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A comparison of health-related quality of life of elderly and younger insulin-treated adults with diabetes

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Abstract

Background: diabetes is a significant disease of elderly people, an age group whose numbers will double over the next 20–30 years. Yet studies which assess diabetes-related quality of life have rarely included elderly participants.
Objectives: to compare and contrast the health-related quality of life of elderly (≥ 65 years) and younger individuals with diabetes using reliable and valid assessment tools.
Methods: 191 adults (≥ 30 years) with diabetes currently on an insulin regimen were recruited. Medical and demographic data were gathered from the medical chart. Participants completed a generic quality of life measure (SF-36) and 3 diabetes-specific measures. Statistical analyses compared adults (30–64 years) to elderly adults (≥ 65 years).
Results: on the generic SF-36, physical and mental summary scores did not differ. However, elderly participants reported greater role limitations due to physical problems, and better social function. On diabetes-specific measures, elderly participants reported higher satisfaction with diabetes-related aspects of their lives, less diabetes-related emotional distress, and better ability to cope with their diabetes.
Conclusions: the differences that did emerge between the two groups suggest that, though experiencing more limitations in their ability to function in their roles, elderly individuals with diabetes may still feel that they can cope with these limitations and thus manage the distress and lifestyle demands of the diabetes. The value of subscale analysis of the SF-36 and use of diabetes-specific health-related quality of life measures is also affirmed.

Keywords: *diabetes mellitus, quality of life, elderly, SF-36*

Introduction

Diabetes is a significant disease in advancing age. A United States survey found 19% prevalence in those aged 65–74 [1]; elderly people represent more than half of individuals with diabetes in a United Kingdom sample [2]. There is significant variance across ethnic groups, i.e., in the 60–74 age group, 11.3% of Caucasian-, 20.9% of African-, and 24.4% of Mexican-Americans have diagnosed diabetes [3]. Another 20–25% meet criteria for impaired glucose tolerance, 20–30% have undiagnosed diabetes [4, 5], leaving 25–40% of older adults with normal glucose tolerance [6].

In 20–30 years, the number of adults over 65 will double and the incidence of diabetes will soar [7]. The largest percentage increase will be in those ≥ 75 years [8]. Furthermore, increased life expectancy means more will suffer impaired quality of life due to complications. Older people with diabetes experience substantial co-morbidity [2, 9], physical disability [10] and psychosocial morbidity including impaired cognitive function [2, 11], poorer social independence [2], and increased medical service use [12]. These factors have led some to recommend treatment guidelines specific to elderly adults [13].

The majority of research on diabetes focuses on blood glucose (glycemic) control as the major endpoint and most significant outcome. Although one study found some positive changes in health-related quality of life (HRQoL) after short-term (12 weeks) treatment [14], it has been somewhat surprising to find that, in most studies that have looked at the relationship between improved glycemic control and quality of life, no direct relationship has been demonstrated [15–18]. Thus, it has been argued that HRQoL is important to assess independent of glycemic control, as it defines how patients live and cope with their illness [19, 20].

Researchers are beginning to explore HRQoL of elderly patients with diabetes. However, diabetes-specific HRQoL measures have not included elderly patients in validation samples. The average age in the landmark Diabetes Control and Complications Trial (DCCT), introducing the Diabetes Quality of Life Scale (DQOL), was 28 ± 7 (range = 13–40) [21]. A study comparing the DQOL to the Medical Outcomes Study Health Survey (SF-36) reported average ages of 44 ± 16 (type 1) and 60 ± 12 (type 2) [22]. The Appraisal of Diabetes Scale (ADS), a measure of cognitive appraisal, was developed with a male population, average age of 58 [23]. Similarly, the Problem Areas in Diabetes scale (PAID), a measure of diabetes-related psychosocial distress, assessed participants with average ages of 36.3 [24] and 52.3 [25].

Studies using generic HRQoL measures have shown greater functional impairments in groups of elderly diabetes patients compared to same-age controls [26, 27]. Wandell and Tovi found that a group of Swedish elderly diabetes patients scored worse on 7 of 13 generic HRQoL scales [28].

