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THE USE OF HEALTH INDEXES IN CALCULATING HEALTH GAINS (QALYs) AND HEALTH-ADJUSTED LIFE EXPECTANCY (HALE)

Invited paper submitted by the University of Kuopio, Finland[1]

Abstract

The paper describes first the methodology of measuring health-related quality of life (HRQOL) by the 15D, EuroQol and HUI:2/3, quality-adjusted life years (QALYs), which combine HRQOL with length of survival, and health-adjusted life expectancy (HALE), which combines HRQOL with life expectancy. Then empirical applications of the methodology to measuring HALE in Canada and Finland for population at the age of 15 years is introduced and results from these applications are presented. Finally, methodological problems with calculating and comparing HALE and the usefulness of HALE as an indicator of population's health and its development are discussed.

1. Introduction

There is a long tradition of measuring population's health by mortality-based indicators. The main indicator has been life expectancy (LE) at various ages. It measures the quantity or length of life and changes in LE serve to indicate progress in terms of prolongation-of-life goal of health policy. For

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example in Finland, LE at birth has increased by 6.3 and 5.3 years for males and females, respectively, between 1975 and 1996.

On the other hand it has been realised for a long time that LE may give an inadequate picture of population's health, because it is insensitive to population's quality of survival. An increase in LE does not tell anything about whether there has been an accompanying improvement, deterioration or no change at all in the health status of those who have lived longer. It is these days widely accepted that health has two major aspects: the length and quality of life. Especially in the developed countries more and more emphasis is being placed on improving health-related quality of life (HRQOL) as a goal of health policy, since the populations of these countries suffer presently mainly from HRQOL detracting diseases and conditions. This has given a strong impetus to developing instruments for measuring HRQOL and to efforts to combine data on quality and quantity of life into a single indicator of population's health referred to as the expected number of quality-adjusted life years (QALYs) or health-adjusted life expectancy (HALE).

The purpose of this paper is to introduce briefly three instruments for measuring HRQOL, namely the 15D, EuroQol and Health Utility Index Mark 2/3 (HUI:2/3) and how the HRQOL data produced by the 15D and HUI have been used to estimate HALE at the age of 15 years in Canada for 1990-92 and 1994, and in Finland for 1992 and 1996. First, the theoretical ideas of measuring QALYs and HALE are presented. Then, materials and methods of empirically measuring population's HRQOL and HALE in Canada and Finland are described. The results section is followed by discussion, where the emphasis is on considering the plausibility and internal validity of the results. The aim is thus primarily to introduce an approach to measuring and following-up population's health in a concise yet illustrative way.

2. The ideas of QALYs and HALE

The idea of QALYs can be clarified with figure 1, which gives a simple example of how QALYs are derived. It is assumed that over time (measured on the horizontal axis) an individual (e.g. a patient without treatment) lives through various health states (states 1 to 3) with durations k_1 to k_3 before she dies. In each separate health state the individual experiences different HRQOL, that is, the states differ in terms of how good or bad people feel they are they from the viewpoint of quality of life. The relative goodness of each state in this respect is indicated by v_1 to v_3 measured on the vertical axis on a scale ranging from zero (death) to one (completely healthy). The v's are referred to as the values, utilities, quality weights or preference weights of the health states, and are derived from a group of individuals by different valuation methods.

When these weights are combined with the duration of the states and data on survival, QALYs can be estimated. In figure 1 the QALYs remaining without treatment ($QALY_0$) is calculated as the area $k_1v_1 + k_2v_2 + k_3v_3$. With treatment the patient lives longer and through health states with a higher HRQOL so in

this case the QALYs remaining ($QALY_w$) is the area $k_4v_4 + k_5v_5 + k_6v_6 + k_7v_7$. The difference of the areas ($QALY_w - QALY_0$) gives the QALYs gained by the treatment (shaded area in figure 1).

