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*User's Manual for the
Medical Outcomes Study
(MOS) Core Measures
of Health-Related
Quality of Life*

*Ron D. Hays, Cathy Donald Sherbourne,
Rebecca M. Mazel*

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PREFACE

This manual describes 116 health-related quality-of-life items that were developed for patients participating in the Medical Outcomes Study (MOS), a multi-year, nonexperimental study of variations in physician practice styles and patient outcomes in three different systems of care: health maintenance organizations, large multi-specialty groups, and solo fee-for-service practice. The manual provides a brief summary of the measures, and presents psychometric results from the MOS.

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CONTENTS

Preface.....	iii
Tables.....	vii
Summary.....	ix
Acknowledgments.....	xi
1. INTRODUCTION.....	1
2. HISTORY OF THE MOS CORE MEASURES	4
3. HEALTH-RELATED QUALITY OF LIFE MEASURES	6
MOS Core Measures of Health-Related Quality of Life	6
Scoring the MOS Core Measures of Health-Related Quality of Life.....	7
Step One: Data Cleaning	11
Step Two: Item Recalibration and Skip Pattern Recoding	11
Step Three: Item Reverse Scoring	13
Step Four: Transforming Items to a 0-100 Possible Range	15
Step Five: Deriving Scales	15
4. MOS PSYCHOMETRIC PHILOSOPHY FOR HRQOL MEASUREMENT	21
Reliability.....	23
Item Discrimination Across Scales	25
Validity.....	27
Threats to Validity.....	29
Socially Desirable Response Set	29
Acquiescent Response Set	31
5. PSYCHOMETRIC PROPERTIES OF THE MOS CORE MEASURES	32
Reliability.....	32
Item Discrimination Across Scales	32
Validity.....	34
Intercorrelations Among Scales	38
6. MOS MEASURES AND SCALES.....	45
Data Quality of MOS Measures	45
Profiles of MOS Scales	53
Comparison of MOS Core Measures to Short-Form Versions	71
Choosing HRQOL Concepts	71
7. FUTURE ISSUES.....	73
Normalized T-scores.....	73
Profiles and Overall Scores	74
Appendix	
A. CORE SURVEY INSTRUMENT	76
B. SAS [®] STATEMENTS TO READ AND CLEAN DATA, AND TO DERIVE CORE MEASURES OF QUALITY OF LIFE	103
C. SOURCE CODE FOR SAS [®] MACRO, MULTI.....	116

D. T-SCORE TABLES	126
References.....	150

TABLES

1.	Definitions of 116-Item MOS Core Functioning and Well-Being Concepts.....	8
2.	Item Recalibration and Skip Pattern Recoding	12
3.	Item Reverse Scoring	14
4.	Transforming Items to a 0-100 Range	16
5.	Deriving Scales.....	17
6.	Reliability, Central Tendency, and Variability of Core Scales in the MOS.....	33
7.	Example of Item-Scale Correlation Matrix	35
8.	Factor Loadings for Hypothesized Factor Analysis Model	38
9.	Standardized Scoring Coefficients	39
10.	Correlations Among Selected Measures	40
11.	Percentage of Panel Completing the Questionnaire Who Missed Items by Age Group.....	46
12.	Percentage of Panel Completing the Questionnaire Who Missed Items by Illness Severity	50
13.	Percentage of Panel Completing the Questionnaire Who Missed Items by Educational Level	54
14.	Percentage of Panel Completing the Questionnaire Who Missed Items by Gender.....	58
15.	Means for Measures by Age, Education, Gender, and Illness Severity.....	63
16.	Standard Deviations for Measures by Age, Education, Gender, and Illness Severity	65
17.	Adjusted Mean Functioning and Well-Being at Baseline for Medical Specialty Sector Patients	67
18.	Adjusted Mean Functioning and Well-Being Two Years After Baseline for Medical Specialty Sector Patients	68
19.	Adjusted Mean Functioning and Well-Being at Baseline for Mental Health Specialty Sector Patients	69
20.	Adjusted Mean Functioning and Well-Being Two Years After Baseline for Mental Health Specialty Sector Patients	70
D.1.	T-Scores for Measures Developed During the MOS	127
D.2.	Means for T-Scores on Measures by Age, Education, Gender, Illness Severity.....	146
D.3.	Standard Deviations for T-Scores for Measures by Age, Education, Gender, Illness Severity	148

SUMMARY

In recent years, use of the patient's point of view to monitor the quality of medical care has been emphasized. However, evaluation of medical interventions has usually focused on biological outcomes. Health-related quality of life (HRQOL) is increasingly recognized as an important outcome in and of itself and as a supplement to traditional biological endpoints such as mortality.

Among patients, especially those who have chronic, incurable diseases, HRQOL may be the most important outcome to consider when assessing treatment effectiveness. Because the patient is the best source of information about his or her HRQOL, a number of practical tools have been developed that rely on patient self-ratings. An advantage of self-administered questionnaires, such as those described in this manual, is that they are substantially less expensive than interviewer-administered surveys and clinical assessments. They also ensure relative privacy and anonymity for the respondent (which encourages respondents to divulge more private or socially undesirable information), and they have the ability to reach a widely dispersed sample simultaneously.

This is a user's manual for the core measures of HRQOL developed for patients participating in the Medical Outcomes Study (MOS), a multi-year longitudinal, observational study of variations in physician practice styles and patient outcomes in one of three different systems of care: health maintenance organizations, large multi-specialty groups, and solo fee-for-service practice. The MOS core measures may help an investigator or clinician to gather reliable and valid information about the health of individuals, save time and money in obtaining this information, obtain information that could not otherwise be obtained, determine the effectiveness of alternative treatments, and assess the course of health over time.

The core measures include 116 items that were administered to MOS patients. This core includes the 113-item subset of the full-length measures, described as the "MOS Functioning and Well-Being Profile Core"

by Stewart, Sherbourne, Hays et al. (1992). Three additional items were added here to allow for scoring of the widely used SF-36™ or RAND 36-Item Health Survey 1.0 (Hays, Sherbourne, & Mazel, 1993; Ware & Sherbourne, 1992).

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In preparing this manual, we adapted liberally from published MOS materials that we had coauthored. We are particularly indebted to Anita Stewart, whose ideas and wisdom are heavily reflected in the final product.

1. INTRODUCTION

This manual is designed to be a companion to the book *Measuring Functioning and Well-Being: The Medical Outcomes Study Approach* (see Stewart, Sherbourne, Hays et al., 1992). The book describes the conceptualization and development of more than 70 survey measures of functioning and well-being that were developed for the Medical Outcomes Study (MOS). Twelve major concepts of functioning and well-being were represented. A core subset of these measures was defined, including those that appeared to define health most directly and were expected to be affected by treatments for health problems. The manual provides a short description of the background and history of the MOS core measures, describes the scoring of the measures (including programming code), gives descriptive information about them, summarizes their data quality, profiles scale scores by demographic and illness severity characteristics of the MOS sample, and discusses issues related to summarizing scales into an overall score. In addition, the manual expands the discussion of psychometric issues and the MOS approach to scaling analysis provided in the book. This information should be useful for those researchers replicating the MOS procedures in other samples.

Extensive details regarding the MOS are provided elsewhere (Rogers, McGlynn, Berry et al., 1992; Tarlov, Ware, Greenfield et al., 1989; Wells, Hays, Burnam et al., 1989; Wells, Stewart, Hays et al., 1989). To summarize briefly, three study sites (Boston, Chicago, and Los Angeles) with well-established forms of each system of care were chosen from Standard Metropolitan Statistical Areas. Within each system of care, a representative sample of physicians (general internists, family physicians, cardiologists, endocrinologists, diabetologists, psychiatrists), psychologists, and other mental health providers was selected. In the single-specialty solo or small group practice sector, a multi-stage selection process was used. In the first stage, clinicians were initially selected by stratified random sampling from lists provided by national professional associations (N = 2216). Of

these, 69 percent were contacted. In the final stage, 511 physicians were identified as eligible (e.g., were between the ages of 31 and 55 years, were board eligible/certified or licensed for independent practice, and had direct patient care as their primary professional activity), and 298 (58 percent) agreed to participate in the main study. All eligible physicians associated with the MOS health maintenance organizations and large multi-specialty groups were asked to participate in the study, and 85 percent were enrolled (N = 225).

Among participating providers, a representative cross section of their patients was studied. We screened all adult patients visiting one of the MOS clinicians over nine days, on average. We excluded patients who were under age 18, did not speak English, or were physically impaired in a way that would prohibit completing forms (e.g., blind). For each participating physician, a log of all patients scheduled to visit the provider during each day of screening was created, which represented the sampling frame from which patients were drawn. Our final cross-sectional sample included 22,399 patients. Patients screened who appeared to have one or more of four chronic diseases (hypertension, diabetes, heart disease, and depression) and met other eligibility criteria constituted the longitudinal panel (N = 2471). (Note that many reports from the MOS list 2546 as the panel sample size. The 2471 number we use here reflects subsequent decisions about patients who were determined to be ineligible for the panel.) Patients with hypertension, diabetes and heart disease (i.e., recent myocardial infarction and congestive heart failure) were identified based on information supplied by the patient's doctor. This approach was validated using patient reports and laboratory data.

Identification of patients with depression was conducted in a two-stage approach. First, patients completed an eight-item depression symptom scale that measured intensity of symptoms of depression over the past week and periods of depressed mood over the past year (Burnam, Wells, Leake et al., 1988). Persons who exceeded a cut-point on this scale, which has high sensitivity and acceptable positive predictive value for identifying current major depression or dysthymia, were defined as having depressive symptoms. Using additional information

from the Diagnostic Interview Survey, a highly structured diagnostic interview designed to determine the presence of psychiatric disorders according to Diagnostic Statistical Manual (DSM) criteria, we defined current depressive disorder as meeting the following criteria: (1) lifetime major depression or dysthymia according to DSM-III criteria, with bipolar affective disorder excluded; (2) an episode of major depression or period of dysthymia during the last 12 months; and (3) not in remission, with remission defined as eight or more weeks with two or fewer depressive symptoms. Those who met the cutoff for depression using the depression symptom scale, but did not meet criteria for current depressive disorder, were defined as having subthreshold depression or depressive symptoms only.

The information included in this manual is based on a sample of adult (ages 18 and older), English-speaking patients who enrolled in the two-year longitudinal study during the fall of 1986 and who constitute the MOS longitudinal panel (N = 2471). The average age of these patients was 55.5 (standard deviation (SD) = 16.3); 60.5 percent were women; 79.6 percent were white, 14.2 percent black, 3.5 percent Hispanic, 1.2 percent Asian or Pacific Islander, and 1.5 percent were from other ethnic groups. The average educational level was 13.3 years (SD = 2.9).

Patients who enrolled in the MOS were better educated than those who were not enrolled.

2. HISTORY OF THE MOS CORE MEASURES

The MOS core measures represent a culmination of several years' experience in developing HRQOL measures at RAND. The MOS HRQOL measures are generic in that they assess health concepts that are relevant to everyone. The advantage of generic measures is that they can be used to compare the health of different groups, for example, the young and the old or the sick and the well. They can also be used in ways not possible with disease-specific or treatment-targeted measures, such as for comparing the relative burden of different diseases and the relative benefits of different treatments.

Because of the need to screen a large number of patients to identify those with the target MOS tracer conditions, a very brief 20-item battery was used to assess HRQOL for the cross-sectional sample. This 20-item survey, the SF-20, consisted of 18 items used in a 1984 national survey fielded by Louis Harris and Associates (Ware, Sherbourne, & Davies, 1992) plus two items measuring social functioning and bodily pain.

Analyses of the MOS cross-sectional data provided strong support for the reliability of the SF-20 (Stewart, Hays, & Ware, 1988). In addition, cross-sectional analyses supported the construct validity of the SF-20 (Stewart, Hays, & Ware, 1988; Ware, Sherbourne, & Davies, 1992). The SF-20 was shown to be sensitive to known group differences in a random half of 11,000 patients participating in the MOS cross-sectional study. General health perceptions were poorest for patients with congestive heart failure and gastrointestinal disorder, and best for patients with hypertension or back problems (Stewart, Greenfield, Hays et al., 1989). Physical functioning was best for hypertensives and poorest for those with myocardial infarction or congestive heart failure. The worst role functioning was observed for patients with myocardial infarction or congestive heart failure. Social functioning was the worst for patients with either myocardial infarction or congestive heart failure and best for patients with hypertension. Pain was greatest in patients with arthritis, and least for patients with

hypertension. Physical and role functioning of patients with depressive symptoms (with or without unipolar depressive disorder), other factors being equal, was significantly worse than that of patients with hypertension or diabetes and significantly better than that of patients with myocardial infarction or congestive heart failure (Wells, Stewart, Hays et al., 1989). Depressed patients reported worse social functioning and more bodily pain than patients with hypertension, diabetes, and heart disease, and worse perceived current health than patients with diabetes or hypertension.

Nonetheless, enthusiasm for the SF-20 waned in part as a result of a study of hospitalized patients showing that further decrements in HRQOL went undetected for persons who scored at the floor on some of the SF-20 subscales (Bindman, Keane, & Lurie, 1990). These floor effects suggest that the scores yielded by the measure are invalid, at least in some samples, for persons scoring at the bottom of the scale. A second generation short-form, the RAND 36-Item Health Survey 1.0, also known as (a.k.a.) the SF-36™, was developed to improve upon the SF-20 (Hays, Sherbourne, & Mazel, 1993; Ware & Sherbourne, 1992). Items were selected to maximize their associations with the long-form MOS scales from which they came. This survey includes 8 multi-item measures of functioning and well-being (number of items in parentheses): physical functioning (10 items), role limitations due to physical health problems (4 items), role limitations due to emotional problems (3 items), social functioning (2 items), pain (2 items), energy/fatigue (4 items), emotional well-being (5 items), and general health perceptions (5 items). It also includes a single item that provides an indication of perceived change in health during the last year. Internal consistency reliability estimates (Cronbach, 1951) were 0.78 or greater for every scale. Additional empirical studies provide support for the construct validity of the measures (e.g., McHorney, Ware, Rogers, Raczek, & Lu, 1992). Floor effects were only observed in the role limitations scales. Substantial ceiling effects were observed for role limitations scales as well as for social functioning (McHorney, Ware, Lu, & Sherbourne, 1994). The extent to which floor effects are present in samples of very ill patients (such as in Bindman et al., 1990) has not yet been ascertained.

3. HEALTH-RELATED QUALITY OF LIFE MEASURES

MOS CORE MEASURES OF HEALTH-RELATED QUALITY OF LIFE

The MOS longitudinal panel was administered a much more extensive battery of measures than that fielded in the cross-sectional screening phase of the study. The MOS measurement book describes 149 functioning and well-being items that were administered to the panel patients (Stewart, Sherbourne, Hays et al., 1992). We discuss the core set of 116 of these items here. These items are "core" in the sense that the MOS investigators determined them to be the set that defined a comprehensive battery of functioning and well-being indicators in the study. Of the 116, 113 were described in detail in the MOS book (Stewart et al., 1992) and 3 others were added here to round-out the picture. SF-36™ is a subset of these items.

The MOS measures were based on a comprehensive conceptual model that includes two overarching dimensions of health--physical and mental (Stewart, Sherbourne, Hays et al., 1992). Hays and Stewart (1990) provide empirical support for these two health dimensions. Conceptually, the MOS measures were constructed to represent the following: *Physical Health* (e.g., physical functioning, satisfaction with physical ability, mobility, pain effects, pain severity, role limitations due to physical health), *Mental Health* (e.g., psychological distress--anxiety and depression, psychological well-being--positive affect and feelings of belonging, cognitive functioning, role limitations due to emotional problems), and *General Health* (e.g., energy/fatigue, sleep problems, psychophysiologic symptoms, social functioning, role functioning--unable to work, role functioning--unable to do housework, current health perceptions, and health distress). A detailed description of these measures and their development is provided elsewhere (Hays & Stewart, 1992a; Sherbourne, 1992a,b; Sherbourne, Allen, Kamberg et al., 1992; Sherbourne, Stewart, & Wells, 1992; Stewart & Kamberg, 1992; Stewart, Hays & Ware, 1992a; Stewart, Sherbourne, Hays et al., 1992).

Table 1 defines each of the HRQOL measures scored from the 116-item core. The 116 items used to score each of the measures are shown in Appendix A. Note that there are several versions of some measures (e.g., Psychological Distress I and Psychological Distress II, Mental Health Index (MHI) I, II, and III). The version I measures are based on the full battery included in the MOS baseline patient assessment questionnaires. To reduce respondent burden, scales from a subset of items (i.e., the version II scales) were also developed without sacrificing reliability. For mental health, a third version of the overall index (MHI-III) was also developed and is identical to the SF-20 and the SF-36™ versions (Hays, Sherbourne, & Mazel, 1993; Ware & Sherbourne, 1992; Ware, Sherbourne, & Davies, 1992).

Below we describe the scoring of these measures, provide descriptive information about them, and summarize their data quality.

SCORING THE MOS CORE MEASURES OF HEALTH-RELATED QUALITY OF LIFE

The MOS HRQOL scales are scored in five steps: (1) data-cleaning (e.g., changing out-of-range values to missing), (2) item recalibration and skip pattern recoding, (3) reverse scoring of items, (4) transforming item scores linearly to a common metric with a possible range of 0-100; and (5) averaging across items in the same scale. We also provide recommendations concerning estimation of missing data. Note that item names correspond to items in Appendix A, beginning with CORE1 (the name of the first item in Appendix A) and increasing sequentially.

Appendix B provides the SAS[®]¹ scoring statements that can be used to create the HRQOL scales. (An IBM-compatible ASCII diskette file containing the programming code (SAS[®]) for creating derived variables and the source code for SAS[®] Macro, MULTI, from Appendix C is available upon request.)

¹ SAS is a registered trademark of SAS, Inc. in the USA and other countries.

Table 1

DEFINITIONS OF 116-ITEM MOS CORE FUNCTIONING AND WELL-BEING CONCEPTS

Measure	No. of Items	Definition
Physical Functioning	10	Extent to which health limits physical activities such as self-care, walking, climbing hills and stairs, bending, lifting, and moderate and vigorous activities (same version used for the MOS SF-36™ short form)
Satisfaction with Physical Ability	1	Satisfaction with physical ability to do what is wanted
Mobility	2	Amount of time in bed or chair-all or most of the day-and amount of time needs assistance getting around community
Effects of Pain	6	Effects of pain on daily activities, including ability to walk, sleep, work; on recreation and on mood and life enjoyment during past 4 weeks
Pain Severity	5	Pain intensity (average and at its worst), frequency, duration during past 4 weeks
SF-36™ Pain	2	Amount of pain interference in daily activities (including work and housework)
Role Limitations Due to Physical Health	7	Limitations in work or other regular activities during the past 4 weeks, such as took frequent rests, limited in kind of work, had difficulty, or accomplished less than wanted
SF-36™ Role Limitations Due to Physical Health	4	SF-36™ short form version including limitations in activities during the past 4 weeks, such as less time spent on activities, limited in kind of work, had difficulty, or accomplished less than wanted
Cognitive Functioning	6	Amount of time in past month became confused, reacted slowly to things, had difficulty reasoning, was forgetful, had trouble keeping attention, had difficulty concentrating
Mental Health Index I	32	Includes depression/behavioral-emotional control, anxiety, feelings of belonging, positive affect
Psychological Distress I	22	Amount of time during past month very nervous, bothered by nervousness, tense, difficulty calming down, anxious, rattled or upset, restless, fidgety, low spirits, downhearted, depressed, moody, depression interfered with life, down in dumps, nothing to look forward to, not in firm control of behavior, felt like crying, felt others better off if dead, not emotionally stable, thought about taking own life

Table 1—Continued

Measure	No. of Items	Definition
Depression/ Behavioral- Emotional Control I	13	Amount of time in past month felt in low spirits, downhearted, depressed, moody, down in the dumps, nothing to look forward to, not in firm control of behavior, felt like crying, felt others better off if dead, not emotionally stable, thought about taking own life
Anxiety I	6	Amount of time in past month very nervous, bothered by nervousness, tense, high strung, difficulty calming down, rattled or upset, restless, fidgety
Psychological Well- Being I	10	Amount of time in past month been happy, enjoyed things, felt calm and peaceful, satisfied, felt living was an adventure, felt cheerful, daily life interesting, love relationships full, felt loved, felt close to people
Positive Affect I	7	Amount of time in past month been happy, enjoyed things, felt calm and peaceful, happy, satisfied, pleased, felt living was an adventure, cheerful, lighthearted, daily life interesting
Feelings of Belonging	3	Amount of time in past month felt love relationships full, felt loved, felt close to people
Mental Health Index II	17	Includes depression/behavioral-emotional control, anxiety, feeling of belonging, positive affect
Psychological Distress II	12	Amount of time in past month very nervous, tense, anxious or worried, restless, fidgety, low spirits, downhearted
Depression/ Behavioral- Emotional Control II	8	Amount of time in past month felt in low spirits, downhearted, depressed, moody, down in dumps, nothing to look forward to, not in firm control of behavior, not emotionally stable
Anxiety II	3	Amount of time during past month been very nervous, tense, restless
Psychological Well- Being II	5	Amount of time during past month been happy, calm and peaceful, cheerful, daily life interesting, felt loved
Positive Affect II	4	Amount of time in past month been happy, felt calm and peaceful, felt cheerful, daily life interesting
Mental Health Index III	5	Amount of time during past month very nervous, downhearted, down in dumps; happy, calm, and peaceful (same version used for the RAND SF-36™)
Role Limitations Due to Emotional Problems	3	Limitations in work or other regular daily activities due to emotional problems during past 4 weeks, including cutting down amount of time spent, accomplished less than wanted, didn't do work as carefully as usual (same version used for SF-36™)

Table 1—Continued

Measure	No. of Items	Definition
Energy/Fatigue	5	Amount of time in past month felt full of pep, energetic, worn out, tired, or had enough energy to do things wanted to do
SF-36™ Vitality	4	Amount of time in past month felt full of pep, worn out, tired, or had a lot of energy
Sleep Problems I	9	Sleep disturbance, adequacy, somnolence, and awaken short of breath during past 4 weeks
Sleep Problems II	6	Sleep disturbance, adequacy, somnolence, and awaken short of breath during past 4 weeks
Physical/ Psychophysiologic Symptoms	8	Frequency of occurrences of 8 general (non-disease-specific) symptoms, including stiffness, pain, swelling, or soreness of muscles or joints; coughing that produced sputum; backaches; nausea, acid indigestion; heavy feelings in arms and legs; headaches; lump in throat, all during the past 4 weeks
Social Activity Limitations Due to Health	4	Limitations in normal social activities during past 4 weeks due to physical health or emotional problems, comparison of these limitations to those of others their age, and changes in social activities over last 6 months because of changes in physical or emotional condition
SF-36™ Social Functioning	2	SF-36™ short form version, includes the extent of limitations by physical health or emotional problems in normal social activities
Role Functioning: Able to Work	1	Unable to work due to health (dichotomous measure)
Able to Do Housework	1	Unable to do housework due to health (dichotomous measure)
General Health Perceptions: Current Health	7	Rating of overall current health (e.g., I have been feeling bad lately)
SF-36™ General Health	5	Ratings of current health, future health, and resistance to illness
SF-20 Current Health	5	Ratings of overall current health
Health Distress	6	Amount of time in past month feeling distressed about health (e.g., discouraged by health, worry about health, afraid because of health)

Note: This table is adapted from Table 20-3 of Stewart, Sherbourne, Hays et al., 1992.

Step One: Data Cleaning

Keypunch and other errors can result in an item having an out-of-range value (i.e., values that are lower or higher than an item's minimum and maximum value). We recommend recoding all out-of-range values to missing data. For example, item CORE8a "Did you feel worn out" has response choices that range from a minimum of 1 to a maximum of 6. Any responses outside of this range should be assigned a missing value. The SAS[®] statements in Appendix B (under the heading "Step 1: Data Cleaning") use SAS[®] arrays (variable lists) for items with the same number of response choices to recode out-of-range values in a single step. For example, array frlto6 contains the CORE8a item (having 6 response choices). The following SAS[®] "do" statement recodes out-of-range values for this item (and the other 59 items in the array) to missing:

```
do i = 1 to 60;
    if frlto6(i) < 1 | frlto6(i) > 6 then frlto6(i) = .;
end;
```

Step Two: Item Recalibration and Skip Pattern Recoding

Before scoring the MOS HRQOL scales, there is one item (CORE1) that is recalibrated while being reversed in direction (see Table 2). In the MOS, it was decided that the distances between response choices were unequal and that they should be adjusted in scoring the item. (Note that this recalibration step is skipped for this item in SF-36[™] scoring procedure.)

Table 2
ITEM RECALIBRATION AND SKIP PATTERN RECODING

<u>ITEM NAME</u>	<u>If original response</u> <u>category is:</u>	<u>Recode to</u> <u>value of:</u>
CORE1	1 ----->	5
	2 ----->	4.36
	3 ----->	3.43
	4 ----->	1.99
	5 ----->	1
CORE10	2	
>>>and<<<		
CORE11, CORE 12, CORE14, CORE15	MISSING ----->	0
CORE10	2	
>>>and<<<		
CORE13a-CORE13f	MISSING ----->	1

Note: Recoded item names are the same as those listed under item name above with an "R" (recoded) added as the first letter.

In addition, a special scoring method is used for the pain measures (including items CORE11, CORE12, CORE13a-CORE13f, CORE14, and CORE15) to accommodate the skip pattern in the MOS questionnaire. To reduce respondent burden, we asked respondents who reported no bodily pain in the past 4 weeks (on item CORE10) to skip the remaining pain items.

Rather than have missing data on the pain scales for people who were asked to skip the battery of pain items because they were pain-free, we assigned them a score on each item they skipped that represents "no pain" for each of these items. Specifically, for items CORE11, CORE12, CORE14, and CORE15, people who responded "2" to CORE10 were assigned a 0, and for items CORE13a-CORE13f, people who responded "2" to CORE10 were assigned a 1. (Then all items are reversed so that high scores reflect favorable health—in this case, the absence of pain; instructions will follow in Step Three.) SAS[®] statements used to perform both recalibration and pain item recoding can be found in Appendix B under the heading "Step 2: Item Recalibration and Skip Pattern Recoding."

Step Three: Item Reverse Scoring

All scales are scored so that a high score defines a more favorable health state. Note that this differs from the convention used in the MOS book (Stewart, Sherbourne, Hays, et al., 1992) in which all measures were scored so that a high score corresponded to the label for the measure (e.g., on a pain severity scale, a high score represented more pain). This manual takes a different approach to facilitate consistent comparisons and profiles across groups (i.e., for each scale, the group with the larger score is doing better).

The third step in scoring each scale involves recoding item responses for those items that are not asked in a direction consistent with a favorable health state. For example, the item CORE8g asks, "Did you have enough energy to do the things you wanted to do?" If a respondent answers, "none of the time," the precoded response of "6" must be reversed so higher scores will indicate a favorable health state (i.e., more frequent occurrences of having enough energy). Item scoring rules for items that need to be recoded are given in Table 3. SAS®

Table 3
ITEM REVERSE SCORING

ITEM NAME		Change original response category (a)	Recode to value of:
CORE3, CORE9a-CORE9h, CORE61b, CORE 61e, CORE61f, CORE3a-CORE3f	1	=====>>	5
	2	=====>>	4
	3	=====>>	3
	4	=====>>	2
	5	=====>>	1
CORE2, CORE5, CORE8c, CORE 8e, CORE 8g, CORE20, CORE21, CORE24- CORE26, CORE31, CORE34, CORE 35, CORE 41, CORE43, CORE51, CORE54, CORE62b, CORE62i	1	=====>>	6
	2	=====>>	5
	3	=====>>	4
	4	=====>>	3
	5	=====>>	2
	6	=====>>	1
CORE11 and CORE12	0	=====>>	5
	1	=====>>	4
	2	=====>>	3
	3	=====>>	2
	4	=====>>	1
	5	=====>>	0
CORE 14, CORE15	0	=====>>	20
	1	=====>>	19
	2	=====>>	18
	3	=====>>	17
	4	=====>>	16
	5	=====>>	15
	6	=====>>	14
	7	=====>>	13
	8	=====>>	12
	9	=====>>	11
	10	=====>>	10
	11	=====>>	9
	12	=====>>	8
	13	=====>>	7
	14	=====>>	6
	15	=====>>	5
	16	=====>>	4
	17	=====>>	3
	18	=====>>	2
	19	=====>>	1
	20	=====>>	0

^aPre-coded response choices as printed in the questionnaire in Appendix A. Note: Recoded item names are the same as those listed under item name above with an "R" (recoded) added as the first letter.

statements in Appendix B (under the heading "Step 3: Concept Consistency Recoding") illustrate an easy method for reversing items that are not in the direction of a high score defining favorable health. For example, item CORE8g is included in an array with other items that have six response choices and need to be reversed (array rfrlto6 includes the reversed items and array ofrlto6 includes the items as originally precoded in the questionnaire). The following SAS® "do" statements reverse items that have 6 response choices:

```
do i = 1 to 19;
    rfrlto6(i) = 7 - ofrlto6(i);
end;
```

Step Four: Transforming Items to a 0-100 Possible Range

The fourth step involves transforming each item linearly so that the lowest and highest possible scores are set at 0 and 100, respectively. In this way, it is possible to combine items with different numbers of response categories into a single score. Scale scores represent the percentage of total possible score achieved. Table 4 provides transformation formulas for each of the 116 CORE items.² Note that items included in the transformation formula are the recoded items, according to Tables 2 and 3, which have a high score equal to good health. Appendix B (under the heading "Step 4—Transforming Items for Range Conformity") shows how arrays are used to process all items with the same number of response codes in one step.