The purpose of this study was to compare HRQoL of elderly (≥ 65) to younger individuals with diabetes using generic and diabetes-specific tools.

Methodology

Participants

One hundred and ninety-one adults with diabetes, ≥ 30 years, were recruited at the Joslin Diabetes Center, SUNY Upstate Medical University, Syracuse NY. We chose 30 as cut-off to minimise the confounding effect of diabetes type, as most younger patients have type 1 diabetes. Participants had diabetes for > 1 year, had no current psychiatric disorder, and were able to provide written informed consent. Only participants on an insulin regimen were included to minimize effect of type of treatment. A total of 280 eligible individuals were approached, 191 completed questionnaires, a 68% response rate. The chart was reviewed, providing demographic (age, race, gender, marital status, work status) and illness information (diabetes type, duration of diagnosed diabetes, number of complications). Participants did not differ significantly from non-participants on these demographic or illness variables. The study was approved by the Institutional Review Board of SUNY Upstate Medical University.

Glycemic control

Assessed by measuring glycated haemoglobin levels (HbA1C) using the Abbott IMX Glycated Hemoglobin Assay; HbA1C reflects average blood glucose over the preceding 3 months, and is widely accepted as a reliable and valid index of blood glucose control [29].

Health-related quality of life measures

Three measures (SF-36, DQOL, PAID) were chosen because, at time of data collection, they were believed to be excellent measures of their respective domains, i.e., SF-36 measures multiple domains that define HRQoL, and PAID and DQOL assess specific quality of life issues related to diabetes. ADS was chosen because the authors have used it in prior studies and found it to be valuable, a brief measure that provides a snapshot of diabetes-related coping.

Medical outcomes study health survey (SF-36)

This 36 item scale measures 8 aspects of functional health status: physical function, social function, pain, general health, mental health, vitality, and role function limitations due to physical or emotional problems [30]. Extensive use with chronically ill patients [31, 32], significant correlations with other HRQoL measures, and adequate internal consistency reliabilities (0.81–0.88) support its use [33].

Diabetes quality of life scale

The 46-item DQOL assesses diabetes-specific satisfaction, impact and worry [21]. Cronbach alphas reported for scales (0.67–0.92), test-retest reliabilities (0.80–0.90) and significant correlation with HRQoL measures support its reliability and validity [34]. As many of the 'worry' items are not relevant to older people, this scale was omitted.

Problem areas in diabetes scale

This 20-item measure of diabetes-specific emotional distress has high internal reliability (alpha = 0.95) and strong concurrent and discriminant validity [24, 25].

Appraisal of diabetes scale

This 7-item scale assesses thoughts about coping with diabetes. Internal consistency (alpha = 0.73) and test-retest reliability ($r = 0.85$, $P < 0.0001$) are good, while strong correlations with measures of anxiety, anger and diabetes-related hassles support its use [23].

Analyses

Physical Composite Scores (PCS) and Mental Composite Scores (MCS) were calculated for the SF-36, as previously described [35]. The PCS measures general physical health status, the MCS measures general mental health status.

We split participants into two groups, participants aged 30–65 and those 65 years or older. Continuous participant characteristics were compared between the two groups using the Student's *t*-test, categorical variables were compared with Pearson's Chi-square test with Yate's continuity correction.

Initially, the means of each HRQoL measure were compared between groups using a one-way analysis of variance (ANOVA). Since several participant characteristics were unevenly distributed between the groups, we performed a multi-way analysis of co-variance (ANCOVA) where age was the classification factor and HRQoL was the dependent variable. Participant characteristics that were marginally predictive ($P \leq 0.20$) of age were entered into the multi-way ANCOVA in a forward stepwise fashion and tested at the 0.15 level of significance. To confirm the independent association between HRQoL and age, we were liberal in setting the entry criteria (i.e., $P \leq 0.15$) of participant characteristics into the model.

Since some HRQoL measures were not strictly normally distributed, normal scores were calculated from the original dependent variables. The ANCOVA models were re-run to determine whether using normal scores altered the original results. They did not. The robustness of ANCOVA against departures from normality held true for our data.