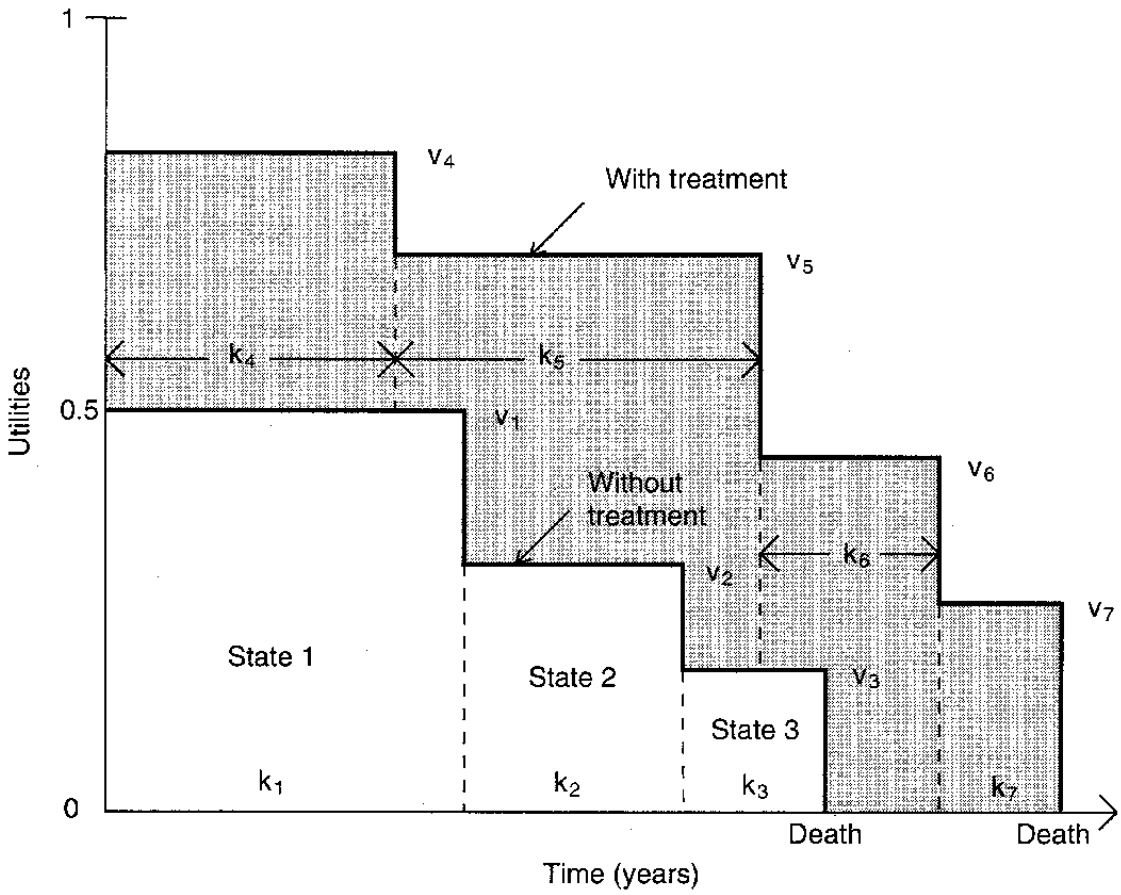


Figure 1. Calculation of QALYs gained with a treatment (shaded area). k_1 , k_2 , k_3 = durations of health states 1, 2 and 3; k_4 , k_5 , k_6 , k_7 = durations of health states 4 to 7; States 1 to 7 = different health states; v_1 to v_7 = quality weights associated with health states 1 to 7 (reproduced from Sintonen 1994a).

For the empirical measurement of the HRQOL aspect for QALY calculations we thus need a standardised health state descriptive/classification system for defining different health states and a valuation method for deriving quality/preference weights for these states. There is a number of standardised health state descriptive systems and valuation methods, i.e. instruments for measuring HRQOL, that differ in their properties. Some instruments relevant for this paper will be introduced briefly below.

The idea of QALYs of weighting survival with its quality can be applied at the population level to derive HALE. One way of calculating HALE at age x is as follows:

$$HALE_x = \left(1-\frac{Q_x}{2}\right)V_x(k) + \sum_{z=x+1}^{w}\left(1-\frac{Q_z}{2}\right)V_z(k)\prod_{y=x}^{z-1}(1-q_y), \quad (1)$$

where
q_x = probability that a person who has just reached the age of x will die within a year (in period x, x+1), x = 0, 1,...,z, ..., w, where w is the last full year lived,
$V_x(k)$ = quality weight of year x, i.e. quality-adjusted time spent in different health states in year x defined as

$$V_x(k) = \sum_{H=D+1}^{G} v_H k_{Hx}, \quad (2)$$

where
v_H = the value/utility of health state H and
k_{Hx} = the proportion of year x spent in health state H (H = G, G+1,..., D+1, D, where G= good health and D = being dead).

