the sample reported experiencing at least one day of poor physical health during the past 30, while 44% experienced at least one day of poor mental health. At least one day of activity limitation was reported by 33% of subjects.

The relationships between self-perceived health and recent limitation in physical health, mental health and days of activity limitation (Tables II-IV) are consistent with findings of the validity study reported by Hennessey.[12] Subjects who reported fewer days of impaired physical health, mental health or activity limitation reported higher levels of self-perceived health. Spearman rank order correlations indicate that physical health and activity limitation are both moderately related to self-perceived health. No relationship was observed between self-perceived and mental health. A strong positive relationship was observed between the HDI and activity limitation (Table V).

Results of the logistic regression analyses indicated that age and income were associated with self-rated health, physical health, mental health, and physical activity limitation (Table VI). Subjects with total family income < $30,000, for example, were almost 9 times more likely to report fair/poor health than those that earn ≥ $70,000. Subjects aged 70 years were 1.7 times more likely to report fair/poor health than those who were 50, and 4 times more likely to report fair/poor health than those who were 20 years of age. As presented here, these odds ratios are simultaneously adjusted for all other variables in the model (income, age, activity level, alcohol consumption and smoking status). Relationships between self-perceived health and selected demographic characteristics are presented graphically in Figure 3.

Approximately 30% of subjects smoked at least occasionally, 5% consumed at least 15 alcoholic drinks per week, and 24% reported being physically active during their leisure time (Table VI). Subjects who were inactive were 1.4 times more likely to report at least one day of poor physical health and 1.4 times more likely to report at least one day of physical activity limita-

tion than those who were active. Smokers were 1.5 times more likely to report at least one poor mental health day in the past 30 days, and 1.8 times more likely to report poor/fair self-perceived health than non-smokers. These odds ratios are simultaneously adjusted for all other variables in the model.

DISCUSSION

Over 90% of subjects in this health survey reported good-to-excellent self-rated health, compared with 87% of the 1993 American nationwide sample.[15] The distributions observed for the remaining items were also consistent with the American data,[15,18-21] and are similar to those implied by the conceptual model presented in Figure 2. The similar patterns observed between ours and the American data provide us with confidence that these questions tap similar dimensions, and provide evidence of construct validity. Relationships observed between the HRQoL, sociodemographic characteristics and independent health practices were in the expected directions, providing evidence of concurrent validity.

The conceptual model proposed by Hennessey et al.[12] presents the mental and

physical health constructs as distinct. For the present study, the magnitude of the relationship between physical and mental health is smaller than that observed between either variable and activity limitation, providing evidence of discriminant validity. However, while the magnitude of the relationship between self-rated and physical health was consistent with expectations, the magnitude of the relationship between mental and self-rated health was weak. This raises concerns about the validity of the mental health measure included in the HRQoL. It appears that many subjects may not consider their mental health status as a relevant or major component of their general health status, therefore reinforcing the importance of asking separately about mental and general health.

Prevalence data on the HRQoL variables reported here were based on probability sampling through random digit dialling of persons living in the geographic area, and appear to be fairly representative of the general population. The characteristics of the respondents match the regional municipality population, however like many other large surveys, the survey was limited to those who were able to understand and respond in English. Also, the design excluded households without telephones,

TABLE IV
Recent Activity Limitation by Self-perceived Health Status* in the Health Survey of the Regional Municipality

Number of Days with Activity Limitation	Self-Perceived Health Status					
	Excellent-Very Good		Good		Fair-Poor	
	Number	(%)	Number	(%)	Number	(%)
None	557	(72.2)	164	(21.2)	51	(6.6)
1-2	62	(62.6)	26	(26.3)	11	(11.1)
3-7	45	(57.7)	22	(28.2)	11	(14.1)
≥8 days in the past 30 days	22	(31.0)	21	(29.6)	28	(39.4)
Total	686		233		101	

* Chi-square = 94.3, degrees of freedom = 6, p<0.001

TABLE V
Spearman's Rank Correlation Coefficients Between Self-perceived Health Variables* in the Health Survey of the Regional Municipality