Since multiple comparisons were conducted, an adjustment to the Type I error rate was made, per hypothesis, to preserve the overall alpha level at 0.05. All primary HRQoL outcome tests of significance were two-tailed, alpha was set *a priori* at 0.05. Data analyses were performed using the SAS software (version 6.12).

Results

Participants

Participants ranged in age from 30–81 years. Sixty-three percent had type 2 diabetes, 51% were male, 95% were white. The majority (61%) were retired; they had been diagnosed with diabetes for an average of 15.8 years. Sixty-nine percent had at least one specific diabetes-related complication, i.e., retinopathy, neuropathy, nephropathy, foot infections, amputations, cardiac disease, and/or stroke. Average HbA1c was 7.9% (S.D. = 1.7%). All participants were using insulin, the type 2 subjects were also prescribed other diabetes-related medications.

Comparisons between the groups (see Table 1) on baseline demographic characteristics showed that the elderly group was less likely to be employed and to have type 1 diabetes, had diabetes for a longer time (18.3 *versus* 13.5 years), and, on average, were in better glycemic control (7.5% *versus* 8.2%). When significant, the factors of diabetes type, duration of diabetes, glycemic control and employment status, as well as other demographic factors (e.g. number of complications) were controlled for in subsequent statistical analyses.

Age and generic HRQoL (SF-36) (Table 2)

The mean PCS for adults was 41.1 (S.D. = 9.2), and for elderly adults was 38.9 (S.D. = 10.1), a mean physical health status below the general population. While significantly lower than a recent finding of 42.6 (S.D. = 11.4) in an elderly Medicare sample [36], these findings are comparable to the published SF-36 norm for individuals with diabetes of 39.30 (S.D. = 11.32) [35]. Controlling for type and complications, the difference in PCS between the groups was not significant ($P = 0.552$). SF-36 subscale analysis found a significant difference on reported role limitations due to physical problems, with elderly participants reporting greater limitation ($P = 0.024$).

The mean MCS for adults was 43.3 (S.D. = 7.9), for elderly adults was 45.2 (S.D. = 7.9), a mean mental health status below the general population. This is lower than published norms for individuals with diabetes of 47.90 (S.D. = 11.37) and significantly lower than a recent elderly sample norm of 53.3 (S.D. = 9.4) [36]. Controlling for HbA1C, the MCS difference between the groups was not significant ($P = 0.492$). Subscale analysis found that elderly adults reported better social function ($P = 0.032$).

Table 1. Subject characteristics according to age

Characteristic	(30–64) years (*n* = 100)	≥ 65 years (*n* = 91)	*P*-value[a]
Age	46.9 ± 8.2	70.5 ± 4.2	
Gender-male	51 (51)	46 (51)	1.000
Race-white	96 (96)	85 (93)	0.523
Married	59 (60)	65 (71)	0.119
Employed	45 (45)	2 (2)	< 0.001
DM type			
Type 1	52 (52)	18 (20)	< 0.001
Duration of DM (years)	13.5 ± 10.2	18.3 ± 11.7	0.003
No. of complications	1.4 ± 1.2	1.7 ± 1.2	0.123
Glycemic control (Haemoglobin A1c)	8.2 ± 1.9	7.5 ± 1.5	0.007

[a]Continuous variables are compared using the Student's *t*-test and expressed as the mean ± standard deviation, whereas categorical variables are compared with Pearson's Chi-square test with Yate's continuity correction and represented as the sum and percentage of the total.

Age and diabetes-specific quality of life (Table 2)

DQOL

Controlling for complications, type and HbA1c, the elderly group reported significantly higher satisfaction with diabetes-related aspects of their lives (71.3 *versus* 63.5, $P = 0.008$), but the groups did not differ on perceived impact of diabetes (68.4 *versus* 66.4, $P = 0.580$).

PAID

Controlling for type and HbA1c, the elderly group reported significantly less diabetes-related emotional distress (56.2 *versus* 72.1, $P \leq 0.001$).