Thus, for calculating HALE for males and females at a certain age we need the age-gender-specific probabilities of death and the age-gender-specific quality weights. To obtain the latter we have to measure the HRQOL in the population by using an HRQOL instrument that produces a single index number [$V_x(k)$], which exhibits a plausible tradeoff between length and quality of life.

3. Instruments for measuring HRQOL

In the Finnish HALE calculations the HRQOL has been measured mainly by the 15D. It is a generic, 15-dimensional, standardised, easy-to-use (self-administered) measure of HRQOL, that can be used as a profile and single index score measure. The dimensions are breathing, mental function, speech, vision, mobility, usual activities, vitality, hearing, eating, elimination, sleeping, distress, discomfort and symptoms, sexual activity and depression. Each dimension is divided into five levels, by which more or less of the attribute is distinguished. Completing the 15D questionnaire (health state descriptive system) takes usually 5-10 minutes and it describes the respondent's HRQOL at that moment as a profile (Sintonen 1994b, 1995b, Sintonen and Pekurinen 1993).

The single index score (15D score) represents the overall HRQOL and ranges from 0 (being dead) to 1 (full HRQOL). It is calculated from the health state descriptive system by using a set of preference weights. They have been elicited from several representative samples of Finnish adult population with an additive 3-stage valuation model based on the multi-attribute utility theory. To simplify a little, in this model we first measure the relative

importance of the various dimensions from the viewpoint of HRQOL in people's mind and then the relative desirability of each level within each dimension.

To obtain the importance weights the subjects were asked to indicate the relative importance of each dimension on an adjacent importance scale (0-100 ratio scale) by placing the dimension considered most important at the top (at 100). The individual values given to a dimension by all subjects were first averaged, and then transformed so that the sum of weights was equal to 1. The within-dimension levels were valued similarly by using a 0-100 ratio scale and placing the most desirable level at 100. In addition to the five levels the states of being unconscious and dead were valued for each dimension. The individual values given to a level were averaged and divided by 100 to obtain the desirability value of that level. The quality/preference weight for a level of a dimension is then obtained by multiplying the level desirability value by the importance weight of that dimension.

In Finland some HALE calculations have also been carried out by using the EuroQol, nowadays also referred to as EQ-5D. It is a simple generic, self-administered HRQOL instrument with five dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression), each divided into three levels (Brooks 1996). Different approaches have been used to elicit the preference weights for establishing the single index scores. In the Finnish survey, a standard visual analog (VAS) scale technique, as agreed upon in the EuroQol Group, was used. Altogether 43 five-dimensional health state descriptions (plus being unconscious and dead) were valued on a 0-100 "feeling thermometer" with the upper end labelled "best imaginable health state" and lower end "worst imaginable health state". The individual values obtained were averaged and divided by 100 to end up on a 0-1 scale. From these data the quality/preference weights for all 243 health states defined by the EuroQol health state descriptive system were derived by using regression modelling (Ohinmaa et al. 1996).

In Britain the EuroQol quality/preference weights were elicited by using the time trade-off (TTO) technique (together with regression modelling) (Dolan et al. 1996). For example, to value a chronic health state i, this technique offers the subject two alternatives: (1) state i for time t followed by death, (2) healthy for time x < t followed by death. Time x is varied until the respondent is indifferent between the two alternatives, at which point the quality/preference weight for state i is x/t (Drummond et al. 1997). Due to the different valuation techniques also the quality weights for the same health states differ substantially between Finland and Britain, especially for poor health states.

