Temporal change in health-related quality of life:
a longitudinal study in general practice 1999–2004

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ABSTRACT

Background
In order to assess and plan for changing healthcare needs, the lack of available information regarding temporal changes in the health-related quality of life of a population must be addressed.

Aim
This paper aims to describe such changes over 5 years in a general population.

Design of study
Longitudinal postal questionnaire study.

Setting
UK general practice.

Method
This was a longitudinal postal questionnaire study in two general practice populations, using the generic instrument EQ-5D to measure health-related quality of life. Individuals were included if they responded to three postal surveys in 1999, 2001, and 2004 and there were three consecutive values of EQ-5D$_{index}$ available between 1999 and 2004.

Results
A total of 2498 subjects were included in the study. After adjustment for potential confounders (including ageing), health-related quality of life declined significantly over the observation period. The change in EQ-5D$_{index}$ was from 0.79 to 0.74 and for EQ-5D$_{vas}$ 76.8 to 73.3 (*P* for both trends <0.001).

Conclusion
Health-related quality of life deteriorated in these populations over 5 years. In an era of improvements in mortality, this has important implications for the use of health-related quality of life data in healthcare planning and resource allocation.

Keywords
chronic disease; EQ-5D; health related quality of life; temporal trend.

INTRODUCTION

To assess the changing health needs of a population and to evaluate the extent to which patients' health-related quality of life (HRQoL) benefits from health care, it is generally agreed that a systematic structured approach is needed.[1] For this purpose, generic HRQoL measures such as EQ-5D have been developed.[2] In contrast to disease-specific instruments, these can compare quality of life in populations, regardless of disease.

EQ-5D has been used in cross-sectional studies in both general populations[3–5] and those with specific morbidities.[6–9] So far, however, there has been no report of any long-term longitudinal study in the UK, although two British population surveys described follow-up of 1 year.[1,10] A recent study from Sweden reported a deterioration over 4 years in HRQoL of women of all ages, and in younger men.[11]

METHOD

The aim of this study was to compare the temporal changes in health-related quality of life in three postal surveys. This study formed part of a larger long-term epidemiological study looking at a

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How this fits in

Health-related quality of life deteriorated in the general practice populations over 5 years. In an era of improvements in mortality, this was unexpected and has important implications for the use of health-related quality of life data in healthcare planning and resource allocation. Although one Swedish study using EQ-5D$_{index}$ which observed a similar deterioration in health status using two time periods was identified, there would appear to be no other reports of the use of EQ-5D over three time points.

population of patients registered with two general practices in South Manchester focusing on respiratory symptoms (WYCAP).[12] Two questionnaires, a respiratory questionnaire based on the European Community Respiratory Health Survey,[13] and an EQ-5D,[1,2] were sent to all adult patients registered with the general practices in three separate surveys in 1999, 2001, and 2004.[12] EQ-5D consists of two parts. The first part records self-assessed health status according to five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension is divided into three levels: no problem, some problems, and severe problems. A unique health state can be expressed by combining the different level from each dimension. This is then transformed into a weighted health state index score (EQ-5D$_{index}$) using a tariff of values derived from valuation exercises carried out in general populations.[14] The second part records the responders' overall assessment of their health on a 20 cm visual analogue scale (EQ-5D$_{vas}$). In both cases, a larger number represents better HRQoL. Using information from EQ-5D, judgements can also be made about the most efficient way to use available resources to improve the health of the population.

The methodolology of these postal surveys and the practice demographics are described in previous publications.[12,15,16] The results from EQ-5D will be considered further here.

Analysis

Only those subjects with three consecutive values of EQ-5D$_{index}$ available between 1999 and 2004 were included in the present analyses. Mean EQ-5D$_{index}$ and EQ-5D$_{vas}$ scores were calculated, and changes over time were determined by longitudinal analysis using a generalised estimating equation (GEE) regression model, which appropriately and efficiently assesses subject-specific temporal changes, implemented with STATA software. Significant changes and trends over time, with their associated confidence intervals (CIs), were derived from the coefficients of the GEE regression model, using the robust Huber–White sandwich estimator of variance. Adjustment was made for a number of possible confounding factors, namely age, sex, smoking status (current, ex, never), education beyond 16 years (yes/no) and degree level education (yes/no).

RESULTS

The response rate to the three postal surveys after adjustment for 'ghosts' was 69.4% in 1999, 69% in 2001, and 46.9% in 2004. A total of 9447 subjects, for whom sufficient data were available to calculate EQ-5D$_{index}$ for at least one survey, were considered for this study. For 2498 (26.4%) of these, EQ-5D$_{index}$ was available for all three questionnaires and these were the subjects included in the present analyses. They were significantly older and had fewer ever-smokers than the excluded group, mean age 50.6 versus 41.7 years (difference 8.9 years, 95% CI = 8.0 to 9.8 years), proportion of ever smokers 60.9% versus 64.6% (difference 3.7, 95% CI = 1.2 to 6.1).