Table 2. Adjusted analyses – quality of life according to age

Quality of life	(30–64) (*n* = 100)	≥ 65 (*n* = 91)	*P*-value[a]	*P*-value[b] (Bonferroni adj)
SF-36				
PCS	41.1 ± 9.2	38.9 ± 10.1	0.138	0.552
Physical Function	62.1 ± 26.8	55.7 ± 29.2	0.129	0.516
Bodily pain	61.3 ± 26.4	59.3 ± 30	0.650	0.650
General health	47.9 ± 14.9	51.8 ± 16.2	0.094	0.376
Role limitations due to physical problems	55.7 ± 36	39.8 ± 39	0.006[a]	0.024[a]
MCS	43.3 ± 7.9	45.2 ± 7.9	0.123	0.492
Social function	50.5 ± 18	58.2 ± 19.5	0.008	0.032[a]
Vitality	50.4 ± 13.5	52.2 ± 14.9	0.397	1.000
Mental Health	59.9 ± 13.2	63.5 ± 13.2	0.072	0.288
Role limitations due to emotional problems	69.2 ± 39.8	54.9 ± 43.1	0.026[a]	0.104
DQOL				
Satisfaction	63.5 ± 16.7	71.3 ± 18.2	0.004	0.008[a]
Impact	66.4 ± 12	68.4 ± 12.9	0.294	0.580
PAID	72.1 ± 24.6	56.2 ± 26.7	< 0.001[a]	< 0.001[a]
ADS	19.7 ± 4.2	18.1 ± 4.6	0.016[a]	0.032[a]

Values are expressed as the adjusted mean ± standard deviation.
[a]ANCOVA was used to control for subject characteristics.
[b]The Bonferroni multiple comparison correction procedure was used to adjust the *P*-value from the ANCOVA models to preserve the overall type I error rate at 0.05.

ADS

Controlling for type, HbA1c and complications, the elderly group reported significantly better appraisal of, or ability to cope with, diabetes (18.1 *versus* 19.7, $P = 0.032$).

Diabetes type and quality of life (Table 3)

Because diabetes type is associated with age, and age predicts some aspects of HRQoL, it is likely that type might also predict quality of life. In all statistical analyses, we controlled for diabetes type. Nevertheless, we felt it worthwhile to look at the relationship between diabetes type and HRQoL. Table 3 indicates that, on the generic SF-36, type 2 participants report significantly poorer physical function (36.3 *versus* 44.7, $P \leq 0.001$), less vitality (48.7 *versus* 53.6, $P = 0.012$) and more role limitations due to emotional problems (51.8 *versus* 72.9, $P = 0.001$), but better social function (59.1 *versus* 49.1, $P \leq 0.001$). On diabetes-specific measures, type 2 participants reported lower satisfaction (62.6 *versus* 69.8, $P = 0.009$). We also tested the interaction coefficient between age and type for each measure and found no statistically significant interactions. This implies that age is not dependent on diabetes type when predicting HRQoL.

Table 3. Quality of life according to diabetes type

Quality of life	Type 1 (*n* = 70)	Type 2 (*n* = 119)	*P*-value
SF-36			
PCS	44.7 ± 10.5	36.3 ± 10.6	<0.001
Physical function	70.1 ± 31.3	50 ± 29.7	<0.001
Bodily pain	69.9 ± 27.7	53.7 ± 28.4	<0.001
General health	51.8 ± 11.6	47.8 ± 16.7	0.059
Role limitations due to physical problems	62.3 ± 42.6	37.6 ± 39.5	< 0.001
MCS	43.4 ± 6.7	44.5 ± 8.6	0.346
Social function	49.1 ± 15.8	59.1 ± 19.3	<0.001
Vitality	53.6 ± 11.2	48.7 ± 14.5	0.012
Mental health	62.1 ± 9.7	61.2 ± 15	0.655
Role limitations due to emotional problems	72.9 ± 40.1	51.8 ± 43.2	0.001
DQOL			
Satisfaction	69.8 ± 16.6	62.6 ± 18.2	0.009
Impact	68.9 ± 13.9	64.8 ± 13.1	0.054
PAID	64.8 ± 26.1	67.1 ± 27.8	0.581
ADS	18.6 ± 4.2	19.7 ± 4.6	0.112

Values are expressed as the mean ± standard deviation.