In the Canadian HALE calculations it is claimed that HRQOL has been measured by Health Utility Index Mark II (HUI:2). It is a generic HRQOL instrument consisting originally of 7 dimensions (attributes): sensation (covering vision, hearing and speech), mobility, emotion, cognition (learning and memory), self-care, pain (pain and discomfort) and fertility (Feeny et al. 1995). These are divided into 3 to 5 levels. However, Wolfson (1996), Roberge et al. (1996) and Roberge et al. (1997) report that the following

attributes were measured: vision, hearing, speech, mobility, emotional state, thinking and memory, dexterity and level of pain and discomfort. These attributes resemble though more the health-state descriptive system of HUI Mark III consisting of vision, hearing, speech, mobility, dexterity, emotion, cognition (thinking and memory) and pain (pain/discomfort) with 5-6 levels on each (Feeny et al. 1995). The utility weights for deriving a single index number on a scale from 0 (being dead) to 1 (full HRQOL) were based on a multiplicative multi-attribute utility model, for which the valuations were elicited from a sample of 203 individuals by using visual analog scale and standard gamble (SG) techniques (Feeny et al. 1991).

When valuing for example a chronic health state i with SG, the subject is offered two alternatives: (1) being in state i for time t followed by death, (2) either immediate return to perfect health for t years with probability p, followed by death, or immediate death with probability 1-p. Probability p is varied until the respondent is indifferent between the two alternatives, at which point the quality/preference weight for state i is p (Drummond et al. 1997).

4. Empirical measurement of HRQOL and HALE

The Finnish approach

The HALE of the Finnish males and females in 1992 and 1996 at the age of 15 years as defined in eq. (1) was calculated with a Markov model built and estimated by using SMLTREE (Hollenberg 1987). The model is depicted graphically in Fig. 2. The Markov model provides a convenient method of considering events that can occur over long periods of time. The model describes what can occur during any time period and then simulates the passage of time by repeatedly evaluating that model using a counter (m.CYCLE) to keep track of time.

In this Markov model there are only two states, being ALIVE and DEAD. At any point of time the person is in only one of these two possible states. Each state is associated with a probability of being in that state. PRDIE stands for the age-gender specific probability of death over the next year (q_x in eq. 1) and # stands for the remaining probability $1-q_x$, that is, the probability of staying alive. Here we consider persons who have just reached the age of 15 so their initial probability of being alive is 1. DEAD is an absorbing state, since once in the DEAD state, the persons remain there, i.e. the transition probability to the other state(s) is zero.

Associated with each state is also a utility or value for being in that state for the defined period, in this case a year [$V_x(k)$ in eq. 1]. The utility of being DEAD is defined as 0. The utility of staying ALIVE is dependent on HRQOL prevailing in any particular year of life, reflected in the quality weight $V_x(k)$. When calculating the ordinary LE, the $V_x(k)$s are assumed to be 1, that is, HRQOL is perfect. When calculating HALE one takes into account the fact that HRQOL is usually less than perfect so that $0<V_x(k)<1$. The model

was run up to the age of 90 so at that age the probability of death was set equal to 1 (and utility equal to 0).

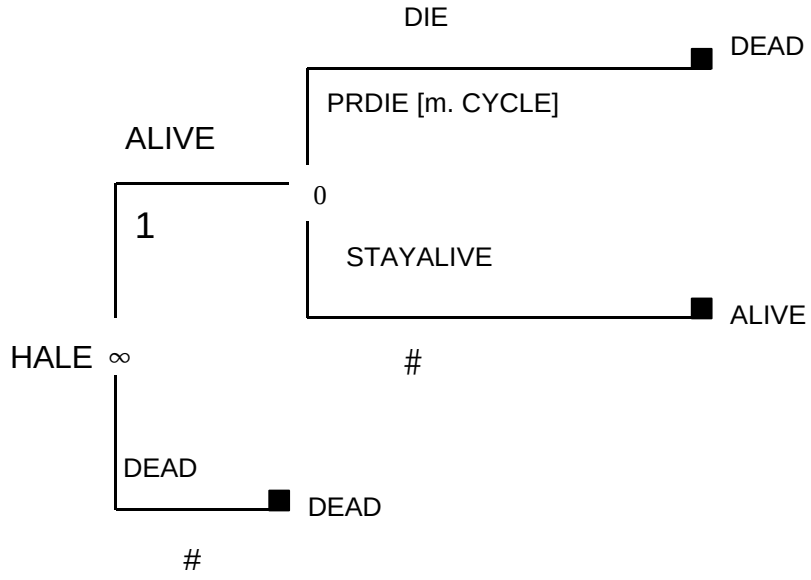


Figure 2. Markov model for estimating HALE

The age-gender-specific probabilities of death (PRDIE) were obtained from the Finnish life tables for 1992 and 1996 (Statistics Finland 1993 and 1997).