Step Five: Deriving Scales

The final step involves simply averaging the scores for items in the same scale. This simple scoring method is possible because all items in a given scale have roughly equivalent relationships to the underlying HRQOL concept being measured and each item is used to

² A general formula to transform linearly to a 0-100 range is:
New score = 100 x (old score - lowest score possible) / (score range)
[score range = highest possible score - lowest possible score].

Table 4
TRANSFORMING ITEMS TO A 0-100 RANGE

Item Response Range ITEM NUMBERS	Recoding Formula	Original Response	Recoded Value
From 1 to 2:			
CORE16a-CORE16g, CORE17a- CORE17c, CORE18, CORE19	NEW = (CORE - 1) x 100	1 -----> 2 ----->	0 100
From 1 to 3:			
CORE4a-CORE4j	NEW = (CORE - 1) x 50	1 -----> 2 -----> 3 ----->	0 50 100
From 1 to 5:			
CORE1, CORE3, CORE6, CORE7, CORE9a-CORE9h, CORE13a- CORE13f, CORE58, CORE59, CORE60, CORE61a-CORE61h	NEW = (CORE - 1) x 25	1 -----> 2 -----> 3 -----> 4 -----> 5 ----->	0 25 50 75 100
From 1 to 6:			
CORE2, CORE5, CORE8a-CORE8k, CORE20-CORE57, CORE62a- CORE62i	NEW = (CORE - 1) x 20	1 -----> 2 -----> 3 -----> 4 -----> 5 -----> 6 ----->	0 20 40 60 80 100
From 0 to 5:			
CORE11, CORE12	NEW = CORE x 20	0 -----> 1 -----> 2 -----> 3 -----> 4 -----> 5 ----->	0 20 40 60 80 100
From 0 to 20:			
CORE14, CORE15	NEW = CORE x 5		

Note: NEW = Transformed item score; CORE = original item score (recoded when necessary to have high score equal good health).

score only one concept (i.e., the same item is not used to score different concepts). It is not necessary to standardize items or to weight them. Table 5 lists the items averaged together to create each scale.

Sometimes respondents leave one or more items blank in a scale. For example, 2 percent of patients 18-44 years old missed only 1 of the 10 core physical functioning items at baseline of the MOS (Sherbourne & Meredith, 1992; also see "Data Quality of MOS Measures" below). The rate of missing data tends to increase with age; 12 percent of patients

Table 5
DERIVING SCALES

CONCEPTUAL AREA Scale/Index		After recoding per Tables 2 and NUMBER 3, and transforming per Table 4, OF ITEMS average the following items:
PHYSICAL HEALTH		
Physical Functioning	10	CORE4a-CORE4j
Satisfaction with Physical Ability	1	CORE5
Mobility	2	CORE6, CORE7
Effects of Pain	6	RCORE13a-RCORE13f
Pain Severity	5	RCORE2, RCORE11, RCORE12, RCORE14, RCORE15
Pain (RAND Scoring)	2*	RCORE2, RCORE13d
Pain (SF-36™ Scoring)	2	RCCORE2, RCCORE13d
Role Limitations Due to Physical Health	7	CORE16a-CORE16g
SF-36™ Role Limitations Due to Physical Health	4	CORE16b, CORE16c, CORE16e, CORE16f
MENTAL HEALTH		
Cognitive Functioning	6	CORE23, CORE28, CORE32, CORE40, CORE49, CORE56
Mental Health Index I	32	RCORE20, RCORE21, CORE22, RCORE24, RCORE25, RCORE26, CORE27, CORE29, CORE30, RCORE31, CORE33, RCORE34, RCORE35, CORE36-CORE39, RCORE41, CORE42, RCORE43, CORE44-CORE48, CORE50, RCORE51, CORE52, CORE53, RCORE54, CORE55, CORE57
Psychological Distress I	22	CORE22, CORE27, CORE29, CORE30, RCORE31, CORE33, RCORE35, CORE36-CORE39, CORE42, CORE44-CORE48, CORE50, CORE52, CORE53, CORE55, CORE57
Depression/Behavioral Emotional Control I	13	CORE22, CORE29, RCORE31, CORE33, RCORE35, CORE36, CORE37, CORE39, CORE44, CORE45, CORE47, CORE53, CORE55
Anxiety I	6	CORE27, CORE30, CORE42, CORE46, CORE48, CORE52
Psychological Well-Being I	10	RCORE20, RCORE21, RCORE24-RCORE26, RCORE34, RCORE41, RCORE43, RCORE51, RCORE54
Positive Affect I	7	RCORE20, RCORE24, RCORE25, RCORE34, RCORE43, RCORE51, RCORE54
Feelings of Belonging	3	RCORE21, RCORE26, RCORE41

Table 5 continued

CONCEPTUAL AREA Scale/Index		After recoding per Tables 2 and NUMBER 3, and transforming per Table 4, OF ITEMS average the following items:
Mental Health Index II	17	RCORE25, RCORE26, CORE27, CORE29, CORE30, RCORE31, CORE33, RCORE34, RCORE35, CORE36, CORE44, CORE46, CORE47, CORE50, RCORE51, CORE53, RCORE54
Psychological Distress II	12	CORE27, CORE29, CORE30, RCORE31, CORE33, RCORE35, CORE36, CORE44, CORE46, CORE47, CORE50, CORE53
Depression/Behavioral Emotional Control II	8	CORE29, CORE36, CORE47, CORE53, RCORE31, CORE33, RCORE35, CORE44
Anxiety II	3	CORE27, CORE30, CORE46
Psychological Well-Being II	5	RCORE25, RCORE26, RCORE34, RCORE51, RCORE54
Positive Affect II	4	RCORE26, RCORE34, RCORE51, RCORE54
Mental Health Index III	5	CORE26, RCORE34, CORE36, CORE44, RCORE51
Role Limitations Due to Emotional Problems	3	CORE17a-CORE17c
GENERAL HEALTH		
Energy/Fatigue	5	CORE8a, RCORE8c, RCORE8e, RCORE8g, CORE8i
SF-36™ Vitality	4	CORE8a, RCORE8c, RCORE8e, CORE8i
Sleep Problems I	9	CORE62a, RCORE62b, CORE62c, CORE62d, CORE62e, CORE62f, CORE62g, CORE62h, RCORE62i
Sleep Problems II	6	RCORE62b, CORE62c, CORE62e, CORE62f, CORE62g, RCORE62i
Physical/Psychophysiologic Symptoms	8	RCORE9a-RCORE9h
Social Activity Limitations Due to Health	4	RCORE3, CORE58-CORE60
SF-36™ Social Functioning	2	RCORE3, CORE58
Role Functioning: Able to Work	1	CORE19
Role Functioning: Able to Do Housework	1	CORE18

Table 5 continued

CONCEPTUAL AREA Scale/Index		After recoding per Tables 2 NUMBER and 3, and transforming per OF ITEMS Table 4, average the following items:
General Health Perceptions:		
Current Health	7	RCCORE1, CORE61a, RCORE61b, CORE61c, CORE61d, RCORE61e, RCORE61f
General Health (RAND Scoring)	5*	RCORE1, RCORE61e, RCORE61f, CORE61g, CORE61h
General Health (SF-36™ Scoring)	5	RCCORE1, RCORE61e, RCORE61f, CORE61g, CORE61h
SF-20 Current Health	5	CORE1, CORE61a, CORE61c, RCORE613, RCORE61f
Health Distress	6	CORE8b, CORE8d, CORE8f, CORE8h, CORE8j, CORE8k

Notes:

1. *Indicates items used for RAND 36-Item Health Survey 1.0 scoring procedure.
2. "RCORE" indicates that the item was reversed; "RCCORE" indicates that the item was reversed and recalibrated.

75 and older had missing data for 1 of the 10 physical functioning items. One advantage of multi-item scales is that a scale score can be estimated as long as the respondent has answered at least one item in the scale. In the initial phases of the MOS, we assigned a scale score as missing if more than half of the items in a given scale were missing. This was a conservative approach, and others may want to assign a scale score based on having any nonmissing data (e.g., the presence of only one item in a given scale). We recommend substituting a person-specific estimate of the missing score for any missing items. The item average for each scale can be imputed by averaging together all nonmissing responses for each respondent separately. The SAS® statements shown in Appendix B under the heading "Step 5: Deriving Scales" use this imputation strategy. This missing data procedure is reasonable because the average of responses to nonmissing items for the MOS core measures is a good estimate of the missing response, as supported by excellent item convergence (i.e., item-scale correlations, corrected for item overlap) for the MOS multi-item scales (Stewart, Sherbourne, Hays et al., 1992). However, biased item estimates can occur using this method

even with large item-scale correlations. More sophisticated missing data imputation strategies, such as regression estimates (Raymond, 1986) can be implemented using some existing software packages (e.g., STATA, 1992).

4. MOS PSYCHOMETRIC PHILOSOPHY FOR HRQOL MEASUREMENT

This section summarizes the MOS approach to HRQOL measurement. It is intended for those interested in the psychometric theory and methods used to construct measures. Those already familiar with this philosophy may want to skip to Section 5.

Measurement is a set of rules for assigning numbers to accurately represent quantities of attributes. Measurement rules must be standard so that different investigators will obtain the same result when using the same measure. Indeed, the fundamental objective of HRQOL assessment is standardized classification of individuals on one or more attributes: A key defining criterion for good measurement in surveys is "standardization." Standardization in social surveys, like other scientific measurement, means that the procedures are consistent each time an observation is made and data are collected (Fowler, 1991, p. 260).

An important consideration in HRQOL measurement is the selection of the response options. The goal in the selection of item response choices in the MOS was to pick a set of options that would provide approximately interval-level information. To achieve this, three important features of response options were considered: what type of response intervals to use, whether to offer a middle "neutral" category, and what the number of options should be.

Four basic types of response options—endorsement, amount of time, intensity, and comparison—were used. The endorsement option was used in assessing statements of perceived health such as "I have been feeling bad lately." The amount of time option was used to assess various subjective states, such as energy/fatigue and anxiety. The intensity option illustrates a set of verbal choices for rating the severity of a symptom, such as pain. For intensity, a numbered response scale was sometimes used. For example, when asking patients to rate their pain by providing the numbers 1 to 20, endpoints were labeled "no pain at all" and "pain as bad as you can imagine." Whenever possible, similar response choices in different batteries were used so respondents would feel familiar with a limited set of choices.

Although most would agree that the various responses are ordered in terms of increasing levels (i.e., they yield at least an ordinal scale), it is never clear whether such "imprecise quantifiers actually have some common meaning" (Bradburn & Sudman, 1980). As Bradburn and Sudman point out, the meaning depends on the context in which the question is asked (e.g., which types of questions preceded it) and can vary across individuals. Standardized administration procedures minimize differences in interpretation by respondents.

It is important to have a good estimate of the distance between response categories, because items may have response choices for which the intervals are uneven. For example, the difference in health from "excellent" to "very good" may be smaller than the differences between "good" and "fair." Thus, when a long-form measure of the same concept was available, the distance between categories was sometimes estimated empirically by calculating mean long-form scores for each response level of the single item. This enables the intermediate response levels (i.e., not the extreme levels) to be transformed using interpolation to reflect the intervals observed based on long-form mean values. For example, the five categories of a general health item in the MOS were coded 5.00 (Excellent), 4.36 (Very Good), 3.43 (Good), 1.99 (Fair) and 1.00 (Poor) rather than 5, 4, 3, 2, and 1 (see Table 2).

With endorsement scales, a neutral (e.g., "don't know") category is often offered to respondents to provide an option for people who have no opinion on a particular question or to provide an additional level of gradation. There is controversy about the usefulness of a neutral category; some argue it should *not* be offered because people choose it instead of being more committal (Converse & Presser, 1986). The MOS approach was to include a neutral category on the assumption that it often provides a valid response.

Regarding the number of item responses, several studies suggest that five to seven well-chosen response categories provide the lower bound necessary for optimal assessment of a measurement domain. For example, there is evidence that reliability of measurement plateaus around this number (Cicchetti, Showalter, & Tyrer, 1985) and responses to 5-point items closely approximate more continuous response data

(e.g., Bollen & Barb, 1981; Johnson & Creech, 1983). Others note that most people cannot consistently discriminate their feelings beyond a 7-point classification (Osgood, Suci, & Tannenbaum, 1957; cited by Wells & Marwell, 1976), thus suggesting that more than seven categories are unnecessary. Items administered with five to seven response options have been shown to correlate strongly with corresponding items administered with a greater number of response options (Hays & Huba, 1988). Dawes (1977), for example, demonstrated that height measured using rating scales correlates very highly with true height. Ratings of the height of 25 male faculty on a six-point rating scale (*very tall, moderately tall, tall, short, moderately short, very short*) correlated 0.94 with self-reported height (reported to the nearest half-inch). The strong association between responses obtained from rating scale data and more continuous response scales indicates that rating scales often yield approximately interval-level data and can be analyzed using parametric statistics (Baker, Hardyck, & Petrinovich, 1966). Based on these guidelines, five or six options were selected most often.

To be useful for research and clinical applications, an HRQOL measure needs to be reliable and valid. Reliability refers to the extent to which the measure yields the same number or score each time it is administered, all other things being equal (i.e., no true change in the attribute being measured has occurred). Validity is the degree to which the measure reflects what it is supposed to measure rather than something else. The distinction between reliability and validity is important because a measure may be reliable (i.e., always yield the same score for the same patient), but it may be consistently measuring something other than what it was intended to measure.

RELIABILITY

Cronbach's (1951) alpha reliability coefficient provides an indication of the degree of convergence between different items hypothesized to represent the same construct or trait. Cronbach's alpha can be calculated using the analysis of variance approach to reliability (Guilford, 1954). The analysis of variance model is a one-way repeated

measures design with items functioning as the repeated measures. Hoyt's (1941) formula for reliability is employed:

$$\alpha = 1 - \frac{MS_{RI}}{MS_R} = \frac{MS_R - MS_{RI}}{MS_R},$$

MS_{RI} = mean square for intersection of respondents by items (mean square within); MS_R = mean square for respondents (mean square between).

Calculation formulas for the intraclass correlation for items (R_{II}), Scott's homogeneity ratio (SCOTT), the coefficient of homogeneity of persons (R_{GG}), and the intraclass correlation for persons (R_{PP}) are provided below (K = number of items in scale, S = standard deviation, N = number of respondents):

$$R_{II} = \alpha / (K + \alpha - (K \times \alpha))$$

$$SCOTT = (MS_R - MS_I) / ((\sum S_i)^2 - MS_I)$$

$$R_{GG} = 1 - (MS_R / MS_I)$$

$$R_{PP} = R_{GG} / (N + R_{GG} - (N \times R_{GG})).$$

A reliability level of 0.70 was advocated by Nunnally (1978) as a minimum standard for measurement that is used to compare different groups of people (e.g., a research study comparing outcomes for HIV patients who receive or do not receive AZT before the onset of AIDS). A more stringent reliability of 0.90 was recommended as a minimum in order to interpret scores at the individual level. This rule of thumb is based on the fact that the standard error of measurement is about one-third of the measure's standard deviation if it has a reliability of 0.90 (standard error of measurement is estimated by the product of the measure's standard deviation and the square root of 1 - reliability). Confidence intervals around an individual's estimated true score are wide at reliabilities below this recommended cutpoint.

Despite the strong rationale for the 0.90 reliability standard, in practice it may be too stringent. To achieve this level of reliability using HRQOL self-reports requires several items per construct being

assessed. Many highly regarded instruments fail to meet these standards. For example, only 2 of the 8 subscales (physical functioning and emotional well-being) in the popular RAND 36-Item Health Survey 1.0 (Hays, Sherbourne, & Mazel, 1993; Ware & Sherbourne, 1992) satisfied the 0.90 reliability standard in the MOS baseline sample. A recent study reported 24-hour test-retest reliabilities for blood pressure that did not meet this standard either (Prisant, Carr, Bottini et al., 1992). Systolic blood pressure and diastolic blood pressure reliabilities were 0.87 and 0.67, respectively.

Even if measures fall short of the 0.90 reliability level, obtaining this information is preferred to not doing so. Although the confidence interval around an individual patient's score is wider than one would like, the interval is still tighter than that based on no information at all. Clinicians need to be aware of the extent of unreliability in all of their measures and interpret them with appropriate caution.

In choosing between a longer self-report measure that offers acceptable reliability (0.90 level) for individual decisions and a briefer measure that has less respondent burden, it is important to evaluate whether the ability and willingness of patients to complete longer self-report instruments is being sold short. We believe that if self-reports became a standard part of the medical process, patients will get used to them, consider them important and valuable, and be very willing to complete longer ones. Questionnaire completion is arguably easier and more tolerable than many of the medical tests to which patients are routinely subjected. In fact, there is substantial anecdotal evidence that patients actually enjoy completing even rather lengthy surveys. Of course, it is also important to include arrangements for face-to-face interviews for patients with reading difficulties.

ITEM DISCRIMINATION ACROSS SCALES

As noted above, it is common practice in scale development to evaluate the internal consistency reliability of multi-item scales by estimating Cronbach's (1951) alpha coefficient. Alpha provides an

indication of the degree of convergence between different items hypothesized to represent the same construct or trait. Yet this provides no information on the degree of independence between constructs or items measuring putatively different constructs.

In multitrait scaling, *item discrimination* across scales is also evaluated. Items are examined with respect to how well they represent a particular trait relative to other traits.

Item-scale correlations are the fundamental elements of multitrait scaling and constitute the multitrait/multi-item (MTMI) correlation matrix. Each row of the MTMI matrix contains correlations between scores for one item and each hypothesized trait (defined by the sum of items composing each trait). Each column contains correlations between the scores for one trait and each item in the analysis, including those hypothesized to be part of that trait and those hypothesized to be part of other traits. Correlations between items hypothesized to define a given trait and the trait itself are corrected for overlap (using the technique recommended by Howard and Forehand, 1962) so that estimates of the item-trait relationships are not spuriously inflated.

Uncorrected item-scale correlations are computed using the following formula (N = number of respondents, J = item, W = scale with "J" in it, S = standard deviation):

$$r_u = \frac{Nx \sum X_J X_W - (\sum X_J)(\sum X_W)}{N^2 S_W S_J}$$

Corrected item-scale correlations are computed using the following formula:

$$r_c = \frac{r_u S_W - S_J}{[S_W^2 + S_J^2 - 2(r_u)(S_W)(S_J)]^{1/2}}$$

Item convergence is supported if an item correlates substantially (a corrected correlation of about 0.40 or above is recommended as a rule of thumb) with the scale it is hypothesized to represent. This is the traditional internal-consistency criterion. For scales that have a previous history of development, and for which analyses are intended to refine and add finishing touches rather than develop from scratch, a

more stringent convergence criterion (i.e., larger correlation) can be applied.

Item discrimination is supported if the highest correlation in a row of the MTMI matrix is the correlation between the item and the trait it is hypothesized to measure and this correlation is significantly larger than the other correlations in the row. The significance of the difference of these correlations can be evaluated using Steiger's (1980) t-test for dependent correlations. Zero-order correlations (and correlations adjusted for unreliability of measurement) between scales are also evaluated. These correlations should be less than unity to support the distinctiveness of the traits.

Multitrait scaling was used routinely in scale development for the RAND Health Insurance Experiment (e.g., Donald & Ware, 1982; Eisen, Donald, Ware, & Brook, 1980) and the Medical Outcomes Study (e.g., Hays & DiMatteo, 1987; Stewart, Hays & Ware, 1988; Stewart, Sherbourne, Hays et al., 1992). Software programs for multitrait scaling analysis were refined for the MOS and in subsequent studies (Hays & Hayashi, 1990; Hays & Wang, 1992).

We provide the source code for an SAS[®] MACRO, MULTI, which can be used to conduct multitrait scaling analyses (see Appendix C). For this program, required input includes the name of the data set being processed, the names and number of items in each scale, and the names and number of scales in the analysis. Up to 19 scales can be included. MULTI produces output consisting of the number of cases in the analysis, the MTMI correlation matrix, intercorrelations among scales, item and scale descriptive statistics, scale normality statistics, intercorrelations among items, and internal consistency reliability estimates for the scales. Correlations between items and scales in the MTMI correlation matrix are corrected for item overlap with scales as discussed above. An example of how to interpret multitrait matrices is provided below in the subsection "Item Discrimination Across Scales."

VALIDITY

The process of validating measures involves accumulating evidence of many different types that indicate the degree to which the measures

represent what they were intended to. Construct validity (Cronbach & Meehl, 1955) is evaluated by hypothesizing how measures should "behave" and confirming or disconfirming these hypotheses. "It is theory which specifies the properties of a concept, its relations to other concepts, and its implications for behavior, including test behavior" (Jessor, Graves, Hanson, & Jessor, 1968, p. 146). Hypotheses are stated regarding the direction (and sometimes the strength) of relationship that might be expected, and validity is supported when the associations are consistent with hypotheses. Construct validation is iterative by its very nature with empirical results feeding into revision of measures, retesting, and further revisions, if necessary (Ware, 1984).

Convergent and discriminant validity are two fundamental aspects of construct validity. Convergent validity refers to the extent to which different ways of measuring the same trait intercorrelate with one another. Discriminant validity involves demonstrating that a measure does not correlate too strongly with measures of conceptually independent constructs. For example, the correlation between a measure of loneliness and a measure of health locus of control would not be expected to be very large (Hays & DiMatteo, 1987). When more than one method of data collection or scale construction has been used, convergent and discriminant validity can be assessed using multitrait-multimethod analytic methods (Campbell & Fiske, 1959).

Guyatt, Walter, and Norman (1987) suggested that another important property of quality-of-life measures is their responsiveness to clinically important changes. These investigators operationalized responsiveness as the change in quality-of-life score due to a "minimal" clinical intervention divided by the fluctuation in quality-of-life score due to error of measurement. Guyatt et al. (1987) proposed that responsiveness is distinct from reliability and validity. We agree that a measure might change (respond) in a manner similar to that expected for a valid measure, but actually not really measure what it is supposed to measure. However, this fact does not support the contention that responsiveness is distinct from validity as a psychometric construct. Rather, it demonstrates that a measure might perform well on one test of validity, but not on another. Validation is an ongoing process of obtaining multiple sources of

information and empirical evidence to assess whether the instrument actually measures what it purports to measure. Each piece of evidence, including the instrument's responsiveness, provides important information about the validity of the measure. If one can argue that a responsive instrument may not be valid, then one could just as well argue that an instrument that exhibits content validity may not actually be valid because it does not discriminate known groups, or that an instrument that displays known-groups' validity may not be valid because of its failure to detect changes in quality of life over time.

A measure that is valid at one time point should also be valid at another time point. Accordingly, valid instruments should, in theory, be responsive to change over time. To maintain otherwise is to claim that an initially valid instrument may somehow lose its validity and thus no longer be able to measure the underlying construct (i.e., quality of life) at a later time point. Therefore, responsiveness simply incorporates longitudinal information (change) into the process of evaluating validity (Hays & Hadorn, 1992).

Thus, a quality-of-life instrument that measures what it is supposed to measure is expected to be responsive to a clinical intervention—it should detect real change in quality of life whether the change is induced experimentally or naturally. Conceptualizing responsiveness as an indicator of validity is consistent with common usage in the psychometric literature (i.e., Does the instrument measure what it is supposed to?). Indeed, other investigators have suggested that sensitivity to change is one test of a measure's construct validity (Boyle & Torrance, 1984; Chambers, 1983).

THREATS TO VALIDITY

Two possible sources of bias that sometimes threaten the validity of health surveys and that often go along with self-reported methods (Bentler & Eichberg, 1975) are socially desirable response set (SDRS) and acquiescent response set.

Socially Desirable Response Set

Socially desirable responding, a tendency to describe oneself in socially desirable or favorable terms, is among the most important

sources of response bias in self-report research. Socially desirable responding affects the validity of self-reports because it results in underreporting of socially undesirable characteristics or overreporting of socially desirable behavior (Nunnally, 1978). There are two basic approaches to handling SDRS: minimizing its occurrence in the design of the question asked and measuring it so its effects can be evaluated and controlled.

SDRS can also be minimized by study design and item selection. For example, SDRS tends to be less problematic in mail surveys than it is in telephone and face-to-face interviews (Dillman, 1978). In addition, because items differ in their susceptibility to socially desirable responding (Edwards, 1970), its effects can be minimized at the item writing stage. Thus, in developing item stems and response choices in the MOS, the potential influence of SDRS was minimized wherever possible, following the recommendation of Smith (1967). Value-laden words were avoided and instructions were written to facilitate accurate, socially undesirable responses. Johnson's (1981) suggestion that "the best strategy for designing a valid scale is not to make lying or misrepresentation difficult, but to make self-presentation as easy as possible" was adopted. Sometimes, item response choices were reversed to put the one that was least "desirable" first. Empirical studies indicate that respondents are somewhat more likely to endorse the first response options presented to them (Carp, 1974; Hays, Bell, Damush et al., 1994; Quinn & Belson, 1969; cited in Schwarz, Hippler, Deutsch & Strack, 1985).

A number of instruments have been developed to measure the tendency to give socially desirable responses (Crowne & Marlowe, 1960; Jacobsen, Brown, & Ariza, 1983). These SDRS measures are typically included in the same questionnaires as the health measures. The correlations between the health measures and the SDRS measures are evaluated to determine the extent to which SDRS is present in other self-report measures (Crowne & Marlowe, 1960; Edwards, 1970). If SDRS is significantly correlated with a self-report measure, SDRS can be statistically controlled for in analyses involving that measure. Using such measures, SDRS has been found to be significantly correlated with

depression, symptoms, life satisfaction, health-related behavior, problem drinking, and life events (Klassen, Hornstra, & Anderson, 1975; Kristiansen & Harding, 1984).

In the MOS, a brief SDRS measure was developed (Hays, Hayashi, & Stewart, 1989) and correlated with the health measures. Statistically significant correlations of SDRS with health measures are regarded as suggestive of a problematic degree of SDRS in responses to the measure.

Acquiescent Response Set

Two types of acquiescent responding have been noted: agreement acquiescence and acceptance acquiescence (Bentler, Jackson, & Messick, 1971). Agreement acquiescence is a tendency of respondents to agree with statements regardless of content. Acceptance acquiescence refers to a tendency to accept characteristics as descriptive of oneself. Thus, acceptance acquiescence is denoted by agreement with items that describe characteristics and disagreement with items that deny characteristics. Acquiescence tends to occur more often when questions are ambiguous, lengthy, complicated, or otherwise difficult to understand. It also occurs more frequently in people with less education (Converse & Presser, 1986).

Both forms of acquiescence can be minimized by keeping questions simple, clear, and short, which the MOS attempted to do wherever possible. Agreement acquiescence can also be minimized by using several items to measure each concept, some with favorable wording and some with unfavorable wording (e.g., "do you have energy?" and "do you feel tired?"). When these items are summed into a multi-item scale, agreement acquiescence tends to cancel out. The latter has been demonstrated for measures of health care attitudes (Ware, 1978). In selecting a final set of items for each measure, the MOS attempted, wherever possible, to achieve a balance between positively and negatively worded items. In some cases, however, this was impossible because some concepts are by definition negative (e.g., psychological distress is measured using only negatively worded items).

5. PSYCHOMETRIC PROPERTIES OF THE MOS CORE MEASURES

RELIABILITY

Internal consistency reliability for the multi-item scales was estimated using Cronbach's (1951) alpha coefficient. Reliability coefficients, shown in Table 6, exceeded 0.70 for every scale. Hence, the MOS core measures are reliable enough to be used for group comparisons. In addition, about one-half of the scales have reliabilities that exceed the 0.90 standard for individual comparisons. The reliability of many of the remaining scales approximates the 0.90 level.

ITEM DISCRIMINATION ACROSS SCALES

Tests of item discrimination across scales were conducted extensively during the development of the MOS HRQOL measures (see Stewart, Sherbourne, Hays et al., 1992). For each HRQOL concept, items were tested against other HRQOL domains to ensure that conceptually distinct measures were constructed. An example of a matrix from the MOS panel sample that allows tests of item discrimination is provided in Table 7. In this matrix, we tested item convergence and discrimination for eight of the core HRQOL measures: physical functioning, pain severity, role limitations due to physical health, cognitive functioning, depression/behavioral emotional control, anxiety, role limitations due to emotional problems, and energy/fatigue. Row entries in the matrix represent correlations between each item and the sum of the items in each scale grouping. Column entries represent correlations between the scores for one HRQOL concept and all items in the analysis. Asterisks indicate item-scale correlations that are corrected for overlap (i.e., each item is correlated with the sum of the other items in a hypothesized scale).