Discussion

Quality of life of elderly individuals with diabetes was hypothesized to differ from that of younger adults. This was found to be true for certain domains, and most clearly true for diabetes-specific quality of life.

Elderly individuals reported more limitations due to physical problems in ability to function in their roles, but better social function. When diabetes-specific domains were assessed, elderly adults stated they are coping better, and experience less distress and greater satisfaction with aspects of their lives related to diabetes.

It is often assumed that aging is associated with more distress and pessimism, due to physical, social and emotional losses, an assumption supported by classic well-being research [37, 38]. However, recent work has shown that older persons are not unhappier [39, 40], well-being may even improve with age [41–43]; generating the hypothesis that older adults regulate their emotions more effectively and gear their lives towards minimising negative emotions while maximizing positive ones [43]. This hypothesis may help explain our findings. Diabetes is a burdensome disease, involving many lifestyle changes. Our data suggest that maximising coping skills and social resources may help elderly adults cope with the difficult demands of the disease, and maintain lower levels of emotional distress.

Since the study is cross-sectional one cannot state that aging leads to less distress and better coping. This may reflect a cohort phenomenon. Or, people who survive into their 70's may live longer because of distress levels and ways of coping. Only longitudinal studies that follow patients through their life spans will answer these questions. Also, our participants were all on an insulin regimen. The recent finding that insulin-treated individuals score worse on HRQoL measures [26] means that we cannot generalise to non-insulin-treated individuals. Similarly, we do not have specific information about complications and non-diabetic co-morbidities; this limits our ability to explore the impact of these factors on HRQoL and to make comparisons to published norms that might have reflected a different participant sample.

The data points to several measurement issues. It highlights the value of examining SF-36 subscales, and not relying solely on physical and mental composite scores. The PCS and MCS have been criticised for not being independent of each other [44], yet it is becoming common to rely on them. Also, the value of diabetes-specific HRQoL measures, suggested by others [15, 45], has been supported. However, one must question whether these measures, standardised on younger adults, are truly valid with elderly patients, a concern raised by others [46, 47]. Future work should explore the validity of these measures, and pursue the development of HRQoL measures specifically relevant to elderly individuals.

The study suggests that elderly individuals with diabetes face adaptation problems related to declines in ability to function in their roles. However, their coping skills, social relationships or other factors may act as buffers and prevent high levels of distress that often accompany diabetes. Interventions for older adults with diabetes could be designed to build on these strengths.

Key points

- A comparison of health-related quality of life (HRQoL) of elderly and younger insulin-treated adults with diabetes reveals several significant differences.
- Elderly people reported greater general role limitations due to physical problems.
- Elderly people reported less diabetes-specific emotional distress, better coping and satisfaction with diabetes-related lifestyle changes.
- The value of subscale analysis of the SF-36 and use of diabetes-specific HRQoL measures is affirmed.

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References

1. Harris MI, Hadden WC, Knowler WC, Bennett PH. Prevalence of diabetes and impaired glucose tolerance and plasma glucose levels in U.S. population aged 20–74 years. Diabetes 1987; 36: 523–4.

2. Dornan TL, Peck GM, Dow JDC, Tattersall RM. A community survey of diabetes in the elderly. Diabetic Med 1992; 9: 860–5.

3. Harris MI, Flegal KM, Cowie CC *et al.* Prevalence of diabetes, impaired fasting glucose, and impaired glucose tolerance in U.S. adults: The Third National Health and Nutrition Examination Survey, 1988–1994. Diabetes Care 1998; 21: 518–24.

4. U.S. Senate Special Committee on Aging, American Association of Retired Persons, Federal Council on Aging, and U.S. Administration on Aging. Aging America: Trends and Projections. Washington, DC: Department of Health and Human Services, 1991.