The utilities of being ALIVE, that is, the $V_x(k)$s, were measured in three cross-sectional population surveys in 1992, 1995 and 1996 by using the 15D. The first cross-sectional population survey took place in November-December 1992. The main purpose of the survey was to elicit the necessary valuations for deriving the 15D single index scores. All valuation tasks were carried out with self-administered postal questionnaires with one reminder and a new questionnaire sent about two weeks after the original mailing. Five random samples (n=500 each) of the Finnish population aged > 16 years were drawn from the National Population Register. In the stratified sampling the elderly (aged >65) were overrepresented to compensate for their lower absolute number in population and a possibly higher nonresponse rate. In addition to the valuation tasks, the respondents also completed the 15D questionnaire and reported some background data (age, gender, etc.) (Sintonen 1995a).

The average response rate was 52%. The 15D questionnaire was filled in by 1288 respondents, completely by 1056 respondents (42.2% of the original total sample of 2500).

The second HRQOL population survey took place in connection with the Finnish National Health Survey 1995/95 in May-June 1995. A random sample of 1800 reference persons was drawn from the non-institutionalised Finnish population aged 15 and over. In the main survey all household members of the reference

person were interviewed, but the 15D questionnaire was given to the reference person alone for self-administration and to be returned by mail. The survey reached 1569 (87%) of the reference persons, and of them 1476 (94%) filled in the 15D questionnaire, completely by 1236 respondents (83.8%).

The third survey took place in connection with the second part of the Finnish National Health Survey 1995/96 in May-June 1996. A random sample of 4218 reference persons was drawn from the non-institutionalised Finnish population aged 15 and over. The survey reached 3616 (85.7%) of the reference persons, and of them 3298 (91.2%) filled in the 15D questionnaire, completely by 2754 respondents (83.5%).

The HRQOL weights [$V_x(k)$] in 1992 and 1995/96 (the data from 1995 and 1996 were pooled, since there was no difference in weights between the years) were calculated as average 15D scores separately for men and women in 5-year intervals (15-19 years, 20-24 years, ..., 75 years). Considering equation (2) it was thus assumed that the respondents' 15D score v_H measured cross-sectionally would prevail for the whole year (k_{Hx}=1).

When calculating the average 15D scores and 15D profiles for the whole population aged 15 and over in 1992 and 1995/96, the final samples were made comparable and compatible with the age and gender structure of the whole adult population of that age in 1992 (Statistics Finland 1993) by appropriate weighting. Differences between the groups or years in variables of interest were tested by independent samples t-test.

Yet another cross-sectional population survey was organised in November-December 1992, where HRQOL was measured by EuroQol. The main purpose of the survey was to elicit the valuations for deriving the EuroQol single index scores. The valuation tasks were carried out with self-administered postal questionnaires with one reminder and a new questionnaire sent about two weeks after the original mailing. A stratified random sample (n=4000) of the Finnish population aged > 16 years was drawn from the National Population Register. In addition to the valuation tasks, the respondents also completed the EuroQol health state descriptive system (2374 completely = 59.3%) and reported some background data (age, gender, etc.) (Ohinmaa and Sintonen 1996).

The Canadian approach

The Canadian calculations of HALE are based on a different technique. They have used a standard Sullivan technique, where the quality weights, by 10 year age group and gender, are multiplied by the sum of the life table stationary person-years for tha same age and gender groups. Total life years lived and quality-adjusted life years are then divided through by initial age-specific cohort survivors to obtain LE and HALE. The underlying mortality data have come from the 1990-1992 detailed life tables (Roberge et al. 1997, Wolfson 1996) and from 1994 abridged table (Roberge et al. 1996).

The age-gender specific quality weights needed in the calculations are claimed to be derived by using the Health Utility Index Mark II (HUI:2).