In this example, all items met the convergent validity criterion of 0.40; that is, they correlated at least 0.40 with their own scale, corrected for overlap. All but one item met the discriminant validity criterion, that is, the correlation between an item and the scale it was hypothesized to measure was more than two standard errors larger than

Table 6

RELIABILITY, CENTRAL TENDENCY, AND VARIABILITY OF CORE SCALES IN THE MOS
(N=2471)

CONCEPTUAL AREA Scale/Index	NUMBER OF ITEMS	INTERNAL CONSISTENCY		
		RELIABILITY	MEAN	SD
PHYSICAL HEALTH				
Physical Functioning	10*	0.93	70.9	27.1
Satisfaction with Physical Ability	1	—	59.5	25.6
Mobility	2	0.74	92.1	17.7
Effects of Pain	6	0.93	76.6	25.0
Pain Severity	5	0.93	62.9	27.4
SF-36™ Pain	2	0.83	67.4	25.4
RAND Pain	2*	0.78	70.8	25.5
Role Limitations Due to Physical Health	7	0.86	61.1	34.1
SF-36™ Role Limitations Due to Physical Health	4*	0.84	52.1	40.7
MENTAL HEALTH				
Cognitive Functioning	6	0.88	80.9	17.3
Mental Health Index I	32	0.98	72.7	19.6
Psychological Distress I	22	0.97	77.3	19.0
Depression/Behavioral Emotional Control I	13	0.96	79.0	19.7
Anxiety I	6	0.93	74.6	20.0
Psychological Well-Being I	10	0.95	62.5	23.3
Positive Affect I	7	0.95	59.5	23.8
Feelings of Belonging	3	0.88	69.6	27.1
Mental Health Index II	17	0.97	71.3	20.6
Psychological Distress II	12	0.96	75.4	20.3
Depression/Behavioral Emotional Control II	8	0.95	77.3	21.0
Anxiety II	3	0.86	73.1	22.1
Psychological Well-Being II	5	0.92	61.5	23.9
Positive Affect II	4	0.92	59.2	24.3
Mental Health Index III	5*	0.90	70.4	22.0
Role Limitations Due to Emotional Problems	3*	0.83	66.0	40.6

Table 6—Continued

CONCEPTUAL AREA Scale/Index	NUMBER OF ITEMS	INTERNAL		
		CONSISTENCY RELIABILITY	MEAN	SD
GENERAL HEALTH				
Energy/Fatigue	5	0.88	53.8	22.1
SF-36™ Vitality	4*	0.86	52.1	22.4
Sleep Problems I	9	0.83	70.1	17.1
Sleep Problems II	6	0.78	71.7	18.2
Physical/Psychophysiologic Symptoms	8	0.76	74.4	17.9
Social Activity Limitations Due to Health	4	0.79	63.4	20.6
SF-36™ Social Functioning	2*	0.85	78.8	25.4
Role Functioning: Able to Work	1	—	81.2	39.1
Role Functioning: Able to Do Housework	1	—	82.5	38.0
General Health Perceptions:				
Current Health	7	0.90	55.9	25.2
RAND General Health	5*	0.78	57.0	21.1
SF-36™ General Health	5	0.78	58.3	21.4
SF-20 General Health	5	0.86	54.8	25.5
Health Distress	6	0.91	78.3	23.6

Notes: Dashes indicate single-item indices for which internal consistency reliability cannot be estimated. * Indicates statistics for SF-36™ scoring procedure. Due to missing data, sample sizes vary somewhat across scales.

other correlations in the row (standard error (SE) = 0.02). The exception was one role-limitations-due-to-physical-health item (CORE16G), which correlated as highly with the physical functioning scale as it did with its hypothesized scale. Previous analyses on a larger MOS sample (baseline sample of panel and non-panel respondents; Sherbourne, Stewart, & Wells, 1992) supported the discrimination of this item, however.

VALIDITY

Previous research demonstrates that self-reported physical and mental health are correlated constructs (Friedman & Booth-Kewley, 1987; George & Landerman, 1984; Wells, Golding, & Burnam, 1988), but that they are empirically distinguishable (Hall, Epstein, & McNeil, 1989). The

Table 7
EXAMPLE OF ITEM-SCALE CORRELATION MATRIX (N=2055)

ITEM	SCALE							
	PHY	PAINSEV	ROLEP	COG	DEP	ANX	ROLEE	EFT
CORE4A	0.60*	0.33	0.48	0.12	0.03	0.07	0.12	0.39
CORE4B	0.77*	0.37	0.56	0.18	0.11	0.15	0.22	0.46
CORE4C	0.74*	0.38	0.56	0.18	0.11	0.15	0.22	0.43
CORE4D	0.75*	0.33	0.51	0.18	0.08	0.13	0.17	0.44
CORE4E	0.76*	0.29	0.49	0.16	0.07	0.13	0.18	0.41
CORE4F	0.69*	0.42	0.50	0.19	0.07	0.12	0.16	0.38
CORE4G	0.75*	0.36	0.51	0.15	0.09	0.13	0.17	0.45
CORE4H	0.79*	0.36	0.52	0.16	0.09	0.13	0.18	0.44
CORE4I	0.72*	0.32	0.46	0.16	0.10	0.14	0.17	0.38
CORE4J	0.48*	0.24	0.36	0.19	0.12	0.15	0.19	0.28
RCORE2	0.49	0.75*	0.52	0.29	0.28	0.31	0.26	0.46
RCORE11	0.43	0.82*	0.49	0.25	0.23	0.26	0.21	0.40
RCORE12	0.26	0.73*	0.36	0.19	0.22	0.26	0.17	0.32
RCORE14	0.43	0.82*	0.51	0.30	0.31	0.33	0.26	0.45
RCORE15	0.36	0.82*	0.48	0.30	0.32	0.34	0.26	0.43
CORE16A	0.54	0.39	0.67*	0.28	0.21	0.20	0.30	0.49
CORE16B	0.49	0.42	0.72*	0.29	0.25	0.25	0.39	0.48
CORE16C	0.42	0.38	0.64*	0.30	0.25	0.26	0.39	0.52
CORE16D	0.39	0.35	0.57*	0.33	0.27	0.30	0.43	0.44
CORE16E	0.57	0.44	0.69*	0.23	0.17	0.18	0.27	0.44
CORE16F	0.47	0.49	0.68*	0.32	0.31	0.31	0.39	0.51
CORE16G	0.42	0.30	0.42*	0.24	0.18	0.21	0.29	0.30
CORE23	0.19	0.24	0.34	0.73*	0.69	0.62	0.55	0.45
CORE28	0.18	0.26	0.33	0.74*	0.68	0.66	0.52	0.47
CORE32	0.12	0.23	0.26	0.68*	0.58	0.58	0.41	0.35
CORE40	0.23	0.24	0.29	0.58*	0.42	0.43	0.32	0.34
CORE49	0.14	0.21	0.29	0.71*	0.65	0.64	0.48	0.42
CORE56	0.17	0.20	0.29	0.52*	0.49	0.45	0.38	0.33
CORE22	0.15	0.28	0.24	0.66	0.81*	0.69	0.63	0.50
CORE29	0.10	0.28	0.29	0.66	0.88*	0.73	0.60	0.51
CORE36	0.10	0.26	0.27	0.63	0.86*	0.70	0.56	0.50
CORE47	0.06	0.26	0.26	0.67	0.83*	0.77	0.57	0.46
CORE53	0.12	0.30	0.31	0.67	0.87*	0.72	0.57	0.51
CORE55	0.04	0.29	0.24	0.62	0.85*	0.71	0.58	0.46
RCORE31	0.09	0.18	0.23	0.58	0.65*	0.60	0.46	0.37
CORE33	0.13	0.22	0.27	0.59	0.74*	0.60	0.49	0.44
RCORE35	0.08	0.23	0.24	0.63	0.74*	0.66	0.53	0.42
CORE37	0.07	0.27	0.26	0.56	0.75*	0.64	0.50	0.41
CORE39	0.11	0.18	0.22	0.58	0.62*	0.49	0.40	0.33
CORE44	0.10	0.24	0.27	0.63	0.80*	0.65	0.52	0.43
CORE45	0.00	0.12	0.10	0.43	0.58*	0.41	0.34	0.27
CORE27	0.17	0.28	0.18	0.58	0.64	0.78*	0.48	0.44

Table 7 continued

ITEM	PHY	PAINSEV	ROLEP	COG	DEP	ANX	ROLEE	EFT
CORE30	0.10	0.29	0.26	0.60	0.71	0.81*	0.50	0.45
CORE42	0.18	0.31	0.30	0.63	0.71	0.82*	0.50	0.47
CORE46	0.13	0.28	0.27	0.63	0.39	0.74*	0.49	0.43
CORE48	0.12	0.27	0.26	0.65	0.70	0.74*	0.48	0.43
CORE52	0.15	0.28	0.28	0.62	0.68	0.77*	0.48	0.42
CORE16A	0.19	0.21	0.41	0.50	0.57	0.48	0.70*	0.42
CORE16B	0.20	0.24	0.41	0.50	0.59	0.52	0.72*	0.46
CORE16C	0.22	0.23	0.41	0.49	0.53	0.48	0.64*	0.41
CORE8A	0.10	0.45	0.51	0.51	0.54	0.55	0.45	0.69*
RCORE8C	0.42	0.35	0.50	0.37	0.38	0.36	0.37	0.75*
RCORE8E	0.43	0.36	0.51	0.37	0.40	0.37	0.39	0.76*
RCORE8G	0.49	0.37	0.56	0.39	0.41	0.37	0.39	0.67*
CORE8I	0.38	0.39	0.47	0.45	0.49	0.48	0.44	0.66*

Notes:

1. Standard error of correlation = 0.02.
2. Scale Abbreviations:

PHY = Physical Functioning
 PAINSEV = Pain Severity
 ROLEP = Role Limitations Due to Physical Health
 COG = Cognitive Functioning
 DEP = Depression/Behavioral-Emotional Control
 ANX = Anxiety
 ROLEE = Role Limitations Due to Emotional Problems
 EFT = Energy/Fatigue Index.

MOS core measures encompass physical health and mental health constructs (Hays & Stewart, 1990, 1992b).

In exploratory factor analysis, the factors identified represent dimensions posited to underlie the measured items. Variables that represent a construct should load substantially on the same factor that defines that construct. We used exploratory factor analysis to examine the structure of the MOS core measures using baseline panel data. The decision regarding the number of factors to rotate is a central issue in factor analysis (Rummel, 1970). Multiple criteria were examined to determine the number of factors to rotate: Guttman's (1954) weakest lower bound, maximum likelihood statistical tests, scree test (Cattell, 1966), and parallel analysis (Humphreys & Ilgen, 1969; Montanelli & Humphreys, 1976). These criteria strongly suggested that a two-factor solution was appropriate.

We then rotated to a two-factor solution, electing a Promax oblique rotation (Hendrickson & White, 1964). We prefer an oblique rather than an orthogonal factor solution because "it is more sensible to rotate the factors obliquely and then determine the tenability of the orthogonality assumption" (Ford, MacCallum, & Tait, 1986). Oblique rotations generally yield a more realistic representation of the factors than do orthogonal rotations (Rummel, 1970). Factor loadings for the rotated two-factor solution are provided in Table 8.

Results of this analysis verify that physical health is defined by physical functioning, role limitations due to physical health, mobility, satisfaction with physical ability, pain, and inability to work or do housework because of health (see Table 8). Current health perceptions also reflect primarily physical health, in contrast to other studies that have found that current health also overlaps with mental health (Davies & Ware, 1981). The physical/psychophysiological symptom measure also loaded on the physical health factor. Mental health is defined by depression/behavioral-emotional control, positive affect, feelings of belonging, anxiety, cognitive function, and role limitations due to

Table 8
FACTOR LOADINGS FOR HYPOTHESIZED FACTOR ANALYSIS MODEL

Scale Name	Physical	Mental	Health Measure	
PHYSFUNC	0.95	-0.28	Physical Functioning	(K=10)
RLMTPHYS	0.79	0.03	Role Limit Due To Physical Health	(K=7)
MOBILITY	0.75	-0.12	Mobility	(K=2)
SATPHYSA	0.73	0.07	Satisfaction With Physical Ability	(K=1)
PAINEFF	0.70	0.16	Effects Of Pain	(K=6)
GHPCORE	0.69	0.20	Current Health	(K=7)
PAINSVRT	0.65	0.07	Pain Severity	(K=5)
UNABLHSE	0.61	0.04	Able To Do Housework	(K=1)
UNABLWRK	0.66	-0.13	Able To Work	(K=1)
PSYCPHYS	0.56	0.28	Physical/Psychophysiologic Symptoms	(K=8)
SLEEPPRB	0.38	0.47	Sleep Problems I	(K=9)
DBEC1	-0.09	0.98	Depression/Beh-Emot Control I	(K=13)
POSAFF1	-0.04	0.92	Positive Affect I	(K=7)
BELONG	-0.22	0.86	Feelings Of Belonging	(K=3)
ANXIETY1	-0.01	0.87	Anxiety I	(K=7)
COGFUNC	0.04	0.79	Cognitive Functioning	(K=6)
RLMTEMOT	0.12	0.65	Role Limit Due To Emotional Health	(K=3)
SOCFUNC	0.42	0.52	Social Activity Limitations Due To Health	(K=4)
ENRGFATG	0.55	0.37	Energy/Fatigue	(K=5)
HLTHDIST	0.47	0.43	Health Distress	(K=6)

Note: INTER-FACTOR CORRELATION IS 0.48655.

emotional problems. General health measures, which were designed to cut across health dimensions, represent physical and mental health about equally, including sleep problems, social activity limitations due to health, energy/fatigue, and health distress. The correlation between the physical and mental health factors shown in Table 8 is substantial but indicates that these two are clearly distinct ($r = 0.49$).

The standardized scoring coefficients for the physical and mental health factors are provided in Table 9. To obtain factor scores, standard scores are multiplied by the coefficients in the first column (physical health factor) and second column (mental health factor) of Table 9.

INTERCORRELATIONS AMONG SCALES

Intercorrelations among the 39 measures of physical and mental health are given in Table 10 (along with the two factor scores and the MOS measure of socially desirable response set). Correlations among

Table 9
STANDARDIZED SCORING COEFFICIENTS

Scale Name	Physical	Mental	Health Measure	
PHYSFUNC	0.16242	-0.07239	Physical Functioning	(K=10)
RLMTPHYS	0.13136	-0.01094	Role Limit Due To Physical Health	(K=7)
MOBILITY	0.12795	-0.03855	Mobility	(K=2)
SATPHYSA	0.12167	-0.00204	Satisfaction With Physical Ability	(K=1)
PAINEFF	0.11426	0.01531	Effects Of Pain	(K=6)
GHPCORE	0.11110	0.02271	Current Health	(K=7)
PAINSVRT	0.10845	-0.00191	Pain Severity	(K=5)
UNABLHSE	0.10168	-0.00675	Able To Do Housework	(K=1)
UNABLWRK	0.11417	-0.03943	Able To Work	(K=1)
PSYCPHYS	0.08800	0.03988	Physical/Psychophysiologic Symptoms	(K=8)
SLEEPPRB	0.05422	0.07982	Sleep Problems I	(K=9)
DBEC1	-0.03600	0.18521	Depression/Beh-Emot Control I	(K=13)
POSAFF1	-0.02692	0.17250	Positive Affect I	(K=7)
BELONG	-0.05717	0.16699	Feelings Of Belonging	(K=3)
ANXIETY1	-0.02129	0.16253	Anxiety I	(K=7)
COGFUNC	-0.01017	0.14753	Cognitive Functioning	(K=6)
RLMTEMOT	0.00587	0.11881	Role Limit Due To Emotional Health	(K=3)
SOCFUNC	0.05929	0.08737	Social Activity Limitations Due To Health	(K=4)
ENRGFATG	0.08471	0.05802	Energy/Fatigue	(K=5)
HLTHDIST	0.07014	0.07074	Health Distress	(K=6)

Table 10
Correlations Among Selected Measures (N = 2471)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	
1. Physical Functioning	--																							
2. Satisfaction with Physical Ability	.63	--																						
3. Mobility	.59	.43	--																					
4. Effects of Pain	.53	.57	.45	--																				
5. Pain Severity	.44	.50	.36	.79	--																			
6. SF-36™ Pain	.54	.55	.44	.87	.87	--																		
7. RAND Pain	.56	.55	.46	.89	.85	.99	--																	
8. Role Limitations Due to Physical Health	.64	.59	.49	.64	.54	.63	.64	--																
9. SF-36™ Role Limitations Due to Physical Health	.60	.58	.43	.62	.53	.61	.62	.96	--															
10. Cognitive Functioning	.22	.35	.27	.41	.30	.35	.36	.39	.35	--														
11. Mental Health Index I	.14	.39	.23	.45	.34	.36	.37	.34	.32	.75	--													
12. Psychological Distress I	.14	.37	.25	.46	.34	.37	.37	.34	.31	.78	.98	--												
13. Depression/Behavioral-Emotional Control I	.12	.36	.23	.44	.32	.35	.35	.32	.30	.75	.96	.98	--											
14. Anxiety I	.17	.36	.25	.45	.34	.37	.37	.33	.30	.73	.86	.90	.81	--										
15. Psychological Well-Being I	.13	.38	.17	.40	.30	.32	.32	.31	.30	.62	.93	.84	.84	.70	--									
16. Positive Affect I	.15	.42	.21	.43	.33	.35	.35	.34	.33	.62	.93	.85	.84	.72	.97	--								
17. Feelings of Belonging	.04	.24	.06	.26	.19	.19	.19	.20	.20	.50	.77	.67	.67	.53	.88	.74	--							
18. Mental Health Index II	.14	.39	.22	.45	.33	.36	.36	.34	.32	.75	.99	.98	.96	.87	.91	.92	.74	--						
19. Psychological Distress II	.14	.38	.23	.45	.33	.36	.37	.33	.31	.77	.97	.99	.97	.90	.84	.85	.66	.98	--					
20. Depression/Behavioral-Emotional Control II	.12	.36	.22	.43	.31	.34	.34	.32	.30	.75	.96	.97	.99	.81	.84	.85	.68	.97	.98	--				
21. Anxiety II	.16	.35	.23	.42	.32	.35	.35	.31	.29	.68	.82	.86	.77	.97	.67	.69	.50	.85	.88	.77	--			
22. Psychological Well-Being II	.13	.37	.18	.40	.30	.32	.32	.31	.30	.63	.93	.84	.84	.72	.98	.97	.82	.93	.84	.85	.69	--		
23. Positive Affect II	.14	.39	.20	.42	.31	.33	.34	.32	.31	.63	.92	.85	.84	.73	.95	.98	.73	.92	.85	.84	.70		--	

Table 10—Continued

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
24. Mental Health Index III	.15	.39	.23	.45	.34	.36	.37	.33	.31	.72	.96	.95	.93	.86	.88	.91	.68	.97	.95	.93	.85
25. Role Limitations Due to Emotional Problems	.23	.35	.26	.39	.27	.32	.33	.48	.44	.57	.64	.65	.64	.57	.55	.56	.44	.63	.64	.64	.55
26. Energy/Fatigue	.53	.62	.42	.56	.46	.52	.53	.62	.60	.50	.57	.55	.53	.51	.56	.59	.39	.57	.55	.53	.49
27. SF-36™ Vitality	.49	.59	.40	.54	.46	.50	.51	.59	.57	.50	.58	.55	.53	.51	.56	.59	.40	.58	.55	.53	.50
28. Sleep Problems I	.37	.46	.36	.56	.45	.49	.50	.50	.47	.53	.58	.59	.56	.57	.52	.54	.39	.58	.59	.56	.55
29. Sleep Problems II	.33	.43	.33	.53	.42	.46	.47	.44	.41	.51	.59	.58	.55	.56	.54	.55	.41	.59	.58	.56	.54
30. Physical/Psychophysiologic Symptoms	.47	.53	.38	.63	.65	.64	.64	.55	.53	.48	.48	.49	.45	.50	.42	.44	.32	.48	.48	.45	.47
31. Social Activity Limitations Due to Health	.44	.53	.49	.58	.42	.50	.52	.54	.51	.58	.67	.67	.67	.58	.60	.63	.44	.66	.66	.66	.55
32. SF-36™ Social Functioning	.43	.50	.47	.60	.44	.52	.54	.54	.50	.59	.68	.68	.68	.59	.61	.63	.45	.67	.67	.67	.56
33. Role Functioning: Able to Work	.50	.38	.48	.36	.27	.35	.37	.46	.41	.22	.18	.18	.17	.18	.16	.18	.09	.18	.18	.17	.17
34. Role Functioning: Able to Do Housework	.48	.45	.45	.44	.32	.39	.41	.47	.42	.30	.30	.31	.30	.27	.26	.29	.16	.30	.31	.30	.27
35. Current Health	.58	.66	.45	.58	.50	.55	.56	.60	.58	.41	.48	.46	.44	.43	.46	.49	.31	.48	.46	.44	.41
36. RAND General Health	.53	.60	.40	.51	.43	.48	.49	.53	.50	.36	.40	.38	.36	.37	.39	.42	.27	.40	.38	.37	.36
37. SF-36™ General Health	.53	.60	.41	.51	.43	.49	.49	.53	.51	.36	.40	.39	.37	.37	.39	.42	.27	.40	.39	.37	.36
38. SF-20 Current Health	.57	.64	.44	.57	.50	.54	.55	.60	.57	.40	.46	.44	.43	.42	.44	.47	.30	.46	.44	.43	.41
39. Health Distress	.44	.55	.45	.57	.42	.49	.50	.53	.49	.54	.60	.62	.61	.56	.51	.54	.35	.60	.61	.60	.53
40. Factor Score: Physical Health	.81	.78	.69	.79	.69	.76	.78	.82	.77	.43	.41	.41	.39	.41	.36	.41	.19	.41	.41	.39	.39
41. Factor Score: Mental Health	.18	.44	.25	.51	.39	.42	.42	.42	.40	.81	.97	.96	.94	.86	.90	.90	.76	.97	.95	.94	.82
42. Socially Desirable Response Set	-.12	.06	-.04	.09	.06	.04	.03	.04	.05	.21	.27	.26	.24	.27	.26	.26	.22	.27	.26	.25	.26

Table 10—Continued

	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.	36.	37.	38.	39.	40.	41.	42.	
24. Mental Health Index III	.90	.92	--	--																		
25. Role Limitations Due to Emotional Problems	.55	.55	.61	--																		
26. Energy/Fatigue	.56	.57	.57	.49	--																	
27. SF-36™ Vitality	.56	.58	.57	.49	.98	--																
28. Sleep Problems I	.52	.53	.57	.45	.62	.62	--															
29. Sleep Problems II	.54	.55	.57	.43	.59	.59	.96	--														
30. Physical/Psychophysiologic Symptoms	.42	.43	.47	.41	.58	.57	.59	.57	--													
31. Social Activity Limitations Due to Health	.60	.61	.65	.56	.61	.60	.54	.52	.50	--												
32. SF-36™ Social Functioning	.61	.61	.66	.56	.59	.57	.55	.54	.52	.91	--											
33. Role Functioning: Able to Work	.19	.17	.19	.24	.36	.34	.30	.28	.33	.36	.34	--										
34. Role Functioning: Able to Do Housework	.26	.28	.31	.30	.47	.44	.38	.35	.37	.47	.47	.39	--									
35. Current Health	.46	.48	.48	.41	.68	.66	.54	.51	.57	.61	.58	.55	.47	--								
36. RAND General Health	.39	.40	.40	.33	.60	.59	.46	.44	.50	.51	.47	.48	.40	.88	--							
37. SF-36™ General Health	.39	.40	.40	.33	.60	.59	.47	.45	.50	.52	.47	.49	.41	.88	.99	--						
38. SF-20 Current Health	.44	.46	.46	.40	.66	.65	.52	.50	.57	.59	.56	.54	.46	.98	.89	.89	--					
39. Health Distress	.51	.53	.59	.52	.60	.59	.54	.51	.54	.65	.65	.45	.46	.66	.57	.58	.65	--				
40. Factor Score: Physical Health	.36	.39	.41	.44	.74	.71	.62	.57	.71	.68	.66	.61	.64	.79	.70	.71	.78	.69	--			
41. Factor Score: Mental Health	.90	.89	.93	.72	.65	.65	.67	.66	.56	.73	.72	.19	.34	.54	.46	.46	.53	.67	.49	--		
42. Socially Desirable Response Set	.26	.27	.25	.17	.09	.10	.15	.14	.07	.15	.13	-.04	-.01	.06	.10	.10	.05	.10	.01	.28	--	

Notes: N's for correlation ranged from 1998 to 2233.

measures of different aspects of health tend to be moderate in size. As expected, measures that tap primarily physical health correlate highest with other measures of physical health. For example, physical functioning correlates 0.64 with role limitations due to physical health and only 0.22 with cognitive functioning and 0.14 with the Mental Health Index I. Similarly, measures that tap primarily mental health correlate higher with other measures of mental health than they do with physical health measures.

Correlations of the health measures with SDRS were somewhat higher for mental than physical health constructs but were small (largest correlation was 0.28), suggesting that these self-reports are not unduly biased by socially desirable responding.

6. MOS MEASURES AND SCALES

DATA QUALITY OF MOS MEASURES

Self-report questionnaires are vulnerable to biases if patients do not respond, selectively answer only certain types of questions or use response scales in a stereotypical way. Previously, we reported the data quality of selected MOS HRQOL scales for younger and older chronically ill patients (Sherbourne & Meredith, 1992). Here we focus on rates of missing data across different HRQOL concepts for several other groups of interest (in addition to age): men versus women, high school graduates versus patients with less than a high school education, and severely ill patients in comparison with less severely ill patients. Serious chronic medical conditions included (1) congestive heart failure (CHF) patients reporting edema, orthopnea, or dyspnea on exertion, (2) myocardial infarction (MI) survivors with noteworthy and recurring angina symptoms and/or severe CHF symptomology, and (3) hypertension patients with reports of severe CHF symptomology and/or a history of stroke. Diabetics were classified as severe if they had at least one of the following: history of MI, weekly angina, severe autonomic neuropathy, moderately severe peripheral neuropathy and lack of blood sugar control or severe vision problems or moderately severe autonomic neuropathy, or recurring angina monthly and lack of blood sugar control or severe vision problems or severe peripheral neuropathy or moderately severe autonomic neuropathy (McHorney, Ware, & Raczek, 1993).