	Self-Perceived Health	Recent Physical Health*	Recent Mental Health*	Good Health Days Index*†
Recent Physical Health	0.24‡			
Recent Mental Health	0.05	0.24‡		
Recent Activity Limitation	0.22‡	0.48‡	0.32‡	0.49‡

* Responses categorized as follows: 1) none, 2) 1-2 days, 3) 3-7 days, and 4) 8 or more days.
† Negative values coded as 0 days.
‡ p<0.05

TABLE VI
Association of Sample Characteristics with Poor/fair Self-perceived Health, and 1+ Days of Poor Physical Health,
Mental Health or Activity Limitation in the Past 30 Days, Final Adjusted Models (n = 1025)

Explanatory Variables	Model 1: Self-perceived Health OR†‡	CI†	Model 2: Physical Health OR	CI	Model 3: Mental Health OR	CI	Model 4: Activity Limitation OR	CI
Age	1.03*	1.02-1.04	0.98*	0.97-0.99	0.96*	0.95-0.97	0.98*	0.97-0.99
Household Income								
≥$70,000	1.00	–	1.00	–	1.00	–	1.00	–
$50-69,999	3.00**	1.49-4.51	1.50	0.99-2.01	1.41	0.93-1.89	1.26	0.69-1.83
$30-49,999	6.21*	4.80-7.62	2.36*	1.88-2.82	0.75	0.29-1.21	1.74**	1.22-2.26
<$30,000	8.90*	7.52-10.28	2.26*	1.80-2.72	1.28	0.83-1.73	1.49	0.98-2.00
Activity Level								
Active	1.00	–	1.00	–	1.00	–	1.00	–
Inactive	1.01	0.51-1.51	1.38**	1.09-1.67	1.17	0.86-1.48	1.42**	1.09-1.75
Smoking								
Non	1.00	–	1.00	–	1.00	–	1.00	–
Daily/occasional	1.78**	1.32-2.24	1.04	0.75-1.33	1.45**	1.16-1.74	1.13	0.81-1.45
Alcohol								
≤7 drinks per week	1.00	–	1.0	–	1.00	–	1.00	–
8-14 drinks per week	2.66**	1.20-4.12	1.0	0.42-1.58	1.49	0.90-2.08	1.28	0.62-1.94
≥15 drinks per week	3.21**	1.61-4.81	1.06	0.35-1.77	1.25	0.53-1.97	1.07	0.26-1.88