In the Canadian applications a population sample of the 1994-95 National Population Health Survey (covering both household and institutional population) aged 15 years and over filled in the HUI health state descriptive system (questionnaire) (n=19000) (Roberge et al. 1997). When these HRQOL data were combined with 1990-92 LE, Wolfson (1996) refers to the result as ”HALE in 1990-92”, whereas Roberge et al. (1997) speak of ”HALE in 1994”. It is to be noted though that the quality weights used in this paper do not include the insitutional population contrary to what is claimed in the paper (Roberge 1998, personal communication). Roberge et al. (1996) speak of ”HALE in 1994” also when they used the 1994-95 HRQOL data, but substituted the LE based on the 1994 life table for that based on 1990-92 life table.

5. Results

The average cross-sectional HRQOL scores for men and women in 10 year age groups with different instruments in the survey years in Finland and Canada are shown in table 1. The 15D scores and EuroQol scores in 1992 are quite close to each other in all age groups apart from the 15D scores for females in age groups over 65 years, which are somewhat higher. The reason for this may a relatively small number of 15D responses in these age groups. There is a clear tendency for the 15D scores in 1995/96 to be higher than the 1992 scores in most age groups and for both sexes. When the Finnish 15D scores in 1995/96 are compared with the Canadian HUI score in 1994/95 the latter tend to be lower in all age groups for both sexes.

Table 1. The average HRQOL scores for men and women in 10 year age groups with different instruments in the survey years in Finland and Canada

	FINLAND						CANADA	
Age	EuroQol 1992		15D 1992		15D 1995/96		HUI 1994/95	
groups	Females	Males	Females	Males	Females	Males	Females	Males
15-24	0.96	0.95	0.95	0.96	0.97	0.98	0.92	0.93
25-34	0.95	0.93	0.94	0.95	0.96	0.96	0.92	0.93
35-44	0.91	0.94	0.93	0.92	0.95	0.95	0.91	0.92
45-54	0.89	0.88	0.90	0.90	0.92	0.93	0.87	0.89
55-64	0.84	0.86	0.88	0.84	0.89	0.89	0.86	0.87
65-74	0.81	0.83	0.86	0.81	0.86	0.86	0.83	0.85
75-84	0.76*	0.77*	0.84*	0.78*	0.78*	0.79*	0.76	0.81
85 +							0.64	0.71

* For age group 75 +

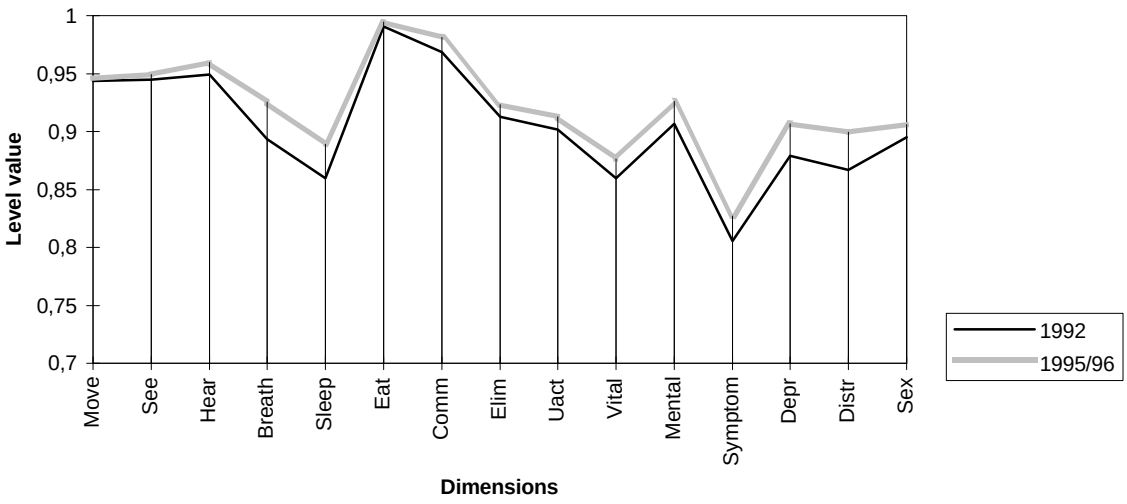
The age-gender-standardised average cross-sectional 15D score of the Finnish population aged 15 and over was 0.908 in 1992 and 0.924 in 1995/96 suggesting a statistically significantly better HRQOL in the latter year (p=.000). In

1992 the average score for men was 0.906, for women 0.909, and in 1995/96 for men 0.931, for women 0.916 (p=.000).