We calculated the number of missing items within the core HRQOL measures to see if item nonresponse differed by groups of interest. For each group, we calculated the percentage of patients who missed none, missed only one, or missed all of the items. Results from those analyses are presented in Tables 11-14. As reported previously, the younger patients appeared to be more likely to complete all items within a given HRQOL measure. The older age groups were more likely to have missed one item. Very few patients in any of the age groups missed all items within a given measure. Missing data rates by gender appeared to be comparable for all but two measures. Females appeared more likely to

Table 11
PERCENTAGE OF PANEL COMPLETING THE QUESTIONNAIRE WHO MISSED ITEMS BY AGE GROUP

Measure	Number of Items	Age Group			
		18-44	45-46	65-74	75+
Physical Functioning	10				
% missed none		93.5	89.8	84.2	78.3
% missed one		2.4	5.4	8.1	11.5
% missed all items		2.8	1.8	3.4	3.0
Satisfaction with Physical Ability	1				
% missed none		96.7	98.1	97.1	96.2
% missed one		3.3	1.9	2.9	3.8
% missed all items		3.3	1.9	2.9	3.8
Mobility	2				
% missed none		97.0	98.1	96.4	97.4
% missed one		0.3	0.4	0.8	0.0
% missed all items		2.7	1.5	2.7	2.6
Effects of Pain	6				
% missed none		95.5	95.5	90.7	87.7
% missed one		1.0	1.0	3.9	3.8
% missed all items		2.8	2.8	3.9	6.0
Pain Severity	5				
% missed none		91.1	89.6	83.2	78.3
% missed one		3.4	4.9	6.5	6.8
% missed all items		0.3	0.0	0.7	0.4
SF-36™ Pain (RAND Pain)	2				
% missed none		94.5	92.9	89.1	86.0
% missed one		4.6	6.9	10.0	13.2
% missed all items		0.9	0.3	0.8	0.9
Role Limitations Due to Physical Health	7				
% missed none		96.3	93.4	88.1	53.0
% missed one		1.6	3.1	4.4	1.3
% missed all items		1.8	2.4	5.1	7.7
SF-36™ Role Limitations Due to Physical Health	4				
% missed none		97.3	94.5	90.3	87.2
% missed one		0.6	2.4	3.1	3.8
% missed all items		1.8	2.7	5.4	7.7
Cognitive Functioning	6				
% missed none		91.2	88.3	86.9	90.4
% missed one		6.4	4.9	7.6	13.2
% missed all items		0.1	0.0	0.5	0.4
Mental Health Index I	32				
% missed none		86.2	81.8	79.5	73.6
% missed one		3.3	3.2	4.9	4.3
% missed all items		0.1	0.0	0.3	0.4

Table 11—Continued

Measure	Number of Items	Age Group			
		18-44	45-46	65-74	75+
Psychological Distress I	22				
% missed none		86.9	83.0	82.3	75.7
% missed one		4.2	5.1	4.6	6.8
% missed all items		0.1	0.0	0.5	0.4
Depression/Behavioral-Emotional Control I	13				
% missed none		88.4	84.8	84.2	77.9
% missed one		3.1	4.0	2.7	5.1
% missed all items		0.1	0.0	0.5	0.4
Anxiety I	6				
% missed none		92.7	91.2	88.3	85.1
% missed one		3.4	3.6	5.1	3.8
% missed all items		0.0	0.0	0.0	0.0
Psychological Well-Being I	10				
% missed none		92.1	88.4	86.3	82.6
% missed one		2.2	4.0	3.4	4.3
% missed all items		0.1	0.0	0.3	0.4
Positive Affect I	7				
% missed none		92.6	89.1	88.1	84.3
% missed one		3.4	7.1	5.9	8.5
% missed all items		0.1	0.0	0.3	0.1
Feelings of Belonging	3				
% missed none		95.5	92.7	90.2	87.7
% missed one		3.4	6.9	8.3	9.4
% missed all items		0.1	0.0	0.5	0.9
Mental Health Index II	17				
% missed none		88.9	85.4	84.2	77.0
% missed one		2.1	3.8	3.7	6.0
% missed all items		0.1	0.0	0.5	0.4
Psychological Distress II	12				
% missed none		90.3	87.2	85.7	80.9
% missed one		3.4	4.4	5.4	7.2
% missed all items		0.1	0.0	0.5	0.4
Anxiety II	3				
% missed none		95.7	94.9	93.5	91.9
% missed one		2.4	2.0	2.4	3.0
% missed all items		0.0	0.0	0.0	0.0
Depression/Behavioral-Emotional Control II	8				
% missed none		90.5	87.2	85.9	81.3
% missed one		5.2	5.7	7.5	9.4
% missed all items		0.1	0.0	0.5	0.4
Psychological Well-Being II	5				
% missed none		94.2	92.4	92.4	89.4
% missed one		2.4	3.6	2.2	3.8
% missed all items		0.1	0.0	0.5	0.4

Table 11—Continued

Measure	Number of Items	Age Group			
		18-44	45-46	65-74	75+
Positive Affect II	4				
% missed none		94.4	92.9	92.5	90.2
% missed one		3.6	5.8	3.7	6.4
% missed all items		0.1	0.0	0.5	0.4
Mental Health Index III	5				
% missed none		93.5	89.6	88.6	85.1
% missed one		3.9	6.2	7.3	9.4
% missed all items		0.1	0.0	0.5	0.4
Role Limitations Due to Emotional Problems	3				
% missed none		97.6	96.0	92.9	88.1
% missed one		0.3	0.5	1.7	2.6
% missed all items		1.9	2.8	5.1	7.7
Energy/Fatigue	5				
% missed none		94.7	95.4	90.7	85.5
% missed one		3.1	2.3	4.6	5.5
% missed all items		1.8	1.6	3.2	5.1
SF-36™ Vitality	4				
% missed none		94.8	95.8	91.2	86.4
% missed one		3.3	2.0	4.4	5.1
% missed all items		1.8	1.6	3.2	5.5
Sleep Problems I	9				
% missed none		94.8	95.3	91.0	88.1
% missed one		1.3	1.1	2.2	3.0
% missed all items		0.6	0.5	1.0	1.7
Sleep Problems II	6				
% missed none		95.2	95.7	92.2	89.8
% missed one		0.9	0.9	0.2	2.6
% missed all items		0.7	0.7	0.2	1.7
Physical/Psychophysiologic Symptoms	8				
% missed none		94.1	90.2	83.7	80.4
% missed one		3.6	3.5	5.8	6.0
% missed all items		1.6	3.2	4.6	5.5
Social Activity Limitations Due to Health	4				
% missed none		93.9	92.7	91.9	90.2
% missed one		4.3	4.9	5.6	5.5
% missed all items		0.1	0.1	0.5	0.0
Role Functioning: Able to Work	1				
% missed none		96.6	96.9	89.6	81.3
% missed one		3.4	3.1	10.4	18.7
% missed all items		3.4	3.1	10.1	18.7

Table 11—Continued

Measure	Number of Items	Age Group			
		18-44	45-46	65-74	75+
Role Functioning: Able to do					
Housework	1				
% missed none		96.3	96.4	96.1	94.0
% missed one		3.7	3.6	3.9	6.0
% missed all items		3.7	3.6	3.9	6.0
Current Health	7				
% missed none		91.8	91.5	88.6	85.1
% missed one		4.3	4.9	1.9	5.1
% missed all items		0.0	0.0	0.3	0.0
SF-36™ General Health (RAND					
General Health)	5				
% missed none		92.9	93.9	91.5	87.2
% missed one		4.9	4.7	4.8	8.1
% missed all items		0.0	0.0	0.3	0.4
SF-20 Current Health	5				
% missed none		92.4	92.9	89.5	86.8
% missed one		3.9	3.8	4.2	4.3
% missed all items		0.0	0.0	0.3	0.0
Health Distress	6				
% missed none		95.4	95.8	90.3	84.7
% missed one		2.7	2.2	4.1	6.4
% missed all items		1.6	1.9	3.6	5.5

have missing data on the measures of physical functioning and physical/psychophysiologic symptoms. Missing data rates were consistently higher among patients with less than a high school education but did not vary greatly by level of disease severity. There was some indication in results (not shown) that, among the oldest patients, those with more severe illness were more likely to have missing data for physical health measures than those with less severe illness. In contrast, among the younger patients, those with more severe illness were more likely to be missing data for mental health measures than those with less severe illness.

In spite of differences found, across all groups, very few patients missed all of the items within a given HRQOL measure. This finding supports the strategy of using multi-item measures that are internally consistent and computing scores based on information that is available (i.e., computing the average of non-missing responses). This strategy

Table 12
PERCENTAGE OF PANEL COMPLETING THE QUESTIONNAIRE WHO MISSED ITEMS BY
ILLNESS SEVERITY

Measure	Number of Items	Illness Severity*	
		Not severe	Severe
Physical Functioning	10		
% missed none		90.5	87.2
% missed one		4.9	6.8
% missed all items		2.3	2.0
Satisfaction with Physical Ability	1		
% missed none		97.5	98.0
% missed one		2.5	2.0
% missed all items		2.5	2.0
Mobility	2		
% missed none		97.8	98.0
% missed one		0.3	0.3
% missed all items		1.9	1.7
Effects of Pain	6		
% missed none		93.8	90.3
% missed one		2.2	3.1
% missed all items		3.0	5.4
Pain Severity	5		
% missed none		88.8	83.0
% missed one		4.6	7.7
% missed all items		0.1	0.6
SF-36™ Pain (RAND Pain)	2		
% missed none		92.6	88.9
% missed one		6.9	9.9
% missed all items		0.5	1.1
Role Limitations Due to Physical Health	7		
% missed none		93.9	88.9
% missed one		2.5	4.3
% missed all items		3.0	4.8
SF-36™ Role Limitations Due to Physical Health	4		
% missed none		94.9	90.9
% missed one		1.8	3.4
% missed all items		3.1	5.1
Cognitive Functioning	6		
% missed none		88.2	86.4
% missed one		8.0	9.4
% missed all items		0.0	1.3
Mental Health Index I	32		
% missed none		82.6	77.6
% missed one		3.7	4.3
% missed all items		0.0	0.3

Table 12—Continued

Measure	Number of Items	Illness Severity*	
		Not severe	Severe
Psychological Distress I	22		
% missed none		84.2	80.1
% missed one		5.1	4.0
% missed all items		0.0	0.3
Depression/Behavioral-Emotional Control I	13		
% missed none		85.8	82.1
% missed one		3.7	3.4
% missed all items		0.0	0.3
Anxiety I	6		
% missed none		91.1	87.2
% missed one		3.7	5.7
% missed all items		0.0	0.0
Psychological Well-Being I	10		
% missed none		88.7	83.1
% missed one		3.3	5.1
% missed all items		0.0	0.3
Positive Affect I	7		
% missed none		89.5	87.5
% missed one		5.6	8.5
% missed all items		0.0	1.3
Feelings of Belonging	3		
% missed none		92.8	91.5
% missed one		6.4	7.1
% missed all items		0.1	0.3
Mental Health Index II	17		
% missed none		85.9	82.4
% missed one		3.1	4.0
% missed all items		0.0	0.3
Psychological Distress II	12		
% missed none		88.2	83.2
% missed one		4.1	5.7
% missed all items		0.0	0.3
Anxiety II	3		
% missed none		94.7	92.0
% missed one		2.4	3.4
% missed all items		0.0	0.0
Depression/Behavioral-Emotional Control II	8		
% missed none		88.3	83.5
% missed one		5.7	7.7
% missed all items		0.0	0.3
Psychological Well-Being II	5		
% missed none		92.4	92.0
% missed one		2.8	4.8
% missed all items		0.0	0.3

Table 12—Continued

Measure	Number of Items	Illness Severity*	
		Not severe	Severe
Positive Affect II	4		
% missed none		92.7	92.3
% missed one		5.0	5.4
% missed all items		0.0	0.3
Mental Health Index III	5		
% missed none		90.8	86.6
% missed one		5.6	8.0
% missed all items		0.0	0.3
Role Limitations Due to Emotional Problems	3		
% missed none		95.2	93.2
% missed one		1.1	0.3
% missed all items		2.0	5.1
Energy/Fatigue	5		
% missed none		93.8	92.3
% missed one		3.2	3.7
% missed all items		2.0	2.0
SF-36™ Vitality	4		
% missed none		94.0	92.6
% missed one		3.2	4.3
% missed all items		2.1	2.0
Sleep Problems I	9		
% missed none		95.3	92.6
% missed one		1.3	2.0
% missed all items		0.8	0.9
Sleep Problems II	6		
% missed none		95.5	93.8
% missed one		1.1	1.1
% missed all items		0.9	0.9
Physical/Psychophysiologic Symptoms	8		
% missed none		88.3	88.6
% missed one		5.1	3.1
% missed all items		3.4	3.4
Social Activity Limitations Due to Health	4		
% missed none		93.4	89.8
% missed one		4.6	7.7
% missed all items		0.2	0.3
Role Functioning: Able to Work	1		
% missed none		95.1	93.5
% missed one		4.9	6.5
% missed all items		4.9	6.5
Role Functioning: Able to Do Housework	1		
% missed none		97.2	96.3
% missed one		2.8	3.7
% missed all items		2.8	3.7

Table 12—Continued

Measure	Number of Items	Illness Severity*	
		Not severe	Severe
Current Health	7		
% missed none		92.2	87.5
% missed one		3.6	6.5
% missed all items		0.0	0.3
SF-36™ General Health (RAND General Health)	5		
% missed none		93.8	91.2
% missed one		4.2	6.5
% missed all items		0.1	0.3
SF-20 Current Health	5		
% missed none		92.8	89.5
% missed one		3.3	1.8
% missed all items		0.0	0.3
Health Distress	6		
% missed none		94.3	91.5
% missed one		2.4	5.1
% missed all items		2.2	2.3

*Serious chronic medical conditions included (1) CHF patients reporting edema, orthopnea, or dyspnea on exertion; (2) MI survivors with noteworthy and recurring angina symptoms and/or severe CHF symptomology; and (3) hypertension patients with reports of severe CHF symptomology and/or a history of stroke. Diabetics were classified as severe if they had at least one of the following: history of MI, weekly angina, severe autonomic neuropathy, moderately severe peripheral neuropathy and lack of blood sugar control or severe vision problems or moderately severe autonomic neuropathy, or recurring angina monthly and lack of blood sugar control or severe vision problems or severe peripheral neuropathy or moderately severe autonomic neuropathy (McHorney, Ware, & Raczek, 1993).

maximizes the ability to assess reliably a given concept in patients who tend to have missing data (e.g., older and less educated patients). Results emphasize the possible negative consequences of using only one or two items to measure a given HRQOL concept.

PROFILES OF MOS SCALES

Unadjusted (raw) mean scores on all measures at baseline by age, education, gender, and illness severity are provided in Table 15; Table 16 gives the corresponding standard deviations. The measures of score central tendency and variation can be used for comparison of other

Table 13
PERCENTAGE OF PANEL COMPLETING THE QUESTIONNAIRE WHO MISSED ITEMS BY
EDUCATIONAL LEVEL

Measure	Number of Items	Education	
		High School Graduate	Less than High School Diploma
Physical Functioning	10		
% missed none		89.9	79.4
% missed one		5.4	8.3
% missed all items		2.4	3.9
Satisfaction with Physical Ability	1		
% missed none		97.4	96.4
% missed one		2.6	3.6
% missed all items		2.6	3.6
Mobility	2		
% missed none		97.5	96.1
% missed one		0.4	0.6
% missed all items		2.1	3.3
Effects of Pain	6		
% missed none		94.0	88.1
% missed one		2.0	4.2
% missed all items		3.1	4.7
Pain Severity	5		
% missed none		88.9	78.3
% missed one		4.6	7.2
% missed all items		0.2	0.8
SF-36™ Pain (RAND Pain)	2		
% missed none		92.5	87.2
% missed one		6.9	11.9
% missed all items		0.6	0.8
Role Limitations Due to Physical Health	7		
% missed none		93.2	86.4
% missed one		2.6	5.8
% missed all items		3.1	5.6
SF-36™ Role Limitations Due to Physical Health	4		
% missed none		94.2	89.7
% missed one		1.9	3.6
% missed all items		3.3	5.6
Cognitive Functioning	6		
% missed none		88.5	85.6
% missed one		7.7	9.4
% missed all items		0.2	0.3
Mental Health Index I	32		
% missed none		82.6	76.7
% missed one		3.6	5.0
% missed all items		0.2	0.3

Table 13—Continued

Measure	Number of Items	Education	
		High School Graduate	Less than High School Diploma
Psychological Distress I	22		
% missed none		84.2	78.3
% missed one		4.6	6.1
% missed all items		0.2	0.3
Depression/Behavioral-Emotional Control I	13		
% missed none		85.7	81.1
% missed one		3.5	3.6
% missed all items		0.2	0.3
Anxiety I	6		
% missed none		90.7	87.8
% missed one		3.7	7.2
% missed all items		0.0	0.0
Psychological Well-Being I	10		
% missed none		89.4	83.3
% missed one		3.2	3.9
% missed all items		0.2	0.3
Positive Affect I	7		
% missed none		90.3	84.4
% missed one		5.4	8.1
% missed all items		0.2	0.3
Feelings of Belonging	3		
% missed none		93.1	88.3
% missed one		5.7	10.3
% missed all items		0.3	0.3
Mental Health Index II	17		
% missed none		86.1	81.1
% missed one		3.0	5.8
% missed all items		0.2	0.3
Psychological Distress II	12		
% missed none		87.9	82.8
% missed one		4.1	7.8
% missed all items		0.2	0.3
Anxiety II	3		
% missed none		94.4	95.0
% missed one		2.5	1.4
% missed all items		0.0	0.0
Depression/Behavioral-Emotional Control II	8		
% missed none		88.1	82.8
% missed one		5.9	8.9
% missed all items		0.2	0.3
Psychological Well-Being II	5		
% missed none		93.3	90.0
% missed one		2.9	3.1
% missed all items		0.2	0.3

Table 13—Continued

Measure	Number of Items	Education	
		High School Graduate	Less than High School Diploma
Positive Affect II	4		
% missed none		93.5	90.0
% missed one		4.5	5.3
% missed all items		0.2	0.3
Mental Health Index III	5		
% missed none		91.0	85.3
% missed one		5.5	9.2
% missed all items		0.2	0.3
Role Limitations Due to Emotional Problems	3		
% missed none		95.6	90.8
% missed one		0.7	2.2
% missed all items		3.2	5.8
Energy/Fatigue	5		
% missed none		93.9	87.8
% missed one		3.3	4.4
% missed all items		2.3	3.3
SF-36™ Vitality	4		
% missed none		94.3	88.3
% missed one		3.1	4.7
% missed all items		2.3	3.6
Sleep Problems I	9		
% missed none		94.6	86.1
% missed one		1.2	4.2
% missed all items		0.8	0.8
Sleep Problems II	6		
% missed none		95.1	88.6
% missed one		0.9	2.8
% missed all items		0.9	1.1
Physical/Psychophysiologic Symptoms	8		
% missed none		89.9	81.7
% missed one		1.3	4.7
% missed all items		3.2	4.2
Social Activity Limitations Due to Health	4		
% missed none		92.7	91.9
% missed one		5.0	4.7
% missed all items		0.2	0.3
Role Functioning: Able to Work	1		
% missed none		95.1	83.9
% missed one		4.9	16.1
% missed all items		4.9	16.1
Role Functioning: Able to Do Housework	1		
% missed none		96.5	93.6
% missed one		3.5	6.4
% missed all items		3.5	6.4

Table 13—Continued

Measure	Number of Items	Education	
		High School Graduate	Less than High School Diploma
Current Health	7		
% missed none		90.8	86.9
% missed one		1.6	5.3
% missed all items		0.1	0.3
SF-36™ General Health (RAND General Health)	5		
% missed none		92.8	89.7
% missed one		5.1	5.3
% missed all items		0.1	0.3
SF-20 Current Health	5		
% missed none		91.8	88.1
% missed one		3.8	4.7
% missed all items		0.1	0.3
Health Distress	6		
% missed none		93.9	88.6
% missed one		3.4	2.8
% missed all items		2.3	4.4

samples to specific subgroups in the MOS sample. Looking at the physical health and mental health factor score rows of Table 15, the results indicate that physical health is highest for the youngest age group (age 18-44), and that the two intermediate age groups score slightly lower (age 45-64, age 65-74). The oldest age group (age 75+), as expected, scores lowest on physical health. Mental health, on the other hand, actually is highest in the two older age groups, lowest in the youngest age group, and intermediate in the middle age group. Previous research is consistent with relatively high levels of mental health among older persons, but the position of middle age persons is less understood (Nelson, Hays, & Arnold et al., 1989). There is some indication that the extent of depressive symptoms may be lowest among the middle-aged but that rates of clinical depression may be highest (Kessler, Foster, Webster, & House, 1992; Mirowsky & Ross, 1992).

Physical health factor scores were also higher among those with a high school education, males, and those without a severe illness. Mental health factor scores were higher among males and those without a

Table 14
PERCENTAGE OF PANEL COMPLETING THE QUESTIONNAIRE WHO MISSED ITEMS BY
GENDER

Measure	Number of Items	Gender	
		Female	Male
Physical Functioning	10		
% missed none		86.0	91.5
% missed one		7.5	3.4
% missed all items		2.9	2.3
Satisfaction with Physical Ability	1		
% missed none		97.1	97.4
% missed one		2.9	2.6
% missed all items		2.9	2.6
Mobility	2		
% missed none		97.3	97.2
% missed one		0.4	0.6
% missed all items		2.3	2.3
Effects of Pain	6		
% missed none		92.2	94.5
% missed one		2.4	2.1
% missed all items		3.6	3.1
Pain Severity	5		
% missed none		86.0	88.9
% missed one		5.5	4.4
% missed all items		0.4	0.1
SF-36™ Pain (RAND Pain)	2		
% missed none		90.8	93.0
% missed one		8.6	6.3
% missed all items		0.7	0.7
Role Limitations Due to Physical Health	7		
% missed none		91.2	93.4
% missed one		3.5	2.5
% missed all items		3.5	3.5
SF-36™ Role Limitations Due to Physical Health	4		
% missed none		92.9	94.4
% missed one		2.5	1.7
% missed all items		3.6	3.7
Cognitive Functioning	6		
% missed none		87.6	88.6
% missed one		8.0	8.0
% missed all items		0.3	0.1
Mental Health Index I	32		
% missed none		80.9	82.8
% missed one		4.3	3.1
% missed all items		0.2	0.1

Table 14—Continued

Measure	Number of Items	Gender	
		Female	Male
Psychological Distress I	22		
% missed none		82.3	84.6
% missed one		5.0	4.6
% missed all items		0.3	0.1
Depression/Behavioral-Emotional Control I	13		
% missed none		84.1	86.3
% missed one		3.6	3.4
% missed all items		0.3	0.1
Anxiety I	6		
% missed none		89.6	91.3
% missed one		4.6	3.8
% missed all items		0.0	0.0
Psychological Well-Being I	10		
% missed none		88.2	88.8
% missed one		5.6	3.4
% missed all items		0.2	0.1
Positive Affect I	7		
% missed none		89.3	89.5
% missed one		5.6	6.2
% missed all items		0.2	0.1
Feelings of Belonging	3		
% missed none		92.2	92.7
% missed one		6.5	6.4
% missed all items		0.3	0.2
Mental Health Index II	17		
% missed none		84.7	86.1
% missed one		3.5	3.5
% missed all items		0.3	0.1
Psychological Distress II	12		
% missed none		86.0	88.7
% missed one		5.3	3.7
% missed all items		0.3	0.1
Anxiety II	3		
% missed none		94.2	94.8
% missed one		2.2	2.5
% missed all items		0.0	0.0
Depression/Behavioral-Emotional Control II	8		
% missed none		86.2	88.8
% missed one		7.1	5.3
% missed all items		0.3	0.1
Psychological Well-Being II	5		
% missed none		92.8	92.7
% missed one		2.5	3.5
% missed all items		0.3	0.1

Table 14—Continued

Measure	Number of Items	Gender	
		Female	Male
Positive Affect II	4		
% missed none		92.8	93.1
% missed one		4.2	5.3
% missed all items		0.3	0.1
Mental Health Index III	5		
% missed none		89.6	90.7
% missed one		6.6	5.3
% missed all items		0.3	0.1
Role Limitations Due to Emotional Problems	3		
% missed none		94.2	95.7
% missed one		1.3	0.6
% missed all items		3.8	3.5
Energy/Fatigue	5		
% missed none		92.3	93.8
% missed one		3.8	3.1
% missed all items		2.4	2.6
SF-36™ Vitality	4		
% missed none		92.8	94.1
% missed one		3.6	2.9
% missed all items		2.4	2.6
Sleep Problems I	9		
% missed none		92.8	94.0
% missed one		2.1	0.9
% missed all items		0.7	0.9
Sleep Problems II	6		
% missed none		93.9	94.2
% missed one		1.4	0.8
% missed all items		0.9	1.0
Physical/Psychophysiologic Symptoms	8		
% missed none		86.7	91.5
% missed one		5.5	2.6
% missed all items		3.5	3.2
Social Activity Limitations Due to Health	4		
% missed none		92.2	93.2
% missed one		5.2	4.5
% missed all items		0.3	0.1
Role Functioning: Able to Work	1		
% missed none		91.7	95.6
% missed one		8.3	4.4
% missed all items		8.3	4.4
Role Functioning: Able to Do Housework	1		
% missed none		95.3	97.1
% missed one		4.7	2.9
% missed all items		4.7	2.9

Table 14—Continued

Measure	Number of Items	Gender	
		Female	Male
Current Health	7		
% missed none		89.1	91.8
% missed one		5.7	3.3
% missed all items		0.1	0.0
SF-36™ General Health (RAND General Health)	5		
% missed none		91.3	93.8
% missed one		6.2	3.5
% missed all items		0.1	0.1
SF-20 Current Health	5		
% missed none		90.0	93.0
% missed one		5.0	2.4
% missed all items		0.1	0.0
Health Distress	6		
% missed none		93.0	93.2
% missed one		3.2	3.3
% missed all items		0.7	2.6

severe illness, but mental health was similar in those with and without a high school education.

Profiles of HRQOL scores by chronic disease group (hypertension, CHF, MI, diabetes, depression) at baseline of the MOS and two years later are shown in Tables 17, 18, 19, and 20. Only the eight SF-36™ scales are provided because these were the only ones measured throughout the longitudinal course of the MOS (see Hays, Sherbourne & Mazel, 1993; Ware & Sherbourne, 1992, for their definition and content). The analytic sample included 1790 patients. The average age of the sample was 55.9 (SD = 15.9). Average educational attainment was 13.4 years (SD = 3.0), 18.7 percent were nonwhite, 58.4 percent married, and 59.6 percent female. Further details about the sample are reported elsewhere (Hays, Wells, Sherbourne, et al., in press).

These profiles reveal substantial limitations in functioning and well-being for patients with depression (depressive symptoms only or current depressive disorder) at the beginning of the study, especially in terms of mental health indicators. Despite noteworthy improvement for depressed patients in functioning and well-being over time, at the two-year follow-up point they still tend to score lower than patients

with chronic medical illness in terms of mental health outcomes. For example, energy scores for insulin-using diabetics (mean = 75.37) and hypertensive patients (mean = 63.97) were significantly greater than scores for all patients with depression in the medical sector (depressive symptoms only: mean = 51.78; major depression: mean = 55.63; dysthymia: mean = 47.60; double depression (major depression superimposed on dysthymia): mean = 45.81) at the two-year follow-up. Medical specialty patients with depression (symptoms or disorder) scored significantly worse on role limitations because of emotional problems than patients with all other medical conditions except CHF at the two-year follow-up. Patients with a medical condition outscored depressed patients (symptoms or disorder) on emotional well-being in both specialty sectors.

In terms of physical health outcomes, depressed patients made some gains relative to the nondepressed over time. At the two-year follow-up, depressed patients overall tended to score similarly to medically ill patients. After two years, for example, general health perceptions of patients with major depression in both specialty sectors were equivalent or better than those of patients with each type of medical condition.

At baseline, patients with only depressive symptoms tended to have higher levels of functioning and well-being than patients with current depressive disorder, particularly in terms of mental health. Although patients with current depressive disorder displayed greater improvements in outcomes over time than patients with only depressive symptoms, the latter tended to score significantly better at both time points on role limitations because of emotional problems and emotional well-being than patients with dysthymia or double depression in the medical sector.