Subjects included in the study were older than the general population sample used to derive UK population norms for EQ-5D,[17] with the proportion aged ≥45 years 61.6% versus 52.3% (difference 9.3%, 95% CI = 6.7 to 11.8). There was no significant difference in sex, with the proportion of males being 44.3% and 43.2% respectively (difference 1.1, 95% CI = −1.5 to 13.6). Mean EQ-5D$_{index}$ was significantly lower in the study sample compared with the UK norms population: 0.79 versus 0.86 (difference 0.07, 95% CI = 0.06 to 0.08).

Age, sex, and smoking status were all found to significantly affect both EQ-5D$_{index}$ and EQ-5D$_{vas}$ scores, but analysis of the effect of educational status on EQ-5D gave mixed results (Table 1). Age had a negative effect (P<0.001), with an average decrease in EQ-5D$_{index}$ for each year of increase in age of 0.0048 and for EQ-5D$_{vas}$ of 0.294. On average, males had higher scores than females, with a difference of 0.034 on EQ-5D$_{index}$ and 1.79 on EQ-5D$_{vas}$.

Ex-smokers and never smokers had higher HRQoL scores compared to current smokers, on both EQ-5D$_{index}$ and EQ-5D$_{vas}$.

There was a significant decline in mean EQ-5D$_{index}$ (Table 2) over the 5-year observation period, from 0.79 to 0.74, (P<0.001), with an estimated annual average decrease of 0.01 (95% CI = 0.008 to 0.012). This trend persisted after adjusting for age, sex, smoking status, and educational level in GEE regression analysis, with an adjusted annual average decrease of 0.0048 (95% CI = 0.0028 to 0.0068), P<0.001 (Table 2).

Similar results were found when EQ-5D$_{vas}$ was examined, with a decrease from 76.6 to 73.3 over the observation period (P<0.001), and an estimated

Table 1. Changes in HRQoL by age, sex, smoking, and education with 95% confidence intervals (CI) and significance levels.

	Difference in EQ-5D$_{index}$ (95%CI)	*P*-value	Difference in adjusted yearly difference in EQ-5D$_{vas}$ (95%CI)	*P*-value
Yearly increase in age	–0.0048 (–0.0053 to –0.0042)	<0.001	–0.294 (-0.332 to –0.257)	*P*<0.001
Male sex	0.034 (0.014 to 0.053)	0.001	1.79 (0.53 to 3.05)	0.005
Ex versus current smoking	0.034 (0.015 to 0.052)	<0.001	2.57 (1.14 to 4.00)	<0.001
Never versus current smoking	0.064 (0.042 to 0.085)	<0.001	6.19 (4.71 to 7.67)	<0.001
Degree education	–0.023 (–0.043 to –0.003)	0.025	Not significant	0.540
Continued education	Not significant	0.190	1.46 (0.30 to 2.62)	0.014

The P-values were derived from the GEE regression models, and correspond to the significance of the specific regression coefficients (using the robust Huber–White sandwich estimator of variance).

annual average decline of 0.696 (95% CI = 0.557 to 0.836). This, too, remained significant after adjustment for the same possible confounding factors, with an adjusted annual average decrease of 0.365 (95% CI = 0.215 to 0.515), *P*<0.001 (Table 2).

DISCUSSION

Summary of main findings

This study has shown a decline in HRQoL in a general population over a 5-year observation period. This remained significant even after adjusting for potential confounders: ageing of the population, sex, and smoking status, and applied whether a societal valuation of HRQoL (EQ-5D$_{index}$ derived from a combination of five dimensions) or an individual valuation (EQ-5D$_{vas}$) was considered. This is an important and unexpected finding, as socioeconomic conditions and affluence in the UK have generally improved and HRQoL could be expected to be better as these factors improve. Browning *et al* found that HRQoL improved in relation to income and education, but did not find an association between poor HRQoL and unemployment.[18]

There are several possible reasons for a decline in HRQoL over time. First, improvements in medical care have led to more people surviving events such as strokes and myocardial infarctions, with the effect of more people being alive but with increased overall morbidity and, therefore, reduced HRQoL. Secondly, expectations and perceptions regarding HRQoL may have changed; this may partially explain the greater decline seen on EQ-5D$_{vas}$, as this measure records the individuals status in relation to 'best imaginable health state'. This may be associated with the recent trend towards medicalisation of conditions (largely driven by the availability of treatments),[19] for example, the lowering of blood pressure targets for hypertension means that more patients have a label for a disease that was not causing them any current symptoms. Thirdly, other factors that affect HRQoL but were not measured in these surveys may have changed, for example the prevalence of obesity.[20]