† CI = 95% Confidence Interval, OR = Odds Ratio
‡ Odds ratios for categorical variables represent comparisons with the referent group (OR=1.0) after adjustment for all other variables in the model. Odds
  ratios for continuous variables represent odds ratios per unit increase in that variable after adjustment for all other variables in the model.
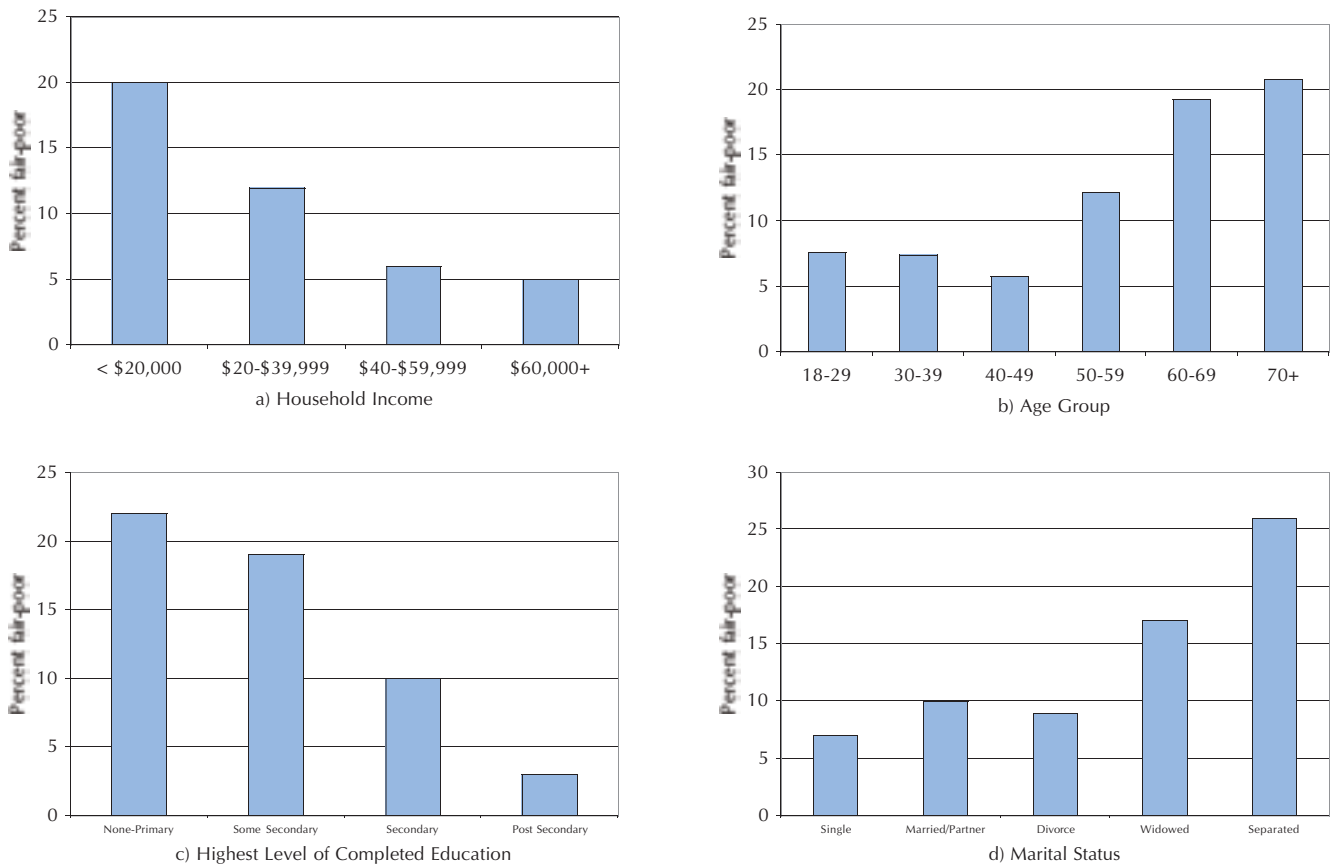* p < 0.01, ** p < 0.05

Figure 3. Percent of Sample Reporting Fair to Poor Self-rated Health by Income, Age Group, Educational Achievement and Marital Status in the Health Survey of the Regional Municipality

homeless persons and persons living in institutions. As individuals in each of these groups tend to be at high risk for physical and/or mental health problems, the results presented slightly overestimate the health of the population from which the sample

was drawn. The brevity of the HRQoL has enabled the standardized collection of reliable and valid measures of quality of life from over 500,000 adults in the US (1993-1997), with minimal respondent burden, therefore enhancing response rates in comparison with other more lengthy tools used in general population surveys. The analyses reported here have included weighting of responses to take account of the sampling design.

SUMMARY

Conceptual models that are based on a number of general constructs are useful, as they provide an organizing framework for the measurement of complex states such as quality of life. The results of this research support the use of the HRQoL in monitoring the health of populations. Most provinces have regionalized their management of health services, and the regional health authorities require some estimate of health levels or need, and whether the restructuring of health, education and social services is having an impact, positive or negative. Indeed Canada's NPHS not only is conducted in each province through time, but some provinces such as Ontario have extended this sample to provide local estimates of health status and determinants. Inclusion of the HRQoL could both reduce the length of the survey questionnaire and enrich the data for community health planning. The accumulating evidence for validity of the HRQoL suggests that it should be considered for inclusion in both national and local population health surveys in Canada.

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