Patients with current depressive disorder treated in the mental health specialty sector were initially much sicker and tended to improve to a greater extent over time than did comparable patients in the medical sector. Patients in the mental health specialty sector with dysthymia improved significantly on six of the eight health status measures (role disability due to physical problems, general health, energy/fatigue, social functioning, role disability due to emotional

Table 15

Means for Measures by Age, Education, Gender, and Illness Severity

Measure	Number of Items	Age					Education			Gender		Illness Severity	
		18-44	45-64	65-74	75+	Less than HS Diploma	HS or higher	Male	Female	Not Severe	Severe		
Physical Functioning	10	82.33	71.61	63.36	54.34	56.22	73.62	67.94	75.46	76.71	54.50		
Satisfaction with Physical Ability	1	60.74	58.41	60.07	57.79	55.16	60.30	58.10	61.58	65.21	50.90		
Mobility	2	94.71	92.20	91.08	86.52	84.38	93.52	89.99	95.23	95.81	85.51		
Effects of Pain	6	75.10	76.53	78.72	76.24	71.17	77.65	74.15	80.40	82.72	71.10		
Pain Severity	5	61.87	62.05	64.95	63.69	57.30	63.98	59.76	67.75	67.99	58.33		
SF-36™ Pain	2	68.02	67.04	68.30	64.85	60.56	68.75	64.66	71.68	72.82	60.90		
RAND Pain	2	71.62	70.46	71.43	67.66	63.51	72.16	67.97	75.05	76.27	64.11		
Role Limitations Due to Physical Health	7	66.61	61.94	58.55	47.75	49.64	63.20	57.37	66.72	69.70	44.34		
SF-36™ Role Limitations Due to Physical Health	4	59.72	53.53	49.89	39.16	42.60	55.01	49.05	59.17	62.74	34.26		
Cognitive Functioning	6	75.68	81.92	85.16	82.16	77.91	81.50	79.80	82.64	85.90	80.60		
Mental Health Index I	32	61.87	73.05	81.37	80.98	73.44	72.56	70.01	76.81	80.43	74.60		
Psychological Distress I	22	67.14	77.94	85.39	84.54	77.22	77.36	74.69	81.37	84.92	79.20		
Depression/Behavioral-Emotional Control I	13	68.18	79.87	87.28	86.29	78.98	78.96	76.25	83.12	86.79	81.14		
Anxiety I	7	65.77	74.59	81.91	81.58	73.68	74.77	72.17	78.28	81.20	76.41		
Psychological Well-Being I	10	50.29	62.34	72.57	73.26	65.11	62.06	59.75	66.82	70.65	64.51		
Positive Affect I	7	47.38	59.26	69.70	69.73	61.74	59.09	56.68	63.85	67.75	61.51		
Feelings of Belonging	3	57.17	69.60	79.22	81.58	72.74	69.02	66.90	73.76	77.39	71.56		
Mental Health Index II	17	60.10	71.58	80.28	80.08	71.69	71.21	68.61	75.39	79.24	73.47		
Psychological Distress II	12	64.82	75.94	80.66	82.98	75.18	75.46	72.80	79.37	83.21	77.73		
Depression/Behavioral-Emotional Control II	8	65.95	77.87	85.88	84.42	76.91	77.11	74.46	81.07	85.21	79.35		
Anxiety II	4	63.65	73.32	80.66	80.78	72.66	73.13	70.76	76.55	80.19	74.77		

Table 15—Continued

Measure	Number of Items	Age					Education			Gender		Illness Severity	
		18-44	45-64	65-74	75+	Less than HS	Diploma or higher	Female	Male	Not Severe	Severe		
		49.17	61.16	71.71	72.85	63.43	61.16	58.73	65.77	69.62	63.83		
Psychological Well-Being II	5	49.17	61.16	71.71	72.85	63.43	61.16	58.73	65.77	69.62	63.83		
Positive Affect II	4	46.56	58.89	69.55	70.28	60.77	58.85	56.34	63.46	67.33	61.79		
Mental Health Index III	5	59.22	70.54	79.51	78.97	70.56	70.32	67.49	74.74	78.47	72.62		
Role Limitations Due to Emotional Problems	3	54.27	68.67	75.52	68.47	62.74	66.61	61.83	72.34	78.63	66.21		
Energy/Fatigue	5	51.02	54.13	56.99	52.45	49.23	54.60	50.33	59.02	60.66	46.13		
SF-36™ Vitality	4	48.65	52.64	55.73	51.70	48.00	52.90	48.61	57.54	59.00	44.86		
Sleep Problems I	9	66.66	70.77	73.10	70.72	66.30	70.85	68.34	72.88	75.52	65.77		
Sleep Problems II	6	66.54	71.51	75.17	72.44	67.75	71.70	68.65	74.76	76.32	67.99		
Physical/Psychophysiological Symptoms	8	72.19	74.09	77.02	75.38	68.62	75.43	71.79	78.33	79.39	70.18		
Social Activity Limitations Due to Health	4	58.07	63.30	68.86	65.94	61.01	63.91	62.17	65.40	71.05	60.10		
SF-36™ Social Functioning	2	72.19	79.81	84.19	80.80	75.63	79.37	76.39	82.41	88.28	75.14		
Role Functioning: Able to Work	1	88.77	80.81	76.70	69.11	58.28	85.05	79.53	84.04	88.71	62.61		
Role Functioning: Able to Do Housework	1	83.02	81.12	84.81	79.64	75.07	83.89	80.25	85.91	91.43	68.44		
Current Health	7	56.01	53.83	58.29	56.56	49.26	57.20	54.47	58.15	63.05	42.83		
RAND General Health	5	57.06	55.50	58.34	57.52	52.62	57.72	56.03	58.27	62.12	45.20		
SF-36™ General Health	5	58.46	56.88	59.73	58.69	53.70	59.14	57.38	59.67	63.65	46.17		
SF-20 Current Health	5	54.90	52.69	56.88	55.96	47.97	56.08	53.16	57.28	61.99	41.21		
Health Distress	6	74.02	77.77	82.52	81.74	72.66	79.30	76.06	81.63	85.37	73.31		
Factor Score: Physical Health	--	73.76	70.79	70.51	66.00	62.63	72.73	68.82	74.62	77.05	60.73		
Factor Score: Mental Health	--	55.90	66.11	73.65	72.94	65.64	65.75	63.37	69.33	73.12	66.68		
Socially Desirable Response Set	5	18.64	25.32	32.54	31.14	32.67	25.12	28.19	23.41	28.26	27.40		

Table 16
Standard Deviations for Measures by Age, Education, Gender, and Illness Severity

Measure	Number of Items	Age					Education			Gender		Illness Severity	
		18-44	45-64	65-74	75+	Less than HS	Diploma or higher	Female	Male	Not Severe	Severe		
		21.77	26.59	26.97	28.66	30.81	25.49	28.12	24.86	23.03	28.31		
Physical Functioning	10	21.77	26.59	26.97	28.66	30.81	25.49	28.12	24.86	23.03	28.31		
Satisfaction with Physical Ability	1	25.86	25.77	25.11	25.79	29.12	24.85	26.40	24.30	23.60	24.67		
Mobility	2	12.76	17.98	19.23	23.01	25.03	15.55	20.20	12.41	12.67	23.22		
Effects of Pain	6	25.01	25.55	24.07	25.07	29.04	24.01	25.55	23.60	21.29	25.68		
Pain Severity	5	25.81	27.88	28.33	27.88	30.82	26.60	27.41	26.71	26.01	26.72		
SF-36 ^W Pain	2	23.66	26.02	26.10	26.29	28.64	24.51	25.64	24.41	23.61	25.60		
RAND Pain	2	23.71	26.18	26.06	26.35	29.09	24.47	25.91	24.16	23.20	25.92		
Role Limitations Due to Physical Health	7	33.55	35.41	34.66	35.84	36.85	34.35	35.45	33.79	32.06	34.15		
SF-36 ^W Role Limitations Due to Physical Health	4	39.20	40.70	41.00	40.70	41.36	40.33	40.65	40.13	38.40	38.00		
Cognitive Functioning	6	19.55	16.86	13.96	15.19	18.62	16.92	17.81	16.22	14.09	15.75		
Mental Health Index I	32	20.85	18.64	14.23	14.75	19.66	19.59	20.14	17.99	15.02	17.09		
Psychological Distress I	22	20.89	18.00	13.76	13.87	19.47	18.96	19.69	17.25	14.11	16.79		
Depression/Behavioral-Emotional Control I	13	22.03	18.55	13.47	13.85	19.74	19.65	20.43	17.66	14.01	17.05		
Anxiety I	7	21.14	19.51	16.38	16.06	21.09	19.79	20.64	18.41	16.86	18.09		
Psychological Well-Being I	10	23.46	22.64	18.09	19.43	23.18	23.33	23.67	22.13	19.39	21.14		
Positive Affect I	7	23.76	22.97	19.23	20.55	24.22	23.75	24.15	22.69	20.12	21.47		
Feelings of Belonging	3	28.04	27.02	21.14	22.52	27.02	27.08	27.40	26.11	23.08	26.77		
Mental Health Index II	17	21.73	19.64	15.30	15.77	20.67	20.59	21.19	18.96	16.09	17.80		
Psychological Distress II	12	22.01	19.34	15.03	15.54	20.57	20.28	20.87	18.79	15.69	17.36		
Depression/Behavioral-Emotional Control II	8	23.28	19.93	14.80	15.69	20.85	21.04	21.69	19.25	15.50	17.93		

Table 16-Continued

Measure	Number of Items	Age					Education			Gender		Illness Severity	
		18-44	45-64	65-74	75+	Less than HS	Diploma or higher	Female	Male	Not Severe	Severe		
Anxiety II	4	23.04	21.37	18.60	18.54	23.13	21.85	22.66	20.63	18.80	19.54		
Psychological Well-Being II	5	23.60	23.12	19.15	20.05	24.16	23.80	24.49	22.22	19.85	21.81		
Positive Affect II	4	23.83	23.48	19.78	20.62	24.73	24.19	24.83	22.77	20.48	22.14		
Mental Health Index III	5	22.87	21.21	17.04	17.63	22.42	21.87	22.50	20.35	17.91	19.57		
Role Limitations Due to Emotional Problems	3	42.11	39.77	36.50	40.28	42.64	40.16	41.22	38.75	34.51	41.08		
Energy/Fatigue	5	21.71	22.45	21.66	22.34	23.02	21.85	22.17	20.99	20.73	21.20		
SF-36™ Vitality	4	22.08	22.59	21.78	22.37	22.66	22.21	22.44	21.11	20.94	21.19		
Sleep Problems I	9	17.86	16.97	15.80	17.00	19.29	16.60	17.51	16.15	14.43	17.10		
Sleep Problems II	6	19.00	18.57	16.87	18.11	21.06	17.92	19.03	17.03	15.82	19.12		
Physical/Psychophysiological Symptoms	8	18.29	17.90	17.45	17.39	20.90	17.14	18.20	16.80	15.92	18.77		
Social Activity Limitations Due to Health	4	20.81	20.25	19.26	20.82	22.62	20.21	21.21	19.57	15.46	20.56		
SF-36™ Social Functioning	2	26.66	24.98	22.88	25.38	28.49	24.76	25.89	24.27	18.80	26.12		
Role Functioning: Able to Work	1	31.60	39.16	35.93	40.36	43.32	36.77	39.83	34.81	28.01	46.55		
Role Functioning: Able to Do Housework	1	37.57	39.16	35.93	40.36	43.32	36.77	39.83	34.81	28.01	46.55		
Current Health	7	24.46	25.17	25.46	26.58	27.04	24.67	25.58	24.51	22.64	24.70		
RAND General Health	5	21.69	21.48	19.81	20.56	21.76	20.82	21.54	20.20	18.95	20.65		
SF-36™ General Health	5	21.94	21.86	20.36	21.08	22.35	21.16	21.97	20.53	19.18	21.23		
SF-20 Current Health	5	24.88	25.47	25.39	27.03	26.83	25.01	25.86	24.68	23.10	24.38		
Health Distress	6	26.19	23.17	20.87	20.92	26.39	22.90	24.74	21.31	18.84	23.34		
Factor Score: Physical Health	-	17.42	20.29	19.76	20.03	22.79	18.26	20.07	17.81	16.32	19.92		
Factor Score: Mental Health	-	19.98	17.82	13.87	14.44	18.81	18.65	19.06	17.47	14.51	16.23		
Socially Desirable Response Set	5	20.62	22.71	23.58	25.21	24.86	22.96	23.53	22.96	23.51	23.66		

Table 17
Adjusted Mean Functioning and Well-Being at Baseline for Medical Specialty Sector Patients*

	Diabetes								
	1	2	3	4	5	6	7	8	9
Subthreshold Depressive Symptoms									
Physical Health									
Physical Functioning	70.9 ^{c,d,e} (2.6)	72.5 ^{b,c,d,e} (4.3)	64.4 ^e (4.0)	67.1 ^{d,e} (5.0)	80.0 ^b (1.0)	64.2 ^e (3.3)	79.1 ^{a,b,c} (3.5)	88.7 ^a (3.9)	76.6 ^{b,c,d} (2.1)
Role Limitations Due to Physical Health	57.3 ^c	49.4 ^{c,d}	38.3 ^d	50.7 ^{c,d}	68.6 ^b	53.2 ^{c,d}	66.4 ^{b,c}	86.0 ^a	69.8 ^b
SF-36™ Pain	(3.9)	(7.1)	(9.5)	(6.3)	(1.8)	(5.3)	(5.9)	(7.0)	(4.1)
SF-36™ General Health	(2.0)	(4.9)	(3.9)	(4.9)	(1.3)	(3.2)	(3.8)	(4.0)	(2.0)
Mental Health									
Mental Health Index III	54.4 ^{c,d} (2.2)	55.8 ^{a,b,c,d} (4.3)	50.5 ^{c,d,e} (4.2)	45.0 ^e (3.5)	63.8 ^a (1.0)	52.3 ^{d,e} (2.6)	63.2 ^{a,b} (2.4)	62.1 ^{a,b,c,d} (6.0)	58.5 ^{b,c} (2.1)
Role Limitations Due to Emotional Problems	65.3 ^c (1.8)	58.6 ^{c,d} (3.3)	52.1 ^{d,e} (4.2)	43.4 ^e (3.6)	79.6 ^b (0.8)	82.9 ^{a,b} (1.9)	77.4 ^b (2.4)	88.0 ^a (3.9)	80.0 ^b (1.5)
SF-36™ Social Functioning	62.2 ^c	40.5 ^d	63.9 ^{b,c}	31.8 ^d	81.0 ^{a,b}	81.0 ^{a,b}	76.6 ^b	95.8 ^a	82.7 ^{a,b}
SF-36™ Vitality	(3.6)	(6.2)	(9.1)	(6.1)	(1.9)	(5.2)	(5.7)	(7.7)	(3.4)

*Scales grouped in terms of the factor (physical or mental health) they load strongest on. The predictions are adjusted for comorbidity, sociodemographics, and system of care. Standard error is in parentheses. Within each row, groups sharing a letter in common do not differ significantly (.05 level) from one another. Subgroup sample sizes are (in parentheses): subthreshold depressive symptoms (229), major depression (73), dysthymia (46), double depression (60), hypertension (961), congestive heart failure (130), myocardial infarction (75), diabetes on insulin (40), and diabetes not on insulin (324).

Table 18

Adjusted Mean Functioning and Well-Being Two Years After Baseline for Medical Specialty Sector Patients*

	Diabetes								
	1	2	3	4	5	6	7	8	9
Subthreshold Depressive Symptoms									
Physical Health	70.7 ^{c,d} (2.8)	71.6 ^{b,c,d} (3.4)	67.6 ^{c,d} (5.2)	74.6 ^{a,b,c} (4.1)	78.1 ^{a,b} (0.9)	63.4 ^d (3.1)	82.0 ^a (2.9)	80.3 ^{a,b,c} (5.0)	75.0 ^{b,c} (1.8)
Physical Functioning	60.8 ^{b,c} (4.1)	49.9 ^{c,d} (6.9)	34.9 ^d (9.4)	57.3 ^{b,c} (6.3)	72.1 ^a (1.9)	49.7 ^{c,d} (4.6)	73.2 ^{a,b} (5.2)	62.0 ^{a,b,c} (7.2)	66.0 ^{a,b} (3.6)
Role Limitations Due to Physical Health	68.5 ^{d,e} (2.4)	61.4 ^e (4.1)	58.3 ^e (6.1)	68.3 ^{b,c,d,e} (4.0)	76.6 ^b (1.6)	72.2 ^{b,c,d} (3.3)	83.6 ^a (2.9)	67.3 ^{c,d,e} (4.1)	74.8 ^{b,c} (1.9)
SF-36™ Pain	57.1 ^b (2.5)	56.3 ^{a,b,c} (4.3)	47.2 ^c (4.7)	54.6 ^{b,c} (4.2)	63.7 ^a (1.3)	49.0 ^c (2.9)	63.6 ^{a,b} (3.0)	55.5 ^{a,b,c} (7.8)	58.2 ^b (2.2)
SF-36™ General Health									
Mental Health	66.9 ^b (1.8)	64.7 ^b (3.1)	53.9 ^c (3.9)	54.1 ^c (3.5)	80.6 ^a (0.7)	81.7 ^a (2.1)	78.5 ^a (2.1)	81.3 ^a (6.7)	78.2 ^a (1.6)
Mental Health Index III	66.1 ^c (4.9)	62.4 ^{c,d} (7.4)	42.3 ^d (10.3)	46.6 ^d (7.7)	84.2 ^{a,b} (1.7)	78.2 ^{a,b,c} (4.7)	83.7 ^{a,b} (6.1)	93.2 ^a (6.3)	79.6 ^b (3.6)
Role Limitations Due to Emotional Problems	76.4 ^{c,d} (3.4)	72.6 ^d (4.4)	66.2 ^d (5.0)	72.0 ^d (5.1)	90.6 ^a (1.0)	84.0 ^{b,c} (2.7)	92.1 ^{a,b} (4.2)	88.1 ^{a,b,c} (5.4)	85.2 ^b (2.2)
SF-36™ Social Functioning	51.8 ^d (2.3)	55.6 ^{b,c,d} (3.6)	47.6 ^{c,d} (5.3)	45.8 ^d (4.0)	64.0 ^a (0.9)	50.5 ^d (2.8)	60.8 ^{a,b} (2.9)	75.4 ^a (6.8)	57.7 ^{b,c} (1.9)
SF-36™ Vitality									

*Scales grouped in terms of the factor (physical or mental health) they load strongest on. The predictions are adjusted for comorbidity, sociodemographics, and system of care. Standard error is in parentheses. Within each row, groups sharing a letter in common do not differ significantly (.05 level) from one another. Subgroup sample sizes are (in parentheses): subthreshold depressive symptoms (229), major depression (73), dysthymia (46), double depression (60), hypertension (961), congestive heart failure (130), myocardial infarction (75), diabetes on insulin (40), and diabetes not on insulin (324).

Table 19
Adjusted Mean Functioning and Well-Being at Baseline for Mental Health
Specialty Sector Patients*

	Subthreshold Depressive Symptoms	Major Depression	Dysthymia	Double Depression
Physical Health				
Physical Functioning	80.0 (2.4) [1,3,4,6]	79.2 (2.9) [1,3,4,6,8]	70.4 (3.9) [5,8]	65.8 (4.0) [5,7,8,9]
Role Limitations Due to Physical Health	61.5 (5.3) [3,8]	51.2 (5.7) [5,8,9]	22.8 (7.5) [1,2,4,5,6, 7,8,9]	34.7 (5.0) [1,4,5,6,7, 8,9]
SF-36™ Pain	68.7 (3.8) [7]	72.4 (3.6) [3,4]	52.2 (4.2) [1,5,6,7,8, 9]	58.2 (4.3) [1,5,6,7,8, 9]
SF-36™ General Health	61.0 (2.7) [3,4,6]	56.6 (3.3) [4,5]	47.4 (4.0) [5,7,8,9]	47.6 (3.7) [5,7,8,9]
Mental Health				
Mental Health Index III	61.9 (2.9) [4,5,6,7,8,9]	53.0 (3.5) [1,5,6,7,8,9]	42.1 (4.6) [1,2,5,6,7, 8,9]	39.3 (3.1) [1,2,3,5,6, 7,8,9]
Role Limitations Due to Emotional Problems	39.8 (5.8) [1,3,5,6,7,8, 9]	37.1 (7.8) [1,3,5,6,7,8, 9]	31.5 (8.6) [1,3,5,6,7, 8,9]	24.8 (5.6) [1,2,3,5,6, 7,8,9]
SF-36™ Social Functioning	69.1 (4.2) [4,5,6,7,8,9]	65.1 (4.4) [1,5,6,7,8,9]	53.4 (4.0) [1,2,5,6,7, 8,9]	47.5 (5.3) [1,2,5,6,7, 8,9]
SF-36™ Vitality	49.8 (2.9) [4,5,7,8,9]	48.8 (3.6) [4,5,7,8,9]	36.5 (5.0) [1,2,5,6,7, 8,9]	30.5 (2.7) [1,2,3,5,6, 7,8,9]

*Scales grouped in terms of the factor (physical or mental health) they load strongest on. The predictions are adjusted for comorbidity, sociodemographics, and system of care. Standard error is in parentheses. Within each row, groups sharing a letter in common do not differ significantly (.05 level) from one another. Significant differences (.05 level) between these groups and medical sector patients are denoted within brackets by the sequence numbers of groups in Table 2. Subgroup sample sizes are (in parentheses): subthreshold depression symptoms (82), major depression (59), dysthymia (26), and double depression (61).

Table 20
Adjusted Mean Functioning and Well-Being Two Years After Baseline for
Mental Health Specialty Sector Patients*

	Subthreshold Depressive Symptoms	Major Depression	Dysthymia	Double Depression
Physical Health				
Physical Functioning	81.1 ^a (1.5) [1,2,3,6,9]	79.0 ^{a,b} (2.7) [1,3,6]	71.9 ^{b,c} (4.1) [7]	68.0 ^c (3.1) [5,7,8]
Role Limitations Due to Physical Health	55.1 ^{a,b} (5.7) [5,7]	61.6 ^a (5.6) [3]	52.6 ^{a,b} (11.6) NS	44.0 ^b (6.3) [1,5,7,9]
SF-36™ Pain	68.7 ^{a,b} (3.0) [5,7]	74.1 ^a (3.0) [2,3,7]	68.9 ^{a,b} (6.7) [7]	64.4 ^b (3.6) [5,7,9]
SF-36™ General Health	63.2 ^a (2.8) [3,6]	63.6 ^a (3.3) [3,6]	60.3 ^{a,b} (3.9) [3,6]	49.9 ^b (4.4) [5,7]
Mental Health				
Mental Health Index III	61.3 ^a (2.6) [5,6,7,8,9]	63.0 ^a (3.0) [5,6,7,8,9]	61.4 ^a (5.0) [5,6,7,8,9]	49.0 ^b (3.9) [1,2,5,6,7,8,9]
Role Limitations Due to Emotional Problems	53.6 ^a (6.7) [5,6,7,8,9]	58.0 ^a (5.9) [5,6,7,8,9]	49.7 ^a (8.7) [5,6,7,8,9]	39.5 ^a (7.5) [1,2,5,6,7,8,9]
SF-36™ Social Functioning	73.6 ^a (3.8) [5,6,7,8,9]	72.1 ^{a,b} (3.5) [5,6,7,8,9]	72.9 ^{a,b,c} (7.0) [5,7]	57.6 ^c (5.2) [1,2,4,5,6,7,8,9]
SF-36™ Vitality	57.3 ^a (3.0) [4,5,8]	56.4 ^a (2.6) [4,5,8]	56.7 ^a (4.0) [8]	46.4 ^b (3.1) [2,5,7,8,9]

*Scales grouped in terms of the factor (physical or mental health) they load strongest on. The predictions are adjusted for comorbidity, sociodemographics, and system of care. Standard error is in parentheses. Within each row, groups sharing a letter in common do not differ significantly (.05 level) from one another. Significant differences (.05 level) between these groups and medical sector patients are denoted within brackets by the sequence numbers of groups in Table 2. NS = no significant differences. Subgroup sample sizes are (in parentheses): subthreshold depression symptoms (82), major depression (59), dysthymia (26), and double depression (61).

problems, emotional well-being); patients with major depression improved significantly on four health measures (general health, energy, role disability due to emotional problems, emotional well-being); and patients with double depression improved significantly on three indicators of mental health (energy, social functioning, emotional well-being). Improvements in functioning and well-being for mental health specialty patients tended to exceed improvements observed for the medical patients on the mental health outcome measures. For example, patients with dysthymia in the mental health sector improved by 19.24 points on emotional well-being compared with an increase of 1.84 points for patients in the medical sector ($t = 2.43$, $p < .05$).

COMPARISON OF MOS CORE MEASURES TO SHORT-FORM VERSIONS

A paper by McHorney et al. (1992) compared the validity and relative precision of MOS short- and long-form health status scales. Five of the core measures described here were compared with the SF-36™ short-form versions and single-item measures of the same HRQOL concept. Those results showed, as expected, that the long-form scales best satisfied traditional psychometric criteria. A noteworthy drop in precision was observed in some of the health concepts when short-form relative to long-form versions were evaluated (e.g., for general health perceptions). The short-form versions tend to be less reliable, define fewer distinct levels of health, and represent the content of a given health domain less than the long-form scales. For some short-form measures, however, a high level of precision can be obtained (e.g., emotional well-being).

The trade-offs between lack of precision and respondent burden should be considered when designing any HRQOL questionnaire. To detect group differences of a given size, shorter measures require a larger sample.

CHOOSING HRQOL CONCEPTS

For the reasons described previously, shorter measures should be used with caution until more information has been published about their ability to detect meaningful group differences and change in a given health concept over time. The measures developed from the Core 116

battery are a good choice until the sensitivity of shorter measures has been established. We estimate that it takes about 23-28 minutes to complete this core battery, although respondent burden tends to increase with age (Sherbourne & Meredith, 1992). Some researchers may not want or need to include all dimensions of HRQOL measures summarized here, although we recommend including as many dimensions of functioning and well-being as are practical for a given study. The measures, although in many cases correlated with each other, were designed to be as unique as possible and represent a comprehensive conceptual model of health. Ultimately, the selection of concepts and measures should be dictated by the specific purposes of each study.

7. FUTURE ISSUES

NORMALIZED T-SCORES

We recommend that the 0-100 linearly transformed scores for the MOS core measures be supplemented with normalized T-scores. The 0-100 scale scores are limited by the fact that raw scores (and the 0-100 linear transformation) yield numbers that are not very informative in and of themselves. For example, a score of 45 on a 10-item physical functioning scale compared with a score of 50 on a 3-item feelings of belonging scale does not necessarily mean that this feelings of belonging score is higher in the MOS than the physical functioning score. Normalized T-scores provide a basis for interpreting HRQOL relative to a reference group (e.g., relative to the MOS sample). The advantages of normalized T-scores in general are discussed in a recent paper by Tellegen and Ben-Porath (1992).

To derive normalized T-scores in the normative sample (the MOS sample in this case), one first transforms the raw scores to percentile scores. A percentile score ranges between 0 and 100 (or 1- to 99+, depending on your philosophy) and represents an individual's position relative to a defined distribution of scores (norms). The percentile score indicates the percentage of individuals in the normative group (MOS) who fall at or below the corresponding raw score. Next, the percentile scores are converted to standard scores (z-scores), with a range between -3 and +3, a mean of 0, and a standard deviation of 1. Finally, the standard scores, or z-scores, are transformed to T-scores by multiplying the z-scores by 10 and adding 50 to the product. This yields a distribution of scores with a mean of 50 and standard deviation of 10. A table to convert raw scores to T-scores based on the MOS normative sample is provided (see appendix Table D.1). T-scores on the MOS measures by subgroups based on age, education, gender, and illness severity are provided in appendix Table D.2. Corresponding standard deviations are given in appendix Table D.3.

PROFILES AND OVERALL SCORES

The ideal HRQOL instrument has two important properties: (1) comprehensive assessment of important health domains (e.g., physical function, pain, and emotional well-being) and (2) integration of domain-specific information into an overall score. The combination of health domains yields a health "state" for each person. An overall score is produced by assigning a value or weight to the health state (quality-adjusted life year or QALY). This overall score is required for usage cost utility evaluations (Detsky & Nagle, 1990). Ratios of cost per QALY can, in theory, be used to decide among competing interventions in, for example, managed health care delivery systems.

Derivation of a single overall HRQOL number using utility methods is methodologically very challenging. There is evidence, for example, that preferences for different health states vary depending on who provides the rating (Froberg & Kane, 1989). In addition, several competing approaches can be used to derive the overall number (e.g., standard gamble, time trade-off, magnitude estimation, category rating, willingness-to-pay, paired preferences, and multi-attribute utility), and these alternatives may yield different results (Hornberger, Redelmeier, & Petersen, 1992).

Derivation of integrated scores using non-utility methods is possible. For example, factor-analytically derived physical and mental health composite scores were developed for the RAND 36-Item Health Survey 1.0 (Hays, Sherbourne, & Mazel, 1993). For the core measures described in this manual, standardized scoring coefficients are provided in Table 9 for physical and mental health factors. To obtain these scores, one needs to standardize scale scores to the MOS sample (i.e., use the MOS means and standard deviations in Table 6) and multiply the resulting standardized scores by the numbers in the first column of Table 9 for the physical factor score and by numbers in the second column for the mental factor score. Of course, use of these standardized scores is recommended only if the MOS chronic-disease sample is considered an appropriate reference group for one's purposes.

In other studies, overall summary scores have been derived by regressing criterion variables on scale scores to obtain scale weights

(Bozzette et al., in press). Empirical weighting methods such as these will require close scrutiny to determine their worthiness in future quality-of-life research (Hays, Stewart, Sherbourne, et al., 1993).

APPENDIX A
CORE SURVEY INSTRUMENT

**THE MEDICAL OUTCOMES STUDY 116 ITEM CORE SET OF MEASURES
OF FUNCTIONING AND WELL-BEING**

SECTION 1: HEALTH AND DAILY ACTIVITIES

The first part of the Health Questionnaire is about your health and your daily activities. Please try to answer every question as accurately as you can.

1. In general, would you say your health is:

(Circle One)

- Excellent 1
- Very good 2
- Good 3
- Fair 4
- Poor 5

2. How much bodily pain have you generally had during the past 4 weeks?

(Circle One)

- None..... 1
- Very mild 2
- Mild..... 3
- Moderate 4
- Severe 5
- Very severe 6

3. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

(Circle One)

- Not at all..... 1
 - Slightly..... 2
 - Moderately..... 3
 - Quite a bit 4
 - Extremely..... 5
-

SECTION 2: PHYSICAL HEALTH

These questions are about your physical activities and symptoms.