The average 15D profiles of the population aged 15 and over in 1992 and 1995/96 are shown in Figure 2. The figure indicates that the population has problems primarily on the dimensions of symptoms and discomfort, sleeping, vitality, distress, depression and sexual activity. The data suggest a statistically significant improvement ($p < .01$) from 1992 to 1995/96 on the dimensions of breathing, sleeping, communication, vitality, mental function, symptoms and discomfort, depression and distress. There was no deterioration on any dimension.

Table 2 shows the LEs and HALEs for Finnish and Canadian males and females at age 15 in different years. From 1992 to 1995/96, the LE of women at age 15 has risen 1 year and that of men 1.2 years in Finland. In HALE the increase has been even more marked: 1.4 QALYs for women and as much as 2.5 QALYs for men. The QALY deficit or burden of ill health, defined as the difference between LE (assumes implicitly perfect HRQOL) and HALE and being around 9% in 1992 has reduced to about 8 % for women and 7% for men in 1996. The gain in HALE seems

Figure 2.The 15D profiles of Finnish population in 1992 and 1995/96



to be attributable both to a decrease in the age-specific probabilities of death and to an improvement in HRQOL, but the change in both respects appears to be clearly more marked for men. The HALE estimate for men at 15 in 1992 is the same regardless of whether quality weights based on the 15D, EuroQol or Canadian weights are used, whereas for women the HALE varies between 57.1 and 58.9 depending on which set of weights is used.

Table 2. The LE and HALE for Finnish and Canadian males and females at age 15 in different years

	FINLAND		
	Females	Males	Difference
LE 1992	64.8	57.6	7.2
LE 1996	65.8	58.8	7.0
Change in LE from 1992 to 1996	+1.0	+1.2	
HALE 1992/15D	58.9	52.1	6.8
HALE 1996/15D	60.3	54.6	5.7
Change in HALE from 1992 to 1996/15D	+1.4	+2.5	
LE 1992 - HALE 1992/15D	5.9 (9.1%)	5.5 (9.5%)	
LE 1996 - HALE 1996/15D	5.5 (8.4%)	4.2 (7.1%)	
HALE 1992/EuroQol	58.1	52.1	6.0
HALE 1992/Canadian quality weights	57.1	52.0	5.1
	CANADA		
LE 1990-92 (Wolfson 1996, Roberge et al. 1997)	66.6	60.3	6.3
LE 1994 (Roberge et al. 1996)	66.8	60.9	5.9
Change in LE from 1990-92 to 1994	+0.2	+0.6	
HALE in 1990-92/HUI (Wolfson 1996)	57.4	53.7	3.7
HALE in 1994/HUI (Roberge et al. 1996)	57.8	54.2	3.6
Change in HALE from 1990-92 to 1994	+0.4	+0.5	
LE 1990-92 - HALE 1990-92	9.2 (14%)	6.6 (11%)	
LE 1994 - HALE 1994	9.0 (13%)	6.7 (11%)	
HALE 1990-92/15D Finnish quality weights 1992	59.5	53.3	6.2

The LE at 15 seems to be a little higher in Canada than in Finland for both sexes, but particularly for men and the gain in LE is less in Canada than in Finland in the early 90's. However, the Canadian LE figures for 1990-92 and 1994 are not strictly comparable, since they are based on different life tables (Roberge 1998, personal communication). It is therefore also to some extent unclear, whether the small gain in HALE in Canada between 1990-92 and 1994 is due to a real LE gain or different quality weights, since the samples for calculating the quality weights were to some extent different on both occasions. The QALY deficit or burden of ill health appears to be somewhat bigger than in Finland, being 11-14%. Substituting Finnish 15D quality weights for Canadian HUI weights leads to a lower HALE for men, but to 2 QALYs higher HALE for women in 1990-92.

6. Discussion

The Finnish results suggest that there has been a marked increase in LE at age 15 from 1992 to 1996 and an even more marked increase in HALE, especially for men. It thus appears that both length of life and HRQOL have increased during that period. But how could these changes be explained and how plausible they are?

The mortality data, on which the LEs are based, are the total final data observed in the country and are thus highly reliable. In that sense the reliability of LEs is beyond doubt.