Strengths and limitations of the study

Selection bias must be considered when interpreting the study findings. Although the group included in the analyses was older and contained fewer smokers than the subjects excluded, the results were adjusted for these potential confounders. Response rates to the postal analysis from another paper[21] on this study show responders in both 2001 and 2004 were older (mean 48.5 versus 37.6 years *P*<0.001 [2001]; 50.5 versus 38.8 years *P*<0.001 [2004]) and more likely to be female (54.9% versus 44.9% *P*<0.001 [2001]; 55.3% versus 48.5% *P*<0.001 [2004]). Early responders were older, and more likely to be female, but less likely to smoke than those who responded to reminders. There was no important association between respiratory symptoms, and associated feature prevalence and stage of response.[21] However, if those who are most ill are least capable and therefore least likely to respond to repeated surveys (or indeed to any postal survey), the resulting response bias would in fact cause an underestimate of the decrease in HRQoL. Ceiling effects on EQ-5D (particularly due to the modelling algorithm for calculating EQ-5D$_{index}$), as reported elsewhere,[22–24] may also have contributed to this potential underestimate.

Table 2. Trends in mean EQ-5D$_{index}$ and EQ-5D$_{vas}$ over time.

All subjects	1999	2001	2004	*P*-value	Adjusted yearly decrease (95% CI)
n	2498	2498	2498		
Mean EQ-5D$_{index}$	0.79	0.78	0.74	<0.001	0.0048 (0.0028 to 0.0068)
SD	0.28	0.28	0.30		
n	2429	2436	2368		
Mean EQ-5D$_{vas}$	76.6	75.9	73.3	<0.001	0.696 (0.557 to 0.836)
SD	19.5	19.4	19.4		

Comparison with existing literature

There would appear to be no other reports of the use of EQ-5D over three time points, which adds considerably to the reliability of assessments of trend.[25] However, a Swedish study using EQ-5D$_{index}$ also observed a smaller deterioration in health status over time in both men and women of all age groups.[11]

In addition to statistical significance, it is also essential to assess the importance of the changes found; given the relatively large population studied, small degrees of change could be statistically significant. Although some studies have addressed this problem and examined minimal important difference (MID)[26] and clinically significant change[27] in HRQoL, they have generally included only subjects who had one specific morbidity. Extrapolating figures from a study comparing the respiratory disease-specific St George's respiratory questionnaire (SGRQ),[27] with EQ-5D, a clinically significant change in EQ-5D$_{index}$ would be 0.08 and in EQ-5D$_{vas}$ 9.08.[28] The MID for EQ-5D$_{vas}$ has not been widely studied, but one estimate is as low as 3.0.[29] There are few reports, so far, of what changes are important in a general population, which includes a majority of healthy people in addition to those with a number of different single and multiple pathologies.

Implications for future research or clinical practice

The use of a generic measure of HRQoL, in this case EQ-5D, enabled the assessment of temporal change to be made irrespective of specific morbidity. HRQoL measures such as EQ-5D are often used to measure the benefit of healthcare interventions, and to ascribe economic value to different health states by conversion to utilities. This is a vital step in assessment of clinical effectiveness, and is recommended by bodies such as the National Institute for Health and Clinical Excellence (NICE).[30] The same measure could be used to compare temporal change in HRQoL of groups of people with different morbidities and also multiple pathologies in one or several populations.

Differences in the rate of change between different morbidities and populations must be taken into account in assessing and planning healthcare needs and resource provision for the population, and it is therefore important to corroborate these unexpected findings of a decline in HRQoL with further research into the temporal change.

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Ethical approval

Ethical approval for the three surveys was obtained via South Manchester Local Research Ethics Committee

Competing interests

Michelle L Hazell has received a fee from Boehringer Ingelheim for speaking, and travel grants from GSK, Boehringer Ingelheim, and MSD. Julie A Morris has no conflicts of interest; Mary F Linehan has received travel grants from GSK. Timothy Frank has received fees from GSK, Boehringer Ingelheim, Schering Plough, and Astra Zeneca for speaking, funds for research from GSK, Boehringer Ingelheim, MSD, and Schering Plough, funds for consultancy from GSK and Pharmacia, and travel grants from GSK, Boehringer Ingelheim, Astra Zeneca, Chiesi Pharmaceuticals, and MSD

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