4. The following items are activities you might do during a typical day. Does your health limit you in these activities?

(Circle One Number on Each Line)

<u>ACTIVITIES</u>	Yes, Limited <u>A Lot</u>	Yes, Limited <u>A Little</u>	No,Not Limited <u>At All</u>
a. <u>Vigorous activities</u> , such as running lifting heavy objects, participating in strenuous sports	1	2	3
b. <u>Moderate activities</u> , such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
c. Lifting or carrying groceries	1	2	3
d. Climbing <u>several</u> flights of stairs.....	1	2	3
e. Climbing <u>one</u> flight of stairs.....	1	2	3
f. Bending, kneeling or stooping.....	1	2	3
g. Walking <u>more than a mile</u>	1	2	3
h. Walking <u>several blocks</u>	1	2	3
i. Walking <u>one block</u>	1	2	3
j. Bathing or dressing yourself.....	1	2	3

5. How satisfied are you with your physical ability to do what you want to do?

(Circle One)

- Completely satisfied..... 1
- Very satisfied..... 2
- Somewhat satisfied..... 3
- Somewhat dissatisfied 4
- Very dissatisfied..... 5
- Completely dissatisfied..... 6

6. When you travel around your community, does someone have to assist you because of your health?

(Circle One)

- Yes, all of the time..... 1
 - Yes, most of the time 2
 - Yes, some of the time..... 3
 - Yes, a little of the time..... 4
 - No, none of the time..... 5
-

7. Are you in bed or in a chair most or all of the day because of your health?

(Circle One)

- Yes, every day 1
- Yes, most days..... 2
- Yes, some days 3
- Yes, occasionally 4
- No, never..... 5

8. How often during the past 4 weeks...

(Circle One Number on Each Line)

	<u>All of the Time</u>	<u>Most of the the Time</u>	<u>A Good Bit of Time</u>	<u>Some of the Time</u>	<u>A Little of the the Time</u>	<u>None of the Time</u>
a. Did you feel worn out?	1	2	3	4	5	6
b. Were you discouraged by your health problems?	1	2	3	4	5	6
c. Did you have a lot of energy?	1	2	3	4	5	6
d. Did you feel weighed down by your health problems?	1	2	3	4	5	6
e. Did you feel full of pep?	1	2	3	4	5	6
f. Were you afraid because of your health?	1	2	3	4	5	6
g. Did you have enough energy to do the things you wanted to do?	1	2	3	4	5	6
h. Was your health a worry in your life?	1	2	3	4	5	6
i. Did you feel tired?	1	2	3	4	5	6
j. Were you frustrated about your health?	1	2	3	4	5	6
k. Did you feel despair over your health problems?	1	2	3	4	5	6

9. How often have you had any of the following symptoms during the past 4 weeks?

(Circle One Number on Each Line)

	<u>Never</u>	<u>Once or Twice</u>	<u>A Few Times</u>	<u>Fairly Often</u>	<u>Very Often</u>
a. Stiffness, pain, swelling or soreness of muscles or joints.....	1	2	3	4	5
b. Coughing that produced sputum.....	1	2	3	4	5
c. Backaches or lower back pains	1	2	3	4	5
d. Nausea (upset stomach).....	1	2	3	4	5
e. Acid indigestion, heartburn, or feeling bloated after meals.....	1	2	3	4	5
f. Heavy feelings in arms and legs	1	2	3	4	5
g. Headaches or head pains	1	2	3	4	5
h. Lump in throat	1	2	3	4	5

SECTION 3: PAIN

10. Did you experience any bodily pain in the past 4 weeks?

(Circle One)

Yes..... 1 --> Continue with Question 11, Below

No 2 --> Skip to SECTION 4

The following questions are about the pain or pains you experienced in the past 4 weeks. If you had more than one pain, answer the questions by describing your feelings of pain in general.

11. During the past 4 weeks, how often have you had pain or discomfort?

(Circle One)

- Once or twice..... 1
- A few times..... 2
- Fairly often..... 3
- Very often 4
- Every day or almost every day..... 5

12. When you had pain during the past 4 weeks, how long did it usually last?

(Circle One)

- A few minutes..... 1
- Several minutes to an hour..... 2
- Several hours 3
- A day or two..... 4
- More than two days..... 5

SECTION 4: DAILY ACTIVITIES

The following questions are about your regular daily activities such as working at a job, keeping house, taking care of children, attending school, volunteer work, or taking part in community activities.

16. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health? (Please answer YES or NO for each question.)

(Circle One Number on Each Line)

	<u>Yes</u>	<u>No</u>
a. Took <u>frequent rests</u> when doing work or other activities	1	2
b. Cut down the <u>amount of time</u> you spent on work or other activities	1	2
c. <u>Accomplished less</u> than you would like	1	2
d. Didn't do work or other activities as <u>carefully</u> as usual... 1	1	2
e. Were limited in the <u>kind</u> of work or other activities..... 1	1	2
f. Had <u>difficulty</u> performing the work or other activities (for example, it took extra effort)	1	2
g. Required <u>special assistance</u> (the assistance of others or special devices) to perform these activities	1	2

17. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? (Please answer YES or NO for each question.)

(Circle One Number on Each Line)

	<u>Yes</u>	<u>No</u>
a. Cut down the <u>amount of time</u> you spent on work or other activities?	1	2
b. <u>Accomplished less</u> than you would like?	1	2
c. Didn't do work or other activities as <u>carefully</u> as usual?.. 1	1	2

18. Does your health keep you from working around the house?

(Circle One)

Yes..... 1

No..... 2

19. Does your health keep you from working at a paying job?

(Circle One)

Yes..... 1

No..... 2

SECTION 5: YOUR FEELINGS

These questions are about how you feel and how things have been with you during the past month. For each question, please circle a number for the one answer that comes closest to the way you have been feeling.

20. How happy, satisfied, or pleased have you been with your personal life during the past month?

(Circle One)

- Extremely happy, could not have been more satisfied or pleased..... 1
- Very happy most of the time 2
- Generally satisfied, pleased 3
- Sometimes fairly satisfied, sometimes fairly unhappy 4
- Generally dissatisfied, unhappy 5
- Very dissatisfied, unhappy most of the time 6

21. During the past month, how often did you feel there were people you were close to?

(Circle One)

- Always 1
- Very often 2
- Fairly often 3
- Sometimes 4
- Almost never..... 5
- Never..... 6

22. During the past month, how often has feeling depressed interfered with what you usually do?

(Circle One)

- Always 1
 - Very often 2
 - Fairly often 3
 - Sometimes 4
 - Almost never..... 5
 - Never..... 6
-

23. How much of the time, during the past month, did you have difficulty reasoning and solving problems; for example, making plans, making decisions, learning new things?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

24. During the past month, how much of the time have you generally enjoyed the things you do?

(Circle One)

- All of the time 1
- Most of the time..... 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- None of the time 6

25. How much of the time, during the past month, has your daily life been full of things that were interesting to you?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

26. During the past month, how much of the time have you felt loved and wanted?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

27. How much of the time, during the past month, have you been a very nervous person?

(Circle One)

- All of the time 1
- Most of the time..... 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- None of the time 6

28. During the past month, how much of the time did you have difficulty doing activities involving concentration and thinking?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

29. During the past month, how much of the time did you feel depressed?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

30. During the past month, how much of the time have you felt tense or "high-strung"?

(Circle One)

- All of the time 1
- Most of the time..... 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- None of the time 6

31. During the past month, how much of the time have you been in firm control of your behavior, thoughts, emotions, feelings?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

32. During the past month, how much of the time did you become confused and start several actions at a time?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

33. During the past month, how much of the time did you feel that you had nothing to look forward to?

(Circle One)

- All of the time 1
- Most of the time..... 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- None of the time 6

34. How much of the time, during the past month, have you felt calm and peaceful?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

35. How much of the time, during the past month, have you felt emotionally stable?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

36. How much of the time, during the past month, have you felt downhearted and blue?

(Circle One)

- All of the time 1
- Most of the time..... 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- None of the time 6

37. How often have you felt like crying during the past month?

(Circle One)

- Always 1
 - Very often 2
 - Fairly often 3
 - Sometimes 4
 - Almost never..... 5
 - Never..... 6
-

38. How much of the time, during the past month, did you feel left out?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

39. During the past month, how often did you feel that others would be better off if you were dead?

(Circle One)

- Always 1
- Very often 2
- Fairly often 3
- Sometimes 4
- Almost never..... 5
- Never..... 6

40. During the past month, how much of the time did you forget, for example, things that happened recently, where you put things, appointments?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time..... 3
 - Some of the time 4
 - A little of the time 5
 - None of the time..... 6
-

41. During the past month, how much of the time did you feel that your love relationships, loving and being loved, were full and complete?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time..... 3
 - Some of the time 4
 - A little of the time 5
 - None of the time..... 6
-

42. How much have you been bothered by nervousness, or your "nerves," during the past month?

(Circle One)

- Extremely so, to the point where I could not take care of things..... 1
- Very much bothered 2
- Bothered quite a bit..... 3
- Bothered some, enough to notice..... 4
- Bothered just a little 5
- Not bothered at all 6

43. During the past month, how much of the time has living been a wonderful adventure for you?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

44. How much of the time, during the past month, have you felt so down in the dumps that nothing could cheer you up?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

45. During the past month, did you ever think about taking your own life?

(Circle One)

- Yes, constantly 1
- Yes, very often 2
- Yes, fairly often..... 3
- Yes, a couple of times 4
- Yes, once 5
- No, never 6

46. During the past month, how much of the time have you felt restless, fidgety, or impatient?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

47. During the past month, how much of the time have you been moody or brooded about things?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

48. During the past month, how often did you get rattled, upset, or flustered?

(Circle One)

- Always 1
- Very often 2
- Fairly often 3
- Sometimes 4
- Almost never..... 5
- Never 6

49. How much of the time, during the past month, did you have trouble keeping your attention on any activity for long?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

50. During the past month, how much of the time have you been anxious or worried?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

51. During the past month, how much of the time have you been a happy person?

(Circle One)

- All of the time 1
- Most of the time..... 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- None of the time 6

52. How often during the past month did you find yourself having difficulty trying to calm down?

(Circle One)

- Always 1
 - Very often 2
 - Fairly often 3
 - Sometimes 4
 - Almost never..... 5
 - Never..... 6
-

53. During the past month, how much of the time have you been in low or very low spirits?

(Circle One)

- All of the time 1
 - Most of the time..... 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

54. How much of the time, during the past month, have you felt cheerful, lighthearted?

(Circle One)

- All of the time 1
- Most of the time..... 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- None of the time 6

55. During the past month, how depressed (at its worst) have you felt?

(Circle One)

- Extremely depressed 1
 - Very depressed 2
 - Quite depressed 3
 - Somewhat depressed 4
 - A little depressed 5
 - Not depressed at all 6
-

56. How much of the time, during the past month, did you react slowly to things that were said or done?

(Circle One)

- All of the time 1
 - Most of the time 2
 - A good bit of the time 3
 - Some of the time 4
 - A little of the time 5
 - None of the time 6
-

57. During the past month, how often did you feel isolated from others?

(Circle One)

- Always 1
- Very often 2
- Fairly often 3
- Sometimes 4
- Almost never 5
- Never 6

SECTION 6: SOCIAL ACTIVITIES

The next questions ask about your social activities.

58. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

(Circle One)

- All of the time 1
- Most of the time..... 2
- A good bit of the time 3
- Some of the time 4
- A little of the time 5
- None of the time 6

59. Compared to your usual level of social activity, has your social activity during the past 6 months decreased, stayed the same, or increased because of a change in your physical or emotional condition?

(Circle One)

- Much less socially active
than before..... 1
- Somewhat less socially active
than before..... 2
- About as socially active as before 3
- Somewhat more socially active
than before..... 4
- Much more socially active than before 5

60. Compared to others your age, are your social activities more or less limited because of your physical health or emotional problems?

(Circle One)

- Much more limited than others..... 1
- Somewhat more limited than others 2
- About the same as others 3
- Somewhat less limited than others 4
- Much less limited than others 5

SECTION 7: YOUR HEALTH

Next are some general questions about your health and health-related matters.

61. How TRUE or FALSE is each of the following statements for you?

(Circle One Number on Each Line)

	<u>Definitely True</u>	<u>Mostly True</u>	<u>Don't Know</u>	<u>Mostly False</u>	<u>Definitely False</u>
a. I am somewhat ill	1	2	3	4	5
b. I feel about as good now as I ever have ...	1	2	3	4	5
c. I have been feeling bad lately	1	2	3	4	5
d. I am in poor health	1	2	3	4	5
e. I am as healthy as anybody I know	1	2	3	4	5
f. My health is excellent.....	1	2	3	4	5
g. I seem to get sick a little easier than other people.....	1	2	3	4	5
h. I expect my health to get worse	1	2	3	4	5

SECTION 8: YOUR SLEEP

62. How often during the past 4 weeks did you ...

(Circle One Number on Each Line)

	<u>All of the Time</u>	<u>Most of the Time</u>	<u>A Good Bit of the Time</u>	<u>Some of the Time</u>	<u>A Little of the Time</u>	<u>None of the Time</u>
a. feel that your sleep was not quiet (moving restlessly, feeling tense, speaking, etc., while sleeping)?	1	2	3	4	5	6
b. get enough sleep to feel rested upon waking in the morning?	1	2	3	4	5	6
c. awaken short of breath or with a headache?	1	2	3	4	5	6
d. feel drowsy or sleepy during the day?	1	2	3	4	5	6
e. have trouble falling asleep?	1	2	3	4	5	6
f. awaken during your sleep time and have trouble falling asleep again ...	1	2	3	4	5	6
g. have trouble staying awake during the day?	1	2	3	4	5	6
h. take naps (5 minutes or longer) during the day?	1	2	3	4	5	6
i. get the amount of sleep you needed?	1	2	3	4	5	6

APPENDIX B

**SAS[®] STATEMENTS TO READ AND CLEAN DATA,
AND TO DERIVE CORE MEASURES OF QUALITY OF LIFE**

```
***** ;
*** FILE: input.sas®                               DATE: 04/22/94 *** ;
*** USES: core.raw                                 CREATES: scales.ssd01 *** ;
***                                                                 *** ;
*** PURPOSE: read core data from raw file          *** ;
*** created to illustrate input statement for      *** ;
*** scale documentation                            *** ;
***** ;
libname coredata v607 'directory/subdirectory' ;
      /* where directory/subdirectory is the location to save
         permanent SAS® datasets                               */
filename CORERAW 'directory/core.raw' ;
      /* where directory/core.raw is the full path name of the
         file containing your raw data                           */

data readraw ;

      /* INPUT RAW DATA:
         A. Name variables & type
         B. Label variables                                     */

      /* alpha characters used to code different kinds of data problems */
missing A B C D E F G H I J K L M N P Q R S T U V W X Y Z ;
infile CORERAW ;
input
      /* read data from card 1 */
      #1 CASEID $CHAR4. (CARD1 CORE1 CORE2 CORE3 CORE4a CORE4b CORE4c
        CORE4d CORE4e CORE4f CORE4g CORE4h CORE4i CORE4j CORE5
        CORE6 CORE7 CORE8a CORE8b CORE8c CORE8d CORE8e CORE8f
        CORE8g CORE8h CORE8i CORE8j CORE8k CORE9a CORE9b CORE9c
        CORE9d CORE9e CORE9f CORE9g CORE9h CORE10 CORE11 CORE12
        CORE13a CORE13b CORE13c CORE13d CORE13e CORE13f) (1.) (CORE14
        CORE15) (2.)
        (CORE16a CORE16b CORE16c CORE16d CORE16e CORE16f CORE16g
        CORE17a CORE17b CORE17c CORE18 CORE19 CORE20 CORE21 CORE22
        CORE23 CORE24 CORE25 CORE26 CORE27 CORE28 CORE29 CORE30
        CORE31 CORE32 CORE33) (1.)
      /* read data from card 2 */
      #2 CASEID2 $CHAR4.
        (CARD2 CORE34 CORE35 CORE36 CORE37 CORE38 CORE39 CORE40
        CORE41 CORE42 CORE43 CORE44 CORE45 CORE46 CORE47 CORE48
        CORE49 CORE50 CORE51 CORE52 CORE53 CORE54 CORE55 CORE56
        CORE57 CORE58 CORE59 CORE60 CORE61a CORE61b CORE61c CORE61d
        CORE61e CORE61f CORE61g CORE61h CORE62a CORE62b CORE62c
        CORE62d CORE62e CORE62f CORE62g CORE62h CORE62i) (1.) ;

label CASEID='CASE IDENTIFIER'
      CARD1='CARD 1 IDENTIFIER'
      CASEID2='CASE IDENTIFIER'
      CARD2='CARD2 IDENTIFIER'
      CORE1="PAT general health"
      CORE2="Past 4 wks-general-how much bodily pain"
      CORE3="Past 4 wks-phys/emo prob inhib soc activ"
      CORE4a="Does hlth limit-vigorous activities"
      CORE4b="Does hlth limit-moderate activities"
      CORE4c="Does hlth limit-lift/carry groceries"
```

CORE4d="Does hlth limit-climb sev flights stairs "
CORE4e="Does hlth limit-climb one flight stairs "
CORE4f="Does hlth limit-bend/kneel/stooping "
CORE4g="Does hlth limit-walking more than a mile "
CORE4h="Does hlth limit-walking several blocks "
CORE4i="Does hlth limit-walking one block "
CORE4j="Does hlth limit-bathing or dressing "
CORE5="How satis w/phys abil do what want to do "
CORE6="Travel community-need assist due to hlth "
CORE7="In bed/chair most or all day due to hlth "
CORE8a="Past 4 wks-how often felt worn out "
CORE8b="Past 4 wks-discouraged by hlth problems "
CORE8c="Past 4 wks-how often had a lot of energy "
CORE8d="Past 4 wks-weighed down by hlth problems "
CORE8e="Past 4 wks-how often felt full of pep "
CORE8f="Past 4 wks-how often afraid due to hlth "
CORE8g="Past 4 wks-had energy to do what wanted "
CORE8h="Past 4 wks-how often hlth worry in life "
CORE8i="Past 4 wks-how often felt tired "
CORE8j="Past 4 wks-frustrated about hlth "
CORE8k="Past 4 wks-felt despair over hlth prob "
CORE9a="Past 4 wks-stiff/pain/swell/sore muscles "
CORE9b="Past 4 wks-coughing producing sputum "
CORE9c="Past 4 wks-backaches or lower back pains "
CORE9d="Past 4 wks-nausea/upset stomach "
CORE9e="Past 4 wks-indigestion/heartburn/bloated "
CORE9f="Past 4 wks-heavy feelings in arms/legs "
CORE9g="Past 4 wks-headaches or head pains "
CORE9h="Past 4 wks-lump in throat "
CORE10="Past 4 wks-experience any bodily pain "
CORE11="Past 4 wks-how often had pain/discomfort "
CORE12="Past 4 wks-when exp pain-usual duration "
CORE13a="Past 4 wks-pain interfere with mood "
CORE13b="Past 4 wks-pain interfere walk or move "
CORE13c="Past 4 wks-pain interfere with sleep "
CORE13d="Past 4 wks-pain interfere normal work "
CORE13e="Past 4 wks-pain interfere recreation act "
CORE13f="Past 4 wks-pain interfere enjoying life "
CORE14="Past 4 wks-num best describ average pain "
CORE15="Past 4 wks-num describ pain at its worst "
CORE16a="Past 4 wks phys prob-freq rest when work "
CORE16b="Past 4 wks phys prob-amt time spent work "
CORE16c="Past 4 wks phys prob-accomplished less "
CORE16d="Past 4 wks phys prob-work no done w/care "
CORE16e="Past 4 wks phys prob-limit kind work/act "
CORE16f="Past 4 wks phys prob-difficulty do work "
CORE16g="Past 4 wks phys hlth-require spec assist "
CORE17a="Past 4 wks emo prob-amt time spent work "
CORE17b="Past 4 wks emo prob-accomplished less "
CORE17c="Past 4 wks emo prob-work not done w/care "
CORE18="Does hlth keep from working around house "
CORE19="Does hlth keep from working paying job? "
CORE20="Past mnth-how happy with personal life "
CORE21="Past mnth-how often feel people close "
CORE22="Past mnth-how often depress interfere "
CORE23="Past mnth-how much difficulty solve prob "

```
CORE24="Past mnth-how much enjoy things done      "  
CORE25="Past mnth-how much time life interesting   "  
CORE26="Past mnth-how much time felt loved        "  
CORE27="Past mnth-how much time very nervous     "  
CORE28="Past mnth-how much time difficulty think  "  
CORE29="Past mnth-how much time feel depressed    "  
CORE30="Past mnth-how much time felt tense       "  
CORE31="Past mnth-how much time control of self   "  
CORE32="Past mnth-how much time became confused  "  
CORE33="Past mnth-how much time nothing ahead    "  
CORE34="Past mnth-how much time felt calm/peace  "  
CORE35="Past mnth-how much time felt emo stable  "  
CORE36="Past mnth-how much time felt downhearted "  
CORE37="Past mnth-how often felt like crying     "  
CORE38="Past mnth-how much time felt left out    "  
CORE39="Past mnth-feel others better if PAT dead "  
CORE40="Past mnth-how much of time forget things "  
CORE41="Past mnth-how much time felt love full   "  
CORE42="Past mnth-how much bothered by nerves    "  
CORE43="Past mnth-how much living an adventure  "  
CORE44="Past mnth-how often felt down w/no cheer "  
CORE45="Past mnth-ever think about taking life   "  
CORE46="Past mnth-how much time felt restless   "  
CORE47="Past mnth-how much time been moody      "  
CORE48="Past mnth-how often get rattled/upset   "  
CORE49="Past mnth-have trouble keeping attention "  
CORE50="Past mnth-how much time been anxious    "  
CORE51="Past mnth-how much time been happy      "  
CORE52="Past mnth-how often difficulty calm down "  
CORE53="Past mnth-how much time been low spirits "  
CORE54="Past mnth-how much time felt cheerful   "  
CORE55="Past mnth-how depressed felt at worst   "  
CORE56="Past mnth-how much of time react slowly  "  
CORE57="Past mnth-how often felt isolated       "  
CORE58="Past 4wks-hlth/emo prob interfer soc act "  
CORE59="Past 6mos-soc activ decreas/same/increas "  
CORE60="Soc activ more/less limit- emo/phys prob "  
CORE61a="True/false-somewhat ill                "  
CORE61b="True/false-feel as good now as ever    "  
CORE61c="True/false-been feeling bad lately     "  
CORE61d="True/false-in poor health              "  
CORE61e="True/false-as healthy as anybody       "  
CORE61f="True/false-health is excellent        "  
CORE61g="True/false-get sick easier than others "  
CORE61h="True/false-expect hlth to get worse   "  
CORE62a="Past 4 wks-feel that sleep not quiet   "  
CORE62b="Past 4 wks-enough sleep feel rest in AM "  
CORE62c="Past 4 wks-awaken w/SOB or w/headache  "  
CORE62d="Past 4 wks-feel drowsy/sleepy during day "  
CORE62e="Past 4 wks-have trouble falling asleep "  
CORE62f="Past 4 wks-awaken then cant fall asleep "  
CORE62g="Past 4 wks-trouble stay awake during day "  
CORE62h="Past 4 wks-take naps during the day    "  
CORE62i="Past 4 wks-get amount sleep needed    " ;  
run ; /* end of data step readraw */
```



```
data clean ;
  set readraw ;

  /* DATA CLEANING: OUT-OF-RANGE VALUE CLEANING, ITEM
  RECALIBRATION, & SKIP PATTERN RECODING */

  /* STEP 1: DATA CLEANING
  Out-of-range value cleaning:
  A. Group variables by number of allowable responses
  B. Recode values outside this range to missing */

  /* A. Group variables by number of allowable responses */
array fr1to2(13) CORE10 CORE16a CORE16b CORE16c CORE16d
  CORE16e CORE16f CORE16g CORE17a CORE17b
  CORE17c CORE18 CORE19 ;
array fr1to3(10) CORE4a CORE4b CORE4c CORE4d CORE4e
  CORE4f CORE4g CORE4h CORE4i CORE4j ;
array fr1to5(29) CORE1 CORE3 CORE6 CORE7 CORE9a
  CORE9b CORE9c CORE9d CORE9e CORE9f
  CORE9g CORE9h CORE13a
  CORE13b CORE13c CORE13d CORE13e CORE13f
  CORE58 CORE59 CORE60 CORE61a
  CORE61b CORE61c CORE61d CORE61e CORE61f CORE61g CORE61h ;
array fr1to6(60) CORE2 CORE5 CORE8a
  CORE8b CORE8c CORE8d CORE8e CORE8f CORE8g CORE8h CORE8i
  CORE8j CORE8k CORE20-CORE57 CORE62a--CORE62i ;
array fr0to5(2) CORE11 CORE12 ;
array fr0to20(2) CORE14 CORE15 ;

  /* B. Recode all out-of-range values to missing (.) */
do i = 1 to 13 ;
  if fr1to2(i) < 1 | fr1to2(i) > 2 then fr1to2(i) = . ;
end ;
do i = 1 to 10 ;
  if fr1to3(i) < 1 | fr1to3(i) > 3 then fr1to3(i) = . ;
end ;
do i = 1 to 29 ;
  if fr1to5(i) < 1 | fr1to5(i) > 5 then fr1to5(i) = . ;
end ;
do i = 1 to 60 ;
  if fr1to6(i) < 1 | fr1to6(i) > 6 then fr1to6(i) = . ;
end ;
do i = 1 to 2 ;
  if fr0to5(i) < 0 | fr0to5(i) > 5 then fr0to5(i) = . ;
  if fr0to20(i) < 0 | fr0to20(i) > 20 then fr0to20(i) = . ;
end ;

  /* STEP 2: ITEM RECALIBRATION AND SKIP PATTERN CODING */

  /* Recalibrate selected variables (RC vars) */
retain RCCORE1 RCCORE2 RCCOR13d ;
***** core1 ;
RCCORE1 = . ;
  if CORE1 eq 1 then RCCORE1 = 5 ;
  else if CORE1 eq 2 then RCCORE1 = 4.36 ;
  else if CORE1 eq 3 then RCCORE1 = 3.43 ;
```

```
else if CORE1 eq 4 then RCCORE1 = 1.99 ;
else if CORE1 eq 5 then RCCORE1 = 1 ;

**** core2 (for sf36pain nmc scale) ;
RCCORE2 = . ;
  if CORE2 eq 1 then RCCORE2 = 6 ;
  else if CORE2 eq 2 then RCCORE2 = 5.4 ;
  else if CORE2 eq 3 then RCCORE2 = 4.2 ;
  else if CORE2 eq 4 then RCCORE2 = 3.1 ;
  else if CORE2 eq 5 then RCCORE2 = 2.2 ;
  else if CORE2 eq 6 then RCCORE2 = 1 ;

**** core13d (for sf36pain nmc scale) ;
RCCOR13d = . ;
  if CORE2 eq 1 & CORE13d eq 1 then RCCOR13d = 6 ;
  else if (CORE2 ge 2 & CORE2 le 6) & CORE13d eq 1 then RCCOR13d = 5 ;
  else if (CORE2 ge 1 & CORE2 le 6) & CORE13d eq 2 then RCCOR13d = 4 ;
  else if (CORE2 ge 1 & CORE2 le 6) & CORE13d eq 3 then RCCOR13d = 3 ;
  else if (CORE2 ge 1 & CORE2 le 6) & CORE13d eq 4 then RCCOR13d = 2 ;
  else if (CORE2 ge 1 & CORE2 le 6) & CORE13d eq 5 then RCCOR13d = 1 ;
  else if CORE2 eq . & CORE13d eq 1 then RCCOR13d = 6 ;
  else if CORE2 eq . & CORE13d eq 2 then RCCOR13d = 4.75 ;
  else if CORE2 eq . & CORE13d eq 3 then RCCOR13d = 3.5 ;
  else if CORE2 eq . & CORE13d eq 4 then RCCOR13d = 2.25 ;
  else if CORE2 eq . & CORE13d eq 5 then RCCOR13d = 1 ;

  /* skip pattern check */
array PNITM1(6) CORE13a--CORE13f ;
array PNITM2(4) CORE14 CORE15 CORE11 CORE12 ;
do i = 1 to 6 ;
  if CORE10 eq 2 and PNITM1(i) eq . then PNITM1(i)=1 ;
end ;
do i = 1 to 4 ;
  if CORE10 eq 2 and PNITM2(i) eq . then PNITM2(i)=0 ;
end ;

/* STEP 3: ITEM REVERSE SCORING */

/* Reverse selected variables such that the higher score
indicates a more healthy response.
A. First establish new variables to be created
B. Group variables needing reversal with same range of response category
C. Derive reversed variables
D. Label newly created reversals */

/* A. Establish new "R" variables to code reversals */

retain RCORE3 RCORE11 RCORE12 RCORE9a RCORE9b
RCORE9c RCORE9d RCORE9e RCORE9f RCORE9g RCORE9h
RCORE13a RCORE13b RCORE13c RCORE13d RCORE13e
RCORE13f RCORE61b RCORE61e RCORE61f
RCORE2 RCORE5 RCORE8c RCORE8e RCORE8g RCORE20
RCORE21 RCORE24 RCORE25 RCORE26 RCORE31 RCORE34 RCORE35
RCORE41 RCORE43 RCORE51 RCORE54 RCORE62b RCORE62i
RCORE14 RCORE15 ;
```

```
/* B. Group variables by ranges of response category */  
  
array ofr1to5(18) CORE3 CORE9a--CORE9h  
CORE13a--CORE13f CORE61b CORE61e CORE61f ;  
array rfr1to5(18) RCORE3 RCORE9a--RCORE9h  
RCORE13a--RCORE13f RCORE61b RCORE61e RCORE61f ;  
  
array ofr1to6(19) CORE2 CORE5 CORE8c CORE8e CORE8g CORE20 CORE21  
CORE24-CORE26 CORE31 CORE34 CORE35 CORE41 CORE43  
CORE51 CORE54 CORE62b CORE62i ;  
array rfr1to6(19) RCORE2 RCORE5 RCORE8c RCORE8e RCORE8g RCORE20  
RCORE21 RCORE24-RCORE26 RCORE31 RCORE34  
RCORE35 RCORE41 RCORE43 RCORE51 RCORE54  
RCORE62b RCORE62i ;  
  
array ofr0to5(2) CORE11 CORE12 ;  
array rfr0to5(2) RCORE11 RCORE12 ;  
  
array ofr0to20(2) CORE14 CORE15 ;  
array rfr0to20(2) RCORE14 RCORE15 ;
```

```
/* C. Next, reverse variables in (o)original arrays into (r)eversed arrays. For items  
with responses whose smallest value is 1, the reversing formula is: reversed =  
(high value + 1) - original value. For items with responses whose smallest  
value is 0, the reversing formula is: reversed = high value - original value. */
```

```
do i = 1 to 18 ;  
    rfr1to5(i) = 6 - ofr1to5(i) ;  
end ;  
do i = 1 to 19 ;  
    rfr1to6(i) = 7 - ofr1to6(i) ;  
end ;  
do i = 1 to 2 ;  
    rfr0to20(i) = 20 - ofr0to20(i) ; rfr0to5(i) = 5 - ofr0to5(i) ;  
end ;
```

```
/* D. Label newly reversed variables */  
label RCCORE1="RC-PAT general health" "  
    RCORE2="R-Past 4 wks-generl-how much bodily pain" "  
RCCORE2="RC-Past 4 wks-generl-how much bodily pan" "  
    RCORE3="R-Past 4 wks-phys/emo prb inhib soc actv" "  
    RCORE5="R-How sat w/phys abil do what want to do" "  
RCCORE8c="R-Past 4 wks-how often a lot of energy" "  
    RCORE8e="R-Past 4 wks-how often felt full of pep" "  
RCCORE8g="R-Past 4 wks-had enrgy to do what wanted" "  
    RCORE9a="R-Past 4 wks-stiff/pn/swell/sore muscles" "  
RCCORE9b="R-Past 4 wks-coughing producing sputum" "  
    RCORE9c="R-Past 4 wks-backaches/ lower back pains" "  
RCCORE9d="R-Past 4 wks-nausea/upset stomach" "  
    RCORE9e="R-Past 4 wks-indigtion/heartburn/bloated" "  
RCCORE9f="R-Past 4 wks-heavy feelings in arms/legs" "  
    RCORE9g="R-Past 4 wks-headaches or head pains" "  
RCCORE9h="R-Past 4 wks-lump in throat" "  
    RCORE11="R-Past 4 wks-how often had pn/discomfort" "
```

```

RCORE12="R-Past 4 wks-when exp pain-usual duraton      "
RCORE13a="R-Past 4 wks-pain interfere with mood        "
RCORE13b="R-Past 4 wks-pain interfere walk or move     "
RCORE13c="R-Past 4 wks-pain interfere with sleep       "
RCORE13d="R-Past 4 wks-pain interfere normal work     "
RCCOR13d="RC-Past 4 wks-pain interfere normal work    "
RCORE13e="R-Past 4 wks-pain interfere recreatn act    "
RCORE13f="R-Past 4 wks-pain interfere enjoyng life    "
RCORE14="R-Past 4 wks-num best describ avg pain       "
RCORE15="R-Past 4 wks-num describ pain at worst       "
RCORE20="R-Past mnth-how happy with personal life    "
RCORE21="R-Past mnth-how often feel people close     "
RCORE24="R-Past mnth-how much enjoy things done      "
RCORE25="R-Past mnth-how much time life interestg    "
RCORE26="R-Past mnth-how much time felt loved        "
RCORE31="R-Past mnth-how much time contrl of self    "
RCORE34="R-Past mnth-how much time felt calm/peac    "
RCORE35="R-Past mnth-how much time felt emo stabl    "
RCORE41="R-Past mnth-how much time felt love full    "
RCORE43="R-Past mnth-how much living an adventure    "
RCORE51="R-Past mnth-how much time been happy        "
RCORE54="R-Past mnth-how much time felt cheerful    "
RCORE61b="R-True/false-feel as good now as ever     "
RCORE61e="R-True/false-as healthy as anybody         "
RCORE61f="R-True/false-health is excellent           "
RCORE62b="R-Past 4 wks-enugh sleep feel rest in AM   "
RCORE62i="R-Past 4 wks-get amount sleep needed      " ;