5. Franse LV, DiBari M, Shorr RI *et al.* The Health, Aging and Body Composition Study Group. Type 2 diabetes in older well-functioning people: who is undiagnosed? Diabetes Care 2001; 24: 2065–70.

6. Harris MI. Epidemiology of diabetes mellitus among elderly in the U.S. Clin Geriatr Med 1990; 6: 703–19.

7. National Diabetes Data Group. In Harris M ed. Diabetes in America. Bethesda, MD: National Institutes of Health, 1995.

8. Boyle JP, Honeycutt AA, Narayan KM *et al.* Projection of diabetes burden through 2050: Impact of changing demography and disease prevalence in the U.S. Diabetes Care 2002; 24: 1936–40.

9. Moritz DJ, Ostfeld AM, Blazer D, Curb D, Taylor JO, Wallace RB. The health burden of diabetes for the elderly in four communities. Public Health Rep 1994; 109: 782–90.

10. Gregg EW, Beckles GL, Williamson DF *et al.* Diabetes and physical disability among older U.S. adults. Diabetes Care 2000; 23: 1272–7.

11. Reaven GM, Thompson LW, Nahum D, Haskins E. Relationship between hyperglycemia and cognitive function in older NIDDM patients. Diabetes Care 1990; 13: 16–21.

12. Pulsinelli WA, Levy DE, Sigsbee B, Scherer P, Plum F. Increased damage after ischemic stroke in patients with and without established diabetes mellitus. Am J Med 1983; 74: 540–4.

13. Sinclair AJ, Woodhouse K. Meeting the challenge of diabetes in the aged. J Royal Soc Med 1994; 87: 607.

14. Testa MA, Simonson DC. Health economic benefits and quality of life during improved glycemic control in patients with type 2 diabetes mellitus: a randomized, controlled, double-blind trial. JAMA 1998; 280: 1490–6.

15. Tovi J, Engfeldt P. Well being and symptoms in elderly type 2 diabetes patients with poor metabolic control: effect of insulin treatment. Pract Dia Intl 1998; 15: 73–7.

16. Mehta Z. Quality of life in type 2 diabetic patients is affected by complications but not by intensive policies to improve blood glucose or blood pressure control (UKPDS 37). Diabetes Care 1999; 22: 1125–36.

17. DCCT (Diabetes Control & Complications Trial) Research Group. Influence of intensive diabetes treatment on quality-of-life outcomes in the Diabetes Control and Complications Trial. Diabetes Care 1996; 19: 195–203.

18. Weinburger M, Kirkman MS, Samsa GP *et al.* The relationship between glycemic control and health-related quality of life in patients with non-insulin-dependent diabetes mellitus. Med Care 1994; 32: 1171–81.

19. Ormel J, Kempen GI, Deeg DJ, Brilman EI, van Sonderen E, Relyveld J. Functioning, well-being, and health perception in late middle-aged and older people: comparing the effects of depressive symptoms and chronic medical conditions. J Am Geriatr Soc 1998; 46: 39–48.

20. Petterson T, Lee P, Hollis S, Young B, Newton P, Dornan T. Well-being and treatment satisfaction in older people with diabetes. Diabetes Care 1999; 21: 930–35.

21. Jacobson AM, Barofsky I, Cleary P, Rand L. The DCCT Research Group. Reliability and validity of a diabetes quality-of-life measure for the Diabetes Control and Complications Trial (DCCT). Diabetes Care 1988; 11: 725–32.

22. Jacobson AM, DeGroot M, Samson JA. The evaluation of two measures of quality of life in patients with Type I and Type II diabetes. Diabetes Care 1994; 17: 267–74.

23. Carey MP, Jorgensen RS, Weinstock RS *et al.* Reliability and validity of the Appraisal of Diabetes Scale. J Behav Med 1991; 14: 43–51.

24. Polonsky WH, Anderson BJ, Lohrer PA *et al.* Assessment of diabetes-related distress. Diabetes Care 1995; 18: 754–60.