The reliability of the HRQOL data is of course much more uncertain. The sample sizes were relatively small in many age groups, especially in the 1992 survey with the 15D. It cannot be completely excluded that the measured average 15D scores for different age groups could have arisen by chance. Especially the average 15D scores in the older age groups for women in 1992 may be biased upwards in the light of other measurements. Also population frame for sampling was to some extent different in 1992 and 1995/96. The 1992 sample was drawn from the whole population aged more than 16 years, whereas the 1995 sample was drawn from population aged 15 years and over by excluding the permanently institutionalised population. Theoretically at least the 1992 sample could thus include sicker people and produce thus lower 15D scores.

On the other hand the main purpose of the 1992 survey was to elicit the necessary valuations for deriving the 15D single index scores. The relatively cumbersome and complicated valuation tasks may have given rise to a selection effect for example so that better educated and healthier people completed and returned the questionnaires to a greater extent than poorly educated. Should this be the case the 1992 sample would exhibit upwards biased 15D scores. Of course it is also possible that sick people are more motived to complete the questionnaires, which would lead to an opposite bias.

Although the final samples were made comparable and compatible with the age and gender structure of the whole adult population in 1992 by accurate weighting before calculating the average 15D scores and 15D profiles for the whole population in 1992 and 1995/96, the samples may still differ in terms of some other important variables, for example education. Unfortunately it was not possible to take the weighting further than what we did. Yet future surveys should pay attention to possibilities of extending weighting also to other variables and first of all the sample sizes should be larger.

There is one factor between the samples that cannot be standardised afterwards, namely the time of HRQOL data collection. In 1992 it took place in late autumn (November-December), whereas in 1995 in late spring, early summer (May-June). In late autumn people quite likely suffer more from season-related illnesses (common colds etc.) so at that time of year people are probably on average sicker than in spring, biasing the 15D scores downwards.

The lesson here is that for more valid comparisons between years, the population frame for sampling and the sampling principles should be the same in different years, and the samples sizes bigger than those so far in Finland. Also the time and way of data collection as well as the content of the questionnaire should be standardised.

In spite of these reservations with the Finnish data, it is still plausible that an improvement in HRQOL would have taken place between 1992 and 1995/96 in Finland, especially among men. In 1992 Finland was on the bottom of perhaps its worst economic recession ever. The volume of production and real disposable income had declined and the rate of unemployment increased rapidly. The uncertainty over the future was great. By 1996 the economy had recovered substantially. This may have contributed to a better HRQOL, since the biggest improvement in health status appear to have taken place on dimensions such as depression, distress, sleeping and vitality as figure 2 shows. These dimensions may well be affected by economic and social circumstances.

Also the Canadian data obviously leave something to be desired. For example the mortality data and the quality weights do not necessarily come from the same year. Evidently the changes in length and quality of life in the early 90’s have been smaller than in Finland. However, it is not possible to make any strict comparisons between HALE in Finland and Canada for several reasons. The population frame for sampling and the principles for sampling may have been different in these two countries (for example there was a special survey in Canada for the institutionalised population). The technique of HRQOL data collection was different (interviewer-administered in Canada, postal survey in Finland) and different may also have been the time of the year when the data were collected. The health state descriptive systems of the 15D and HUI are to some extent different and the valuations for these HRQOL instruments have been elicited from different samples with different techniques.

The somewhat greater QALY deficit or burden of ill health in Canada suggested by the results is also probably explained by these methodological differences rather that by the Canadian being sicker than the Finns. Yet in spite of these numerous sources of potential incomparability the Finnish and Canadian quality weights are remarkably similar and so are the results.

The purpose of this paper is primarily to describe the development in population’s health in recent years in Finland and Canada by using LE, HRQOL and their combination, HALE, as indicators. It is hoped that this paper demonstrates convincingly the usefulness and versatility of that approach as a tool for following up the development in population's health and possibly for assessing the performance of health policy at a macro level. For that purpose a longitudinal National Population Health Survey, expected to last 20 years was launched in Canada in 1994, and in that survey HRQOL is due to be measured every two year (Roberge et al. 1996). Unfortunately there is no gold standard for the measurement of HRQOL. The debate continues over which is the most appropriate health state descriptive systen for defining health states and the most suitable technique for eliciting quality weights for them. More

methodological work is needed to establish the relationship between different instruments and the comparability of results obtained with them.

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