```

/* STEP 4: TRANSFORMING ITEMS TO A 0-100 POSSIBLE RANGE

Transform all variables to a 0-100 scale:

- A. Establish (n)ew groups of variables to process together (using newly reversed variables)
- B. Transform data to new scale using the formula:
 $TRANSFORMED\ VAR = (OBSERVED\ VAR - 1) * CONSTANT$ */

/* A. Establish groups based on ranges of response category */

```

array    nfr1to2(12)  CORE16a--CORE16g CORE17a--CORE17cCORE18 CORE19 ;
          /* array fr1to3 already established, new array not needed */
array    nfr1to5(29)  RCCORE1 RCORE3 CORE6 CORE7 RCORE9a--RCORE9h
          RCORE13a--RCORE13f CORE58 CORE59 CORE60 CORE61a
          RCORE61b CORE61c CORE61d RCORE61e RCORE61f
          CORE61g CORE61h ;
array    nfr1to6(62)  RCORE2 RCCORE2 RCORE5 CORE8a CORE8b RCORE8c
          CORE8d RCORE8e CORE8f RCORE8g CORE8h CORE8i
          CORE8j CORE8k RCCOR13d RCORE20 RCORE21 CORE22
          CORE23 RCORE24 RCORE25 RCORE26 CORE27-CORE30
          RCORE31 CORE32 CORE33 RCORE34 RCORE35 CORE36-
          CORE40 RCORE41 CORE42 RCORE43 CORE44-CORE50
          RCORE51 CORE52 CORE53 RCORE54 CORE55-CORE57
          CORE62a RCORE62b CORE62c--CORE62h RCORE62i ;
array    nfr0to5(2)   RCORE11 RCORE12 ;
array    nfr0to20(2)  RCORE14 RCORE15 ;

```

```
/* B. Transform items to 0-100 scale using arrays */
do i = 1 to 12 ;
    nfr1to2(i) = (nfr1to2(i) - 1) * 100 ;
end ;
do i = 1 to 10 ;
    fr1to3(i) = (fr1to3(i) - 1) * 50 ;
end ;
do i = 1 to 29 ;
    nfr1to5(i) = (nfr1to5(i) - 1) * 25 ;
end ;
do i = 1 to 62 ;
    nfr1to6(i) = (nfr1to6(i) - 1) * 20 ;
end ;

/* NOTE: When original response range starts at 0, use the following formula to
transform values: NEW = OLD X CONSTANT */
do i = 1 to 2 ;
    nfr0to20(i) = nfr0to20(i) * 5 ;
    nfr0to5(i) = nfr0to5(i) * 20 ;
end ;

run ; /* end of data step clean */

/* NOTE: To create a permanent file, use a 2-part filename. For more information about
SAS® data files, see official SAS® documentation */

data scales ;
set clean ;

/* STEP 5: DERIVING SCALES
Create scales based on the transformed data, using the mean of the transformed
items making up the scale (and for which there is non-missing values on at least
half of the individual items).

To create scales:
A. Establish a variable to indicate the number of missing items for each group of
items representing a scale (NM vars).
B. Create scales by using mean if number of missing is not more than half of the
total items making up the scale.
C. Label newly created scale variables.

A. Establish missing variables: */

NMPHYSF =NMIS (OF CORE4a--CORE4j) ;
NMMOB =NMIS (CORE6,CORE7) ;
NMPNEFF =NMIS (OF RCORE13a--RCORE13f) ;
NMPNSVR =NMIS (RCORE2,RCORE11,RCORE12,RCORE14,RCORE15) ;
NMROLEP =NMIS (OF CORE16a--CORE16g) ;
NMCOGF =NMIS (CORE23,CORE28,CORE32,CORE40,CORE49,CORE56) ;
NMMHI1 =NMIS (RCORE20,RCORE21,CORE22,RCORE24,RCORE25,RCORE26,
CORE27,CORE29,CORE30,RCORE31,CORE33,RCORE34,
RCORE35,CORE36,CORE37,CORE38,CORE39,RCORE41,
CORE42,RCORE43,CORE44,CORE45,CORE46,CORE47,CORE48,
CORE50,RCORE51,CORE52,CORE53,RCORE54,CORE55,
CORE57) ;
```

NMDIST1 =NMISS (CORE22,CORE27,CORE29,CORE30,RCORE31,CORE33,
RCORE35,CORE36,CORE37,CORE38,CORE39,CORE42,CORE44,
CORE45,CORE46,CORE47,CORE48,CORE50,CORE52,CORE53,
CORE55, CORE57) ;
NMDBEC1 =NMISS (CORE22,CORE29,CORE36,CORE47,CORE53,CORE55,RCORE31,
CORE33,RCORE35,CORE37,CORE39,CORE44,CORE45) ;
NMANX1 =NMISS (CORE27,CORE30,CORE42,CORE46,CORE48,CORE52) ;
NMWELLB1 =NMISS (RCORE20,RCORE21,RCORE24,RCORE25,RCORE26,RCORE34,
RCORE41,RCORE43,RCORE51,RCORE54) ;
NMPOSAF1 =NMISS (RCORE20,RCORE24,RCORE25,RCORE34,RCORE43,RCORE51,
RCORE54) ;
NMBELONG =NMISS (RCORE21,RCORE26,RCORE41) ;
NMMHI2 =NMISS (RCORE25,RCORE26,CORE27,CORE29,CORE30,RCORE31,
CORE33,RCORE34,RCORE35,CORE36,CORE44,CORE46,CORE47,
CORE50,RCORE51,CORE53,RCORE54) ;
NMDIST2 =NMISS (CORE27,CORE29,CORE30,RCORE31,CORE33,RCORE35,
CORE36, CORE44,CORE46,CORE47,CORE50,CORE53) ;
NMANX2 =NMISS (CORE27,CORE30,CORE46) ;
NMDBEC2 =NMISS (CORE29,CORE36,CORE47,CORE53,RCORE31,CORE33,
RCORE35, CORE44) ;
NMWELLB2 =NMISS (RCORE25,RCORE26,RCORE34,RCORE51,RCORE54) ;
NMPOSAF2 =NMISS (RCORE25,RCORE34,RCORE51,RCORE54) ;
NMMHI3 =NMISS (CORE27,RCORE34,CORE36,CORE44,RCORE51) ;
NMROLEE =NMISS (OF CORE17a--CORE17c) ;
NMENGFT =NMISS (CORE8a,RCORE8c,RCORE8e,RCORE8g,CORE8i) ;
NMSLPPRB =NMISS (CORE62a,RCORE62b,CORE62c,CORE62d,CORE62e,CORE62f,
CORE62g,CORE62h,RCORE62i) ;
NMSLPPB2 =NMISS (RCORE62b,CORE62c,CORE62e,CORE62f,CORE62g,RCORE62i) ;
NMPSPYPH =NMISS (OF RCORE9a--RCORE9h) ;
NMSOCF =NMISS (RCORE3,CORE58,CORE59,CORE60) ;
NMGHPCRE =NMISS (RCCORE1,CORE61a,RCORE61b,CORE61c,CORE61d,RCORE61e,
RCORE61f) ;
NMGHP36 =NMISS (RCCORE1,RCORE61e,RCORE61f,CORE61g,CORE61h) ;
NMGHP20 =NMISS (RCCORE1,CORE61a,CORE61c,RCORE61e,RCORE61f) ;
NMHLTHD =NMISS (CORE8b,CORE8d,CORE8f,CORE8h,CORE8j,CORE8k) ;
NM36PAIN =NMISS (RCCORE2,RCCOR13d) ;
NM36PANA =NMISS (RCORE2,RCORE13d) ;
NM36VITL =NMISS (RCORE8e,RCORE8c,CORE8a,CORE8i) ;
NM36SOCF =NMISS (RCORE3,CORE58) ;
NM36ROLP =NMISS (CORE16b,CORE16c,CORE16e,CORE16f) ;

/* B. Creating scales (scales with one item only are assigned the value of the item):*/

if NMPHYSF > 5 then PHYSFUNC = . ;
else PHYSFUNC=mean(OF CORE4a--CORE4j) ;
SATPHYSA = RCORE5 ;
if NMMOB > 1 then MOBILITY = . ;
else MOBILITY=mean(CORE6,CORE7) ;
if NMPNEFF > 3 then PAINEFF = . ;
else PAINEFF=mean(OF RCORE13a--RCORE13f) ;
if NMPNSVR > 2 then PAINSVRT = . ;
else PAINSVRT=mean(RCORE2,RCORE11,RCORE12,RCORE14,RCORE15) ;
if NMROLEP > 3 then RLMTPHYS = . ;
else RLMTPHYS=mean(OF CORE16a--CORE16g) ;
if NMCOGF > 3 then COGFUNC = . ;
else COGFUNC=mean(CORE23,CORE28,CORE32,CORE40,CORE49,CORE56) ;

```
if NMMHI1 > 16 then MHINDX1 = . ;
  else MHINDX1=mean(RCORE20,RCORE21,CORE22,RCORE24,RCORE25,
    RCORE26,CORE27,CORE29,CORE30,RCORE31,CORE33,
    RCORE34,RCORE35,CORE36,CORE37,CORE38,CORE39,
    RCORE41,CORE42,RCORE43,CORE44,CORE45,CORE46,
    CORE47,CORE48,CORE50,RCORE51,CORE52,CORE53,
    RCORE54,CORE55,CORE57) ;
if NMDIST1 > 11 then PSYCDST1 = . ;
  else PSYCDST1=mean(CORE22,CORE27,CORE29,CORE30,RCORE31,CORE33,
    RCORE35,CORE36,CORE37,CORE38,CORE39,CORE42,
    CORE44,CORE45,CORE46,CORE47,CORE48,CORE50,
    CORE52,CORE53,CORE55,CORE57) ;
if NMDBEC1 > 6 then DBEC1 = . ;
  elseDBEC1=mean(CORE22,CORE29,CORE36,CORE47,CORE53,CORE55,
    RCORE31,CORE33,RCORE35,CORE37,CORE39,
    CORE44,CORE45) ;
if NMANX1 > 3 then ANXIETY1 = . ;
  else ANXIETY1=mean(CORE27,CORE30,CORE42,CORE46,CORE48,CORE52) ;
if NMWELLB1 > 5 then WELLBNG1 = . ;
  else WELLBNG1=mean(RCORE20,RCORE21,RCORE24,RCORE25,RCORE26,
    RCORE34,RCORE41,RCORE43,RCORE51,RCORE54) ;
if NMPOSAF1 > 3 then POSAFF1 = . ;
  else POSAFF1=mean(RCORE20,RCORE24,RCORE25,RCORE34,RCORE43,
    RCORE51,RCORE54) ;
if NMBELONG > 1 then BELONG = . ;
  else BELONG=mean(RCORE21,RCORE26,RCORE41) ;
if NMMHI2 > 8 then MHINDX2 = . ;
  else MHINDX2=mean(RCORE25,RCORE26,CORE27,CORE29,CORE30,
    RCORE31,CORE33,RCORE34,RCORE35,CORE36,CORE44,
    CORE46, CORE47,CORE50,RCORE51,CORE53,RCORE54) ;
if NMDIST2 > 6 then PSYCDST2 = . ;
  else PSYCDST2=mean(CORE27,CORE29,CORE30,RCORE31,CORE33,RCORE35,
    CORE36, CORE44,CORE46,CORE47,CORE50,CORE53) ;
if NMANX2 > 1 then ANXIETY2 = . ;
  else ANXIETY2=mean(CORE27,CORE30,CORE46) ;
if NMDBEC2 > 4 then DBEC2 = . ;
  else DBEC2=mean(CORE29,CORE36,CORE47,CORE53,RCORE31,CORE33,
    RCORE35, CORE44) ;
if NMWELLB2 > 2 then WELLBNG2 = . ;
  else WELLBNG2=mean(RCORE25,RCORE26,RCORE34,RCORE51,RCORE54) ;
if NMPOSAF2 > 2 then POSAFF2 = . ;
  else POSAFF2=mean(RCORE25,RCORE34,RCORE51,RCORE54) ;
if NMMHI3 > 2 then MHINDX3 = . ;
  else MHINDX3=mean(CORE27,RCORE34,CORE36,CORE44,RCORE51) ;
if NMROLEE > 1 then RLMTEMOT = . ;
  else RLMTEMOT=mean(OF CORE17a--CORE17c) ;
if NMENGFT > 2 then ENRGFATG = . ;
  else ENRGFATG=mean(CORE8a,RCORE8c,RCORE8e,RCORE8g,CORE8i) ;
if NMSLPPRB > 4 then SLEPPRB = . ;
  else SLEPPRB=mean(CORE62a,RCORE62b,CORE62c,CORE62d,CORE62e,
    CORE62f,CORE62g,CORE62h,RCORE62i) ;
if NMSLPPB2 > 3 then SLEPPB2 = . ;
  else SLEPPB2 = mean(RCORE62b, CORE62c, CORE62e, CORE62f, CORE62g,
    RCORE62i);
if NMPSYPH > 4 then PSYCPHYS = . ;
  else PSYCPHYS=mean(OF RCORE9a--RCORE9h) ;
```

```

if NMSOCF > 2 then SOCFUNC = . ;
    else SOCFUNC=mean(RCORE3,CORE58,CORE59,CORE60) ;
UNABLWRK = CORE19 ;
UNABLHSE = CORE18 ;
if NMGHPCRE > 3 then GHPCORE = . ;
    else GHPCORE=mean(RCCORE1,CORE61a,RCORE61b,CORE61c,
        CORE61d,RCORE61e, RCORE61f) ;
if NMGHP36 > 2 then GHPSF36 = . ;
    else GHPSF36=mean(RCCORE1,RCORE61e,RCORE61f,CORE61g,CORE61h) ;
if NMGHP20 > 2 then GHPSF20 = . ;
    else GHPSF20=mean(RCCORE1,CORE61a,CORE61c,RCORE61e,RCORE61f) ;
if NMHLTHD > 3 then HLTHDIST = . ;
    else HLTHDIST=mean(CORE8b,CORE8d,CORE8f,CORE8h,CORE8j,CORE8k) ;
if NM36PAIN > 1 then SF36PAIN = . ;
    else SF36PAIN = mean(RCCORE2,RCCOR13d) ;
if NM36PANA > 1 then SF36PANA = . ;
    else SF36PANA = mean(RCORE2,RCORE13d) ;
if NM36VITL > 2 then SF36VITL = . ;
    else SF36VITL = mean(RCORE8e,RCORE8c,CORE8a,CORE8i) ;
if NM36SOCF > 1 then SF36SOCF = . ;
    else SF36SOCF = mean(RCORE3,CORE58) ;
if NM36ROLP > 2 then SF36ROLP = . ;
    else SF36ROLP = mean(CORE16b,CORE16c,CORE16e,CORE16f) ;

```

/* C. Label scale variables */

label

PHYSFUNC	= 'Physical Functioning	(K=10)'
SATPHYSA	= 'Satisfaction With Physical Ability	(K=1)'
MOBILITY	= 'Mobility	(K=2)'
PAINEFF	= 'Effects Of Pain	(K=6)'
PAINSVRT	= 'Pain Severity	(K=5)'
SF36PAIN	= 'SF-36™ Pain	(K=2)'
SF36PANA	= 'SF-36™ Rand Pain	(K=2)'
RLMTPHYS	= 'Role Limitations Due To Physical Health	(K=7)'
SF36ROLP	= 'SF-36™ Role Limitations Due To Physical Health	(K=4)'
COGFUNC	= 'Cognitive Functioning	(K=6)'
MHINDX1	= 'Mental Health Index I	(K=32)'
PSYCDST1	= 'Psychological Distress I	(K=22)'
DBEC1	= 'Depression/Behavioral-Emotional Control I	(K=13)'
ANXIETY1	= 'Anxiety I	(K=7)'
WELLBNG1	= 'Psychological Well-Being I	(K=10)'
POSAFF1	= 'Positive Affect I	(K=7)'
BELONG	= 'Feelings Of Belonging	(K=3)'
MHINDX2	= 'Mental Health Index II	(K=17)'
PSYCDST2	= 'Psychological Distress II	(K=12)'
DBEC2	= 'Depression/Behavioral-Emotional Control II	(K=8)'
ANXIETY2	= 'Anxiety II	(K=4)'
WELLBNG2	= 'Psychological Well-Being II	(K=5)'
POSAFF2	= 'Positive Affect II	(K=4)'
MHINDX3	= 'Mental Health Index III	(K=5)'
RLMTEMOT	= 'Role Limitations Due To Emotional Problems	(K=3)'
ENRGFATG	= 'Energy/Fatigue	(K=5)'
SF36VITL	= 'SF-36™ Vitality	(K=4)'
SLEPPRB	= 'Sleep Problems I	(K=9)'
SLEPPB2	= 'Sleep Problems II	(K=6)'


```
PSYCPHYS ='Physical/Psychophysiologic Symptoms (K=8)'  
SOCFUNC ='Social Activity Limitations Due To Health (K=4)'  
SF36SOCF ='SF-36™ Social Functioning (K=2)'  
UNABLWRK ='Role Functioning: Able To Work (K=1)'  
UNABLHSE ='Role Functioning: Able To Do Housework (K=1)'  
GHPCORE ='Current Health (K=7)'  
GHPCORER ='RAND Current Health (K=7)'  
GHPSF36 ='SF-36™ - General Health (K=5)'  
GHPSF36R ='RAND General Health (36 Item Survey) (K=5)'  
GHPSF20 ='SF-20 - General Health (K=5)'  
GHPSF20R ='RAND General Health (20 Item Survey) (K=5)'  
HLTHDIST ='Health Distress (K=6)';
```

```
run ; /* data step coredata.scales */
```

APPENDIX C

SOURCE CODE FOR SAS[®] MACRO, MULTI

MULTITRAIT SCALING PROGRAM: MULTI

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ABSTRACT

Item convergence within multi-item scales, or internal consistency, is commonly evaluated using Cronbach's (1951) alpha reliability coefficient. Evaluating item discrimination across scales, multitrait scaling analysis, is also desirable (Hays & Hayashi, 1990). The purpose of this paper is to describe a program to compute the necessary statistics for multitrait scaling using the SAS[®]STAT[™] software and the SAS[®] macro facility.

INTRODUCTION

Item convergence within multi-item scales, or internal consistency, is commonly evaluated using Cronbach's (1951) alpha reliability coefficient. Alpha can be obtained as an option in the CORR procedure in SAS[®]/STAT software. Evaluating item discrimination across scales, multitrait scaling analysis, is also desirable (Hays & Hayashi, 1990). In multitrait scaling analysis, items are examined with respect to how well they represent a particular scale relative to other scales. Hays and Hayashi (1990) described a microcomputer program for multitrait scaling analysis, but a SAS[®]/STAT procedure has not yet been developed for this purpose. This paper describes a macro, MULTI, for conducting multitrait scaling analysis.

USING THE MULTI MACRO

Required input is the name of the data set being processed, the names and number of items in each scale, and the names and number of scales in the analysis. Up to 19 scales can be included. MULTI produces output consisting of the number of cases in the analysis, the multitrait-multiitem correlation matrix, intercorrelations among scales, item and scale descriptive statistics, scale normality statistics, intercorrelations among items, and internal consistency reliability estimates for the scales (see Table 1). Correlations between items and scales in the multitrait-multitem correlation matrix are corrected for item overlap with scales (Howard & Forehand, 1962). A listing of MULTI is provided in Table 2. The program is designed to run on any operating system.

Table 1—Example Output from Multitrait Scaling Macro

NUMBER OF CASES IN ANALYSIS

SAMPSIZE	SE
5	0.44721

MULTITRAIT MULTITEM CORRELATION MATRIX

item	scale1	scale2
ITEM1	0.48*	0.97
ITEM2	0.48*	0.31
ITEM3	0.73	0.60*
ITEM4	0.76	0.80*
ITEM5	0.29	0.50*

INTERCORRELATIONS AMONG SCALES

OBS	SCALE	SCALE1	SCALE2
1	SCALE1	1.00000	0.67278
2	SCALE2	0.67278	1.00000

ITEM AND SCALE MEANS AND STANDARD DEVIATIONS

Variable	N	Mean	Std Dev	Minimum	Maximum
ITEM1	5	3.60	1.14	2.00	5.00
ITEM2	5	3.80	1.64	2.00	5.00
ITEM3	5	2.00	1.00	1.00	3.00
ITEM4	5	4.20	1.30	2.00	5.00
ITEM5	5	2.40	1.52	1.00	4.00
SCALE1	5	7.40	2.41	4.00	10.00
SCALE2	5	8.60	3.21	4.00	12.00

SKEWNESS OF SCALE SCORES (unbounded)

SCALE1	SCALE2
-0.60136	-0.60805

KURTOSIS OF SCALE SCORES (-2→ +infinity)

SCALE1	SCALE2
-0.94530	-0.68150

NORMALITY OF SCALE SCORES

Shapiro-Wilk statistic if n <= 2000

Kolomogorov D statistic if n > 2000

SCALE1	SCALE2
0.95682	0.95785

INTERCORRELATIONS AMONG ITEMS

OBS	ITEMS	ITEM1	ITEM2	ITEM3	ITEM4	ITEM5
1	ITEM1	1.00000	0.48038	0.87706	0.90811	0.69398
2	ITEM2	0.48038	1.00000	0.45644	0.49010	-0.06019
3	ITEM3	0.87706	0.45644	1.00000	0.76696	0.32969
4	ITEM4	0.90811	0.49010	0.76696	1.00000	0.58158
5	ITEM5	0.69398	-0.06019	0.32969	0.58158	1.00000

ALPHA INTERNAL CONSISTENCY RELIABILITY

scale1

ALPHA	SALPHA	RII	SRII	SCOTT	K
0.62069	0.64900	0.45000	0.48038	0.48038	2

ALPHA INTERNAL CONSISTENCY RELIABILITY

scale2

ALPHA	SALPHA	RII	SRII	SCOTT	K
0.77184	0.79206	0.53000	0.55941	0.55234	3

Table 2—MULTI Macro

```

*****;
options nonumber NOCENTER ls=182
  MPRINT MTRACE SYMBOLGEN NONUMBER
  NODATE MISSING=' ';
*****;
%MACRO ALPHA;
*****;
PROC CORR DATA=ALPHA1 NOPRINT NOMISS COV
  OUTP=CORROUT;
VAR
  &&ITEMS&i ;
TITLE1 'ALPHA INTERNAL CONSISTENCY RELIABILITY';
TITLE2 "&&nscal&i";
RUN;
*****;
DATA ALPHA;
  SET CORROUT;
*****;
ARRAY STOT (I)
  &&ITEMS&i ;
*****;
RETAIN TOT SDTOT VAR SDSUM;
*****;
KK=&&nit&i;
*****;
IF _N_=1 THEN DO;
  TOT=0;SDTOT=0;VAR=0;SDSUM=0;
END;
*****;
IF _N_<=KK THEN DO;
  DO I=1 TO KK;
    TOT=STOT+TOT;
    IF I=_N_ THEN VAR=STOT+VAR;
  END;
END;
*****;
IF _N_=(KK+2) THEN DO;
  DO I=1 TO KK;
    SDSUM=STOT+SDSUM;
  END;
END;
*****;
IF _N_>(KK+3) THEN DO;
  DO I=1 TO KK;
    SDTOT=STOT+SDTOT;
  END;
END;
*****;
IF _N_=(2*KK)+3) THEN DO;
  COV=TOT-VAR;
  ALPHA=(KK*COV)/((KK-1)*TOT);

```

```

RII=COV/((KK-1)*VAR);
SCOV=SDTOT-KK;
SALPHA=(KK*SCOV)/((KK-1)*SDTOT);
SRII=SCOV/((KK-1)*KK);
SCOTT=COV/((SDSUM+SDSUM)-VAR);
OUTPUT;
END;
RENAME KK=K;
*****;
PROC PRINT NOOBS;
  VAR ALPHA SALPHA RII SRII SCOTT K;
RUN;
%MEND ALPHA;
*****;
%MACRO MULTI(DATA=,items1 =,items2 =,items3 =,
items4 =,items5 =, items6 =,items7 =,items8 =, items9=,
items10=, items11=, items12=, items13=, items14=,
items15=, items16=, items17=, items18=, items19=, NIT1=,
NIT2=, NIT3=, NIT4=, NIT5=, NIT6=, NIT7=, NIT8=, NIT9=,
NIT10=, NIT11=, NIT12=, NIT13=, NIT14=, NIT15=, NIT16=,
NIT17=, NIT18=, NIT19=, nSCAL1 =, nSCAL2 =, nSCAL3 =,
nSCAL4 =, nSCAL5 =, nSCAL6 =, nSCAL7 =, nSCAL8 =,
nSCAL9 =, nSCAL10=, nSCAL11=, nSCAL12=, nSCAL13=,
nSCAL14=, nSCAL15=, nSCAL16=, nSCAL17=, nSCAL18=,
nSCAL19=, NSCALES=);
*****;
DATA ALPHA;
  SET &DATA;
*****;
count=0;
do i=1 to 19;
  n=symget('nit'||left(i));
  count=count + n ;
end;
call symput('k',left(put(count,2)));
*****;
%let scales=;
%do i=1 %to &nscals;
%let scales = &scales &&nscal&i ;
%end;
*****;
%let items =;
%do i=1 %to 19;
%let items = &items &&items&i ;
%end;
*****;
ARRAY NO (I) &ITEMS &SCALES;
KEEP=1;
DO OVER NO;
  IF NO<=.Z THEN KEEP=0;
END;
*****;
DATA ALPHA1;
  SET ALPHA;