25. Welch GW, Jacobson AM, Polonsky WH. The problem areas in diabetes scale: an evaluation of its clinical utility. Diabetes Care 1997; 20: 760–6.

26. Hiltunen L, Keinänen-Kiukaanniemi S, Läärä E, Kivelä SL. Functional ability of elderly persons with diabetes or impaired glucose tolerance. Scand J Primary Health Care 1996; 14: 229–37.

27. Bourdel-Marchasson I, Dubroca B, Manciet G, Decamps A, Emeriau J-P, Durtiques J-F. Prevalence of diabetes and effect on quality of life in older French living in the community: The PAQUID epidemiological survey. J Am Geriatr Soc 1997; 45: 295–301.

28. Wändell PE, Tovi J. The quality of life of elderly diabetic patients. J Diabetes Complications 2000; 14: 25–30.

29. Nathan DM, Singer DE, Hurxthal K, Goodson JD. The clinical information value of the glycosalated hemoglobin assay. N Engl J Med 1984; 310: 341–6.

30. Ware JE, Sherbourne CD. The MOS 36-item short form health survey (SF-36), I. Conceptual framework and item selection. Med Care 1992; 30: 473–83.

31. McHorney CA, Ware JE, Raczek A. The MOS 36-item Short Form Health Survey (SF-36), II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. Med Care 1993; 31: 247–63.

32. Stewart AL, Greenfield S, Hays RD *et al.* Functional status and well-being of patients with chronic conditions. JAMA 1989; 262: 907–13.

33. McHorney CA, Ware JE, Lu JFR, Sherbourne CD. The MOS 36-item Short Form Health Survey (SF-36), III. Tests of data quality, scaling assumptions, and reliability across diverse patient groups. Med Care 1994; 32: 40–66.

34. Jacobson AM. DCCT Research Group. The diabetes quality of life measure. In Bradley C ed. Handbook of Psychology and Diabetes. Switzerland: Harwood Academic, 1994.

35. Ware JE, Kosinski M, Keller SD. SF-36 Physical & Mental Health Summary Scales: A Users Manual. Boston, MA: The Health Institute, New England Medical Center, 1994.

36. Cooper JK, Kohlmann T. Factors associated with health status of older Americans. Age Ageing 2001; 30: 495–501.

37. Andrews FM, Withey SB. Social Indicators of Well-Being: America's Perception of Life Quality. New York: Plenum, 1976.

38. Ryff CD, Keyes CLM. The structure of psychological well-being revisited. J Pers Soc Psychol 1995; 69: 719–27.

39. Brandstadter J, Greve W. The aging self: Stabilizing and protective processes. Dev Review 1994; 14: 52–80.

40. Filipp SH. Motivation and emotion. In Birren JE, Schaie KW eds. Handbook of the Psychology of Aging. San Diego, CA: Academic Press, 1996: 218–35.

41. Carstensen LL, Turk-Charles S. The salience of emotion across the adult life span. Psychol Aging 1994; 9: 259–64.

42. Lawton MP. Quality of life and affect in later life. In Magai C, McFadden SH eds. Handbook of Emotion, Adult Development and Aging. San Diego, CA: Academic Press, 1996: 327–48.

43. Mroczek DK, Kolarz CM. The effect of age on positive and negative affect: A developmental perspective on happiness. J Pers Soc Psychol 1998; 75: 1333–49.

44. Simon GE, Revicki DA, Grothaus L, Vonkorff M. Are physical and mental health truly distinct? Med Care 1998; 36: 567–72.

45. Woodcock AJ, Julious SA, Kinmonth AL, Campbell MJ. Problems with the performance of the SF-36 among people with type 2 diabetes in general practice. Qual Life Res 2001; 10: 661–70.

46. Brazier JE, Walters SJ, Nicholl JP, Kohler B. Using the SF-36 and Euroqol on an elderly population. Qual Life Res 1996; 5: 195–204.

47. Walters SJ, Munro JF, Brazier JE. Using the SF-36 with older adults: a cross-sectional community-based survey. Age Ageing 2001; 30: 337–43.

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