```

```
IF KEEP=1;
*****;
PROC CORR DATA=ALPHA1 NOPRINT OUTP=CORROUT;
VAR
  &ITEMS &SCALES;WITH &ITEMS;
RUN;
*****;
DATA ALPHA;
SET CORROUT;
*****;
ARRAY ITEMSD (II) &ITEMS;
ARRAY ISD (II) I1-I200;
ARRAY NIT(nscale) NITEM1-NITEM19;
ARRAY SCALED (I) S1-S19;
ARRAY CORSCALE (I) &SCALES;
RETAIN SCALED ISD II WHERE NSCALE NCASES;
*****;
array item{19} nitem1 nitem2 nitem3 nitem4
  nitem5 nitem6 nitem7 nitem8 nitem9 nitem10
  nitem11 nitem12 nitem13 nitem14 nitem15
  nitem16 nitem17 nitem18 nitem19 ;
do i=1 to 19;
  item(i)=symget('nit'||left(i));
end;
*****;
IF _N_=2 THEN DO I=1 TO &NSCALES;
SCALED=CORSCALE;
END;
*****;
IF _N_=2 THEN DO II=1 TO &K;
ISD=ITEMSD;
END;
*****;
IF _N_=3 THEN DO II=1 TO 1;
NCASES=ITEMSD;
END;
*****;
IF _N_=3 THEN II=1;
*****;
IF _N_>3 THEN DO;
IF _N_=4 THEN NSCALE=1;
IF _N_=4 THEN WHERE=1;
IF WHERE<=NIT THEN WHERE=WHERE+1;
*****;
DO I=1 TO &NSCALES;
IF I=NSCALE THEN DO;
DENO=(SCALED*SCALED+ISD*ISD) -
  (2*CORSCALE*SCALED+ISD);
DENOM=sqrt(DENO);
CORSCAL=(CORSCALE*SCALED)-ISD;
CORSCALE=CORSCAL/DENOM;
END;
END;
END;
OUTPUT;
```

```
II=II+1;
IF WHERE=NIT+1 THEN DO;
  NSCALE=NSCALE+1;
  WHERE=1;
END;
END;
*****;
PROC MEANS DATA=ALPHA NOPRINT;
VAR NCASES;
OUTPUT OUT=ONE MEAN=SAMPsize;
TITLE 'NUMBER OF CASES IN ANALYSIS';
RUN;
*****;
DATA;
  SET ONE(KEEP=SAMPsize);
  SE=1/SQRT(SAMPsize);
  PROC PRINT NOOBS;RUN;
*****;
data a;
length s1 s2 s3 s4 s5 s6 s7 s8 s9 s10
  s11 s12 s13 s14 s15 s16 s17 s18 s19 $ 1;
SET ALPHA(KEEP=_NAME_ &SCALES NITEM1-NITEM19);
IF _N_<=&K;
RENAME _NAME_=ITEM;
*****;
array s{19} $ s1 s2 s3 s4 s5 s6 s7 s8 s9 s10
  s11 s12 s13 s14 s15 s16 s17 s18 s19;
array t{19} nitem1 nitem2 nitem3 nitem4 nitem5 nitem6
  nitem7 nitem8 nitem9 nitem10 nitem11 nitem12
  nitem13 nitem14 nitem15 nitem16 nitem17 nitem18
  nitem19 ;
nt=0;
do i=1 to 19;
ot=nt;
nt=ot + t(i);
if ot<_N_ <= nt then s(i)='*';
end;
*****;
%let put=@2 item $8. +2;
%do i=1 %to &nscals;
%let put= &put &&nscal&i 4.2 s&i $ 1. +4 ;
%end;
data _null_;
set a end=endfile;
file print notitles header=hd;
put &put;
RETURN;
hd:
put / @1 'MULTITRAIT MULTIITEM CORRELATION MATRIX ' ;
PUT //
  @2 'item '
  @12 "&nscal1"
  @21 "&nscal2"
```

```

@30 "&nscal3"
@39 "&nscal4"
@48 "&nscal5"
@57 "&nscal6"
@66 "&nscal7"
@75 "&nscal8"
@84 "&nscal9"
@93 "&nscal10"
@102 "&nscal11"
@111 "&nscal12"
@120 "&nscal13"
@129 "&nscal14"
@138 "&nscal15"
@147 "&nscal16"
@156 "&nscal17"
@165 "&nscal18"
@174 "&nscal19"
/;
/*
PUT @2 '-----';
RUN;
-----;
*/
/*
DATA in.scale;
  SET ALPHA(KEEP=_NAME_ &SCALES);
  IF _N_<=&K;
  RENAME _NAME_=ITEM;
  TITLE ' MULTITRAIT MULTIITEM CORRELATION MATRIX';
  PROC PRINT ROUND UNIFORM;
  RUN;
  -----;
*/
PROC CORR DATA=ALPHA1 NOPRINT OUTP=CORROUT;
VAR
&SCALES;
RUN;
-----;
DATA;
  SET CORROUT(KEEP=_NAME_ &SCALES);
  IF _N_>3;
  RENAME _NAME_=SCALE;
  TITLE 'INTERCORRELATIONS AMONG SCALES';
  PROC PRINT;
  RUN;
  -----;
PROC MEANS DATA=ALPHA1 MAXDEC=2 FW=10;
VAR
&ITEMS &SCALES;
TITLE 'ITEM AND SCALE MEANS AND STANDARD DEVIATIONS';
RUN;
-----;
PROC UNIVARIATE DATA=ALPHA1 NOPRINT NORMAL;
VAR
&SCALES;
OUTPUT OUT=ONE SKEWNESS=&SCALES;
TITLE 'SKEWNESS OF SCALE SCORES (unbounded)';
RUN;
-----;
DATA;
  SET ONE;
  PROC PRINT NOOBS;RUN;
  -----;
PROC UNIVARIATE DATA=ALPHA1 NOPRINT NORMAL;
VAR
&SCALES;
OUTPUT OUT=ONE KURTOSIS=&SCALES;
TITLE 'KURTOSIS OF SCALE SCORES (-2--> +infinity)';
RUN;
-----;
DATA;
  SET ONE;
  PROC PRINT NOOBS;RUN;
  -----;
PROC UNIVARIATE DATA=ALPHA1 NOPRINT NORMAL;
VAR
&SCALES;
OUTPUT OUT=ONE NORMAL=&SCALES;
TITLE1 'NORMALITY OF SCALE SCORES';
TITLE2 'Shapiro-Wilk statistic if n <= 2000';
TITLE3 'Kolmogorov D statistic if n > 2000';
RUN;
-----;
DATA;
  SET ONE;
  PROC PRINT NOOBS;RUN;
  -----;
DATA;
  SET ALPHA(KEEP=_NAME_ &ITEMS);
  IF _N_<=&K;
  RENAME _NAME_=ITEMS;
  TITLE1 'INTERCORRELATIONS AMONG ITEMS';
  TITLE2 ' ';
  TITLE3 ' ';
  PROC PRINT;
  %do i=1 %to &nscals;
  %ALPHA;
  %end;
  -----;
  %MEND MULTI;
  -----;
DATA NEW;
INPUT
ID 1-2
ITEM1 4
ITEM2 5
ITEM3 6
ITEM4 7

```



```
ITEM5      8;
CARDS;
01 55354
02 45351
03 42254
04 35142
05 22121
;
run;
DATA NEW;
  SET NEW;
  SCALE1=MEAN(ITEM1,ITEM2)*2;
  SCALE2=MEAN(ITEM3,ITEM4,ITEM5)*3;
  *****;
  %MULTI (DATA=NEW,items1=ITEM1 ITEM2,
items2=ITEM3 ITEM4 ITEM5, items3=, items4=, items5=,
items6=, items7=, items8=, items9=, items10=, items11=,
items12=, items13=, items14=, items15=, items16=, items17=,
items18=,items19=,NIT1=2,NIT2=3,NIT3=0,NIT4=0,NIT5=0,
NIT6=0,NIT7=0,NIT8=0,NIT9=0,NIT10=0, NIT11=0, NIT12=0,
NIT13=0, NIT14=0, NIT15=0, NIT16=0, NIT17=0, NIT18=0,
NIT19=0, nscal1=scale1, nscal2=scale2, nscal3=3, nscal4=4,
nscal5=5, nscal6=6, nscal7=7,nscal8=8, nscal9=9, nscal10=10,
scal11=11,nscal12=12,nscal13=13,nscal14=14,nscal15=15,
nscal16=16,nscal17=17, nscal18=18,nscal19=19,nscales=2);
```


ACKNOWLEDGMENTS

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APPENDIX D

T-SCORE TABLES

Table D.1
T-Scores for Measures Developed During the MOS

Raw Score	Measure		Raw Score	Measure		Raw Score	Measure	
	Normalized t-score	Normalized t-score		Normalized t-score	Normalized t-score		Normalized t-score	Normalized t-score
Physical Functioning								
0.00	22.85	45.67	0.00	16.69	54.17	41.01		
5.00	28.16	46.41	12.50	22.64	54.17	41.44		
7.14	29.86	47.19	37.50	25.71	58.33	41.85		
12.50	31.18	47.90	50.00	28.41	58.33	42.51		
15.00	32.96	47.98	62.50	31.29	60.00	42.93		
16.67	33.74	48.78	75.00	34.59	62.50	43.39		
20.00	34.64	49.54	87.50	39.46	65.00	43.87		
22.22	35.54	50.39	100.00	55.79	66.67	44.00		
25.00	36.41	51.21	Mobility					
27.78	37.22	51.32	Effects of Pain					
30.00	37.82	52.47	0.00	21.44	70.00	45.21		
33.33	38.35	53.63	12.50	26.83	70.83	45.73		
35.00	38.96	54.90	16.67	29.29	70.83	46.22		
38.89	39.55	56.21	20.83	30.57	75.00	46.91		
40.00	40.17	58.03	25.00	32.04	79.17	48.25		
41.67	40.74	65.34	29.17	33.56	80.00	48.92		
45.00	41.21		30.00	34.41	83.33	49.64		
50.00	42.24		33.33	35.13	85.00	50.36		
55.00	43.25		35.00	35.57	87.50	51.10		
55.56	43.70		37.50	36.45	91.67	51.86		
56.25	43.78		41.67	37.62	91.67	52.73		
60.00	44.36		43.75	38.32	95.00	53.59		
61.11	44.94		45.83	39.03	95.83	54.37		
64.29	44.98		45.83	39.59	100.00	61.87		
			50.00	40.27				
			Satisfaction with Physical Ability					
			0.00	26.97				
			20.00	35.65				
			40.00	42.62				
			60.00	49.49				
			80.00	57.37				
			100.00	67.66				

Table D.1 (continued)

Raw Score	Measure		Measure		Measure	
	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score
0.00	23.00	44.00	43.82	68.00	51.74	0.00
6.67	27.93	45.00	44.09	68.75	51.97	10.00
11.00	30.10	46.00	44.43	69.00	52.11	20.00
13.33	31.43	46.67	44.77	70.00	52.37	21.00
15.00	32.64	48.00	45.14	71.00	52.65	22.00
19.00	33.70	49.00	45.48	72.00	52.93	24.00
20.00	34.49	50.00	45.76	73.33	53.19	30.00
21.00	35.34	51.00	46.06	74.00	53.45	31.00
24.00	36.17	51.25	46.22	76.00	53.84	32.00
25.00	36.70	52.00	46.45	76.25	54.17	40.00
26.67	37.17	52.50	46.70	78.00	54.47	41.00
26.67	37.71	53.33	46.93	79.00	54.73	42.00
28.00	38.22	54.00	47.31	80.00	54.93	50.00
29.00	38.83	55.00	47.56	81.00	55.15	51.00
31.00	39.33	56.00	47.80	83.00	55.43	52.00
32.00	39.65	57.00	48.13	83.33	55.81	54.00
33.33	40.04	58.00	48.48	86.00	56.11	54.00
34.00	40.45	59.00	48.75	86.25	56.46	60.00
35.00	40.79	60.00	49.15	90.00	56.81	61.00
37.50	41.19	61.00	49.53	91.67	56.94	62.00
38.00	41.63	62.00	49.82	92.00	56.94	64.00
39.00	41.98	63.00	50.12	94.00	57.33	70.00
40.00	42.44	64.00	50.46	96.00	57.76	72.00
41.00	42.88	65.00	50.83	97.00	58.80	74.00
42.50	43.23	66.00	51.14	100.00	59.89	75.00
43.00	43.56	66.67	51.42		65.32	80.00

Pain Severity

SF-36™ Pain

Table D.1 (continued)

Measure		Measure		Measure		Measure	
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score
Mental Health Index I							
13.13	23.22	60.00	43.39	78.10	50.08	88.57	56.78
25.22	28.08	61.25	43.75	78.13	50.30	88.75	57.11
27.50	30.29	61.88	44.07	78.75	50.60	89.38	57.69
30.63	31.80	62.31	44.30	79.38	50.85	89.63	57.98
33.75	32.99	63.75	44.62	80.00	51.06	90.00	58.25
35.00	33.91	63.85	44.87	81.11	51.32	90.43	58.54
36.25	34.84	65.00	45.16	81.25	51.62	90.63	58.87
38.06	35.58	65.71	45.48	81.88	51.92	91.03	59.22
39.38	36.21	66.88	45.71	81.94	52.11	91.25	59.62
42.73	36.88	67.50	45.94	82.50	52.34	91.54	60.05
43.75	37.43	68.13	46.28	83.13	52.76	91.88	60.47
45.00	37.91	69.38	46.59	83.70	53.01	92.38	61.15
46.25	38.43	70.00	46.78	83.75	53.19	92.59	61.55
47.50	38.95	70.63	46.99	83.87	53.39	93.13	61.91
49.38	39.38	71.25	47.30	84.38	53.65	93.75	62.63
50.00	39.82	72.50	47.62	85.00	54.01	93.91	63.14
51.25	40.20	73.13	47.86	85.19	54.21	94.38	63.54
52.00	40.62	73.75	48.11	85.63	54.48	95.00	64.31
52.86	41.01	74.38	48.36	85.93	54.71	95.63	65.19
54.19	41.34	75.00	48.62	86.25	54.99	96.25	66.07
55.00	41.75	75.56	48.90	86.88	55.47	96.88	67.01
56.13	42.11	76.13	49.07	86.92	55.74	97.50	68.20
57.14	42.46	76.25	49.27	87.50	55.96	98.75	69.84
58.13	42.77	76.88	49.59	88.13	56.38	99.38	71.82
58.75	43.06	77.50	49.88	88.15	56.68	100.00	76.21

Table D.1 (continued)

Measure			Measure			Measure		
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score
<u>Psychological Distress I</u>								
11.82	23.30	66.36	43.36	82.86	50.38	93.64	58.03	
23.64	28.10	67.27	43.62	83.64	50.63	93.75	58.40	
30.67	30.35	68.18	43.95	83.81	50.85	94.29	58.49	
34.12	31.93	69.09	44.32	84.55	51.07	94.55	58.91	
37.27	33.02	70.00	44.62	85.00	51.31	95.29	59.37	
40.91	33.95	70.91	44.92	85.45	51.57	95.45	59.88	
42.35	34.77	71.25	45.14	86.32	51.89	95.56	60.38	
43.64	35.43	71.82	45.42	86.36	52.23	96.19	60.48	
45.45	36.15	72.73	45.73	86.36	52.51	96.36	61.16	
47.27	36.85	73.64	45.98	87.27	52.66	96.36	61.79	
50.00	37.44	74.55	46.29	87.27	52.92	96.47	61.90	
50.91	37.94	75.45	46.63	88.18	53.35	97.27	62.49	
52.73	38.39	75.56	46.84	88.24	53.71	97.27	63.23	
53.64	38.91	76.36	47.00	89.09	54.11	98.18	63.98	
56.36	39.40	77.27	47.28	89.41	54.48	98.33	64.61	
56.47	39.81	77.27	47.57	90.00	54.82	99.09	65.80	
58.18	40.21	78.18	47.90	90.48	55.17	100.00	71.14	
59.09	40.53	78.46	48.12	90.91	55.49	Depression/Behavioral-		
60.00	40.90	79.09	48.32	91.43	55.80	Emotional Control I		
60.91	41.34	80.00	48.76	91.76	55.88	12.31	23.15	
61.18	41.72	80.91	49.21	91.82	56.27	20.00	27.97	
62.22	42.07	81.67	49.42	92.38	56.71	30.77	30.13	
63.64	42.43	81.82	49.62	92.73	56.90	32.31	31.66	
63.81	42.76	82.22	49.84	92.73	57.28	35.38	32.85	
65.45	43.07	82.73	50.11	93.64	57.62	38.46	33.70	

Table D.1 (continued)

Measure		Measure		Measure		Measure	
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score
41.54	34.56	75.38	45.69	93.85	56.46	56.00	40.62
43.08	35.53	75.56	45.97	95.00	57.06	56.67	41.06
46.15	36.19	76.92	46.26	95.38	57.61	56.67	41.59
47.69	36.72	78.18	46.54	95.56	58.15	60.00	42.38
50.77	37.28	78.46	46.86	96.36	58.28	63.33	43.18
52.31	37.83	78.46	47.15	96.92	59.25	63.33	43.74
53.85	38.37	80.00	47.55	98.18	60.32	64.00	44.25
55.38	38.85	81.54	48.28	98.33	60.54	66.67	44.93
57.50	39.27	81.67	48.69	98.46	61.71	68.00	45.50
58.46	39.67	82.22	48.75	100.00	67.69	70.00	46.20
60.00	40.27	83.08	49.14	Anxiety I		72.00	46.86
61.54	40.89	83.64	49.56	13.33	23.32	73.33	47.57
63.08	41.34	84.62	49.94	23.33	28.28	73.33	48.31
63.64	41.61	85.00	50.36	26.67	30.16	76.67	49.09
64.62	41.89	86.15	50.73	30.00	31.44	80.00	50.81
66.15	42.37	86.67	51.15	36.67	32.80	83.33	52.59
66.67	42.67	87.69	51.77	36.67	33.75	85.00	53.42
67.69	42.98	88.00	52.29	40.00	34.83	86.67	54.34
69.09	43.27	88.89	52.38	43.33	35.91	88.00	55.25
69.23	43.55	89.23	52.96	43.33	36.52	90.00	56.36
70.77	44.00	90.00	53.51	46.67	37.32	92.00	57.51
70.91	44.23	90.77	53.88	46.67	37.90	93.33	58.76
72.31	44.49	91.11	54.34	50.00	38.56	95.00	60.27
72.73	44.77	92.00	54.46	53.33	39.27	96.67	61.86
73.85	45.06	92.31	55.11	53.33	39.99	100.00	68.11
75.00	45.38	93.33	55.84				

Table D.1 (continued)

Measure		Measure		Measure		Measure	
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score
Psychological							
Well-Being I							
2.00	23.78	46.67	44.11	72.50	51.76	0.00	22.87
12.00	28.00	48.00	44.36	73.33	51.85	8.57	28.15
14.00	29.49	48.89	44.63	74.00	52.27	11.43	30.29
16.00	31.13	50.00	44.91	75.00	52.72	14.29	31.58
20.00	32.83	51.11	45.17	76.00	53.31	17.14	33.31
22.00	34.11	52.00	45.44	77.14	53.86	20.00	35.02
22.22	34.68	53.33	45.74	77.50	53.92	22.86	35.77
24.00	35.41	54.00	46.04	78.00	54.50	22.86	36.28
26.00	36.41	55.56	46.32	80.00	55.70	24.00	36.88
26.67	36.85	56.00	46.58	82.00	56.96	25.71	37.68
28.00	37.32	57.14	46.80	82.50	57.66	26.67	38.38
30.00	38.16	58.00	47.12	83.33	57.76	28.57	39.03
32.00	39.04	60.00	47.68	84.00	58.52	30.00	39.68
33.33	39.50	62.00	48.18	85.00	59.42	31.43	40.28
34.00	39.97	62.22	48.43	86.00	60.29	32.00	40.80
34.29	40.42	64.00	48.71	87.50	61.24	33.33	40.85
36.00	40.74	64.44	48.97	88.00	62.23	34.29	41.42
37.50	41.03	65.71	49.02	88.57	63.23	36.00	42.04
38.00	41.31	66.00	49.28	90.00	64.21	37.14	42.31
40.00	41.85	67.50	49.52	91.11	65.23	37.14	42.73
42.00	42.44	68.00	49.83	92.00	65.82	40.00	43.41
42.86	42.83	68.89	50.15	94.00	67.00	42.86	44.02
44.00	43.19	70.00	50.48	96.00	68.45	42.86	44.29
44.44	43.50	71.11	50.81	98.00	70.21	45.71	44.69
46.00	43.81	72.00	51.28	100.00	74.69	46.67	45.03

Table D.1 (continued)

Measure		Measure		Measure		Measure	
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score
48.57	45.43	83.33	61.53	66.67	46.52	47.06	39.70
50.00	45.83	85.71	62.63	66.67	47.26	48.24	40.10
51.43	46.14	86.67	63.84	70.00	47.93	49.41	40.55
52.00	46.49	88.57	64.61	73.33	48.73	50.67	40.97
54.29	46.89	90.00	65.30	73.33	49.59	51.76	41.44
55.00	47.25	91.43	66.04	80.00	51.07	52.31	41.75
57.14	47.48	93.33	66.85	86.67	53.79	52.94	42.02
57.14	47.88	94.29	67.83	90.00	55.40	54.29	42.42
60.00	48.54	97.14	69.77	93.33	57.23	56.25	42.76
62.86	49.18	100.00	74.43	100.00	64.64	56.47	43.09
62.86	49.59	Feelings of Belonging		Mental Health Index II		57.65	43.44
65.00	49.86	0.00	20.60	18.57	23.05	58.82	43.70
65.71	50.25	6.67	26.69	21.43	27.89	58.82	43.88
66.67	50.66	10.00	29.24	23.53	30.04	60.00	44.22
68.00	50.79	13.33	31.08	28.24	31.56	61.18	44.59
68.57	51.24	20.00	34.16	30.59	32.89	62.35	44.86
70.00	51.70	26.67	35.76	31.11	33.91	63.53	45.18
71.43	52.35	26.67	36.84	34.12	34.77	64.62	45.42
72.00	53.01	30.00	37.88	36.47	35.61	64.71	45.63
74.29	53.09	33.33	38.80	38.18	36.26	65.88	45.99
74.29	53.72	40.00	40.65	40.00	36.90	67.06	46.38
75.00	54.35	46.67	42.17	41.18	37.50	67.14	46.60
76.67	54.45	46.67	42.88	42.00	37.96	68.24	46.81
77.14	55.48	50.00	43.25	43.53	38.38	68.57	47.15
80.00	57.82	53.33	44.04	44.71	38.81	70.00	47.32
82.86	60.29	60.00	45.53	46.25	39.28	71.43	47.53

Table D.1 (continued)

Measure		Measure		Measure		Measure	
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score
71.76	47.91	88.00	56.69	31.11	31.78	68.33	44.97
72.00	48.14	88.24	57.28	34.29	32.94	68.89	45.24
72.94	48.38	89.09	57.90	35.00	33.85	70.00	45.61
74.00	48.60	89.41	58.44	36.67	34.71	71.11	45.99
74.12	48.82	90.00	58.93	40.00	35.51	71.67	46.28
75.29	49.21	90.59	59.44	41.67	36.13	72.50	46.54
76.00	49.44	90.67	59.97	43.33	36.72	73.33	46.77
76.47	49.66	90.77	60.08	45.00	37.31	74.55	47.00
77.33	49.88	91.76	60.70	48.33	37.85	75.00	47.31
77.65	50.01	92.31	61.36	48.33	38.30	75.56	47.65
77.65	50.32	92.94	61.98	50.00	38.76	76.67	48.04
78.33	50.65	93.75	62.57	51.67	39.30	78.00	48.44
78.82	51.02	94.12	63.30	53.33	39.80	78.33	48.82
80.00	51.52	94.29	64.06	55.00	40.31	78.33	49.14
81.18	52.08	95.00	64.12	56.36	40.64	80.00	49.55
81.43	52.46	95.29	64.87	56.67	40.89	81.67	49.95
82.35	52.70	95.71	66.28	56.67	41.35	81.67	50.28
82.35	53.02	97.65	67.28	58.33	41.81	82.22	50.69
82.86	53.27	97.65	68.14	60.00	42.35	82.86	50.78
83.53	53.66	98.82	69.82	61.67	42.81	83.33	51.22
84.62	54.05	100.00	74.68	61.82	43.06	84.44	51.70
84.71	54.39	Psychological		63.33	43.29	85.00	52.26
85.71	54.74	Distress II		64.44	43.57	85.45	52.79
85.88	55.20	13.33	23.12	65.00	43.99	86.00	52.83
86.67	55.70	21.82	27.95	65.71	44.26	86.67	53.34
87.06	56.19	26.67	30.22	66.67	44.51	87.27	53.91

Table D.1 (continued)

Measure			Measure			Measure		
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score
88.33	54.49	42.50	36.15	80.00	48.44	33.33	34.40	34.40
89.09	55.06	45.00	36.85	82.50	49.57	40.00	36.55	36.55
90.00	55.69	45.71	37.28	84.00	50.19	46.67	38.89	38.89
91.11	56.33	48.00	37.69	85.00	50.96	46.67	40.02	40.02
91.67	56.95	50.00	38.38	85.71	51.72	53.33	40.40	40.40
92.73	57.63	51.43	38.76	86.67	51.82	53.33	41.43	41.43
93.33	58.41	52.50	39.18	87.50	52.54	60.00	43.38	43.38
94.55	59.18	55.00	39.88	88.00	53.28	66.67	44.58	44.58
95.00	59.96	57.14	40.28	88.57	53.36	66.67	45.60	45.60
95.56	60.81	57.50	40.62	90.00	54.18	70.00	46.60	46.60
96.67	61.74	60.00	41.43	91.43	55.01	73.33	48.02	48.02
97.78	62.77	62.50	42.26	92.00	55.10	73.33	49.39	49.39
98.18	62.99	62.86	42.67	92.50	55.98	80.00	51.30	51.30
98.33	64.17	65.00	43.09	94.29	56.92	86.67	54.84	54.84
100.00	69.74	65.71	43.46	95.00	57.91	90.00	56.63	56.63
Depression/Behavioral- Emotional Control II		66.67	43.50	96.00	59.12	93.33	58.56	58.56
		67.50	43.92	97.50	60.50	100.00	65.87	65.87
16.00	23.07	68.57	44.37	100.00	66.76	Psychological		
17.50	28.13	70.00	44.77	Anxiety II		Well-Being II		
25.71	30.08	71.43	45.17	0.00	22.53	0.00	21.87	21.87
28.00	31.36	72.50	45.67	13.33	26.84	8.00	26.77	26.77
32.50	32.75	73.33	46.13	20.00	29.60	12.00	29.69	29.69
35.00	33.86	75.00	46.53	26.67	31.70	16.00	32.05	32.05
37.50	34.73	76.00	46.98	26.67	32.73	20.00	34.33	34.33
40.00	35.51	77.50	47.44	33.33	33.41	24.00	36.28	36.28

Table D.1 (continued)

Measure			Measure			Measure		
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score
26.67	37.10	85.00	61.93	60.00	48.57	45.00	40.38	40.38
28.00	38.05	88.00	63.36	65.00	50.02	46.67	40.46	40.46
30.00	38.91	90.00	64.90	66.67	50.77	48.00	41.04	41.04
32.00	39.62	92.00	65.85	70.00	51.73	50.00	41.66	41.66
35.00	40.31	93.33	67.02	73.33	52.71	52.00	42.41	42.41
36.00	41.11	96.00	68.15	75.00	53.93	55.00	43.10	43.10
40.00	42.55	100.00	73.07	80.00	57.92	56.00	43.67	43.67
44.00	43.82	<u>Positive Affect II</u>			62.58	60.00	44.85	44.85
45.00	44.42	0.00	21.06	86.67	64.24	64.00	45.99	45.99
46.67	44.48	5.00	26.64	90.00	65.47	66.67	46.55	46.55
48.00	44.91	10.00	29.89	93.33	66.77	68.00	47.23	47.23
50.00	45.34	13.33	31.15	95.00	67.85	70.00	47.84	47.84
52.00	45.83	15.00	32.64	100.00	72.89	72.00	48.41	48.41
55.00	46.34	20.00	35.43	<u>Mental Health Index II</u>			48.96	48.96
56.00	46.85	25.00	37.90	0.00	23.25	73.33	49.06	49.06
60.00	47.88	26.67	38.99	15.00	27.71	76.00	49.80	49.80
64.00	48.93	30.00	39.97	20.00	29.67	80.00	51.50	51.50
66.67	49.47	33.33	40.90	24.00	31.45	84.00	53.73	53.73
68.00	50.11	35.00	41.89	26.67	32.87	85.00	55.11	55.11
70.00	50.73	40.00	43.58	30.00	33.52	86.67	55.31	55.31
72.00	51.60	45.00	44.90	32.00	34.57	88.00	56.80	56.80
73.33	52.51	46.67	45.49	35.00	35.56	90.00	58.44	58.44
76.00	53.43	50.00	46.04	36.00	36.37	92.00	60.62	60.62
80.00	55.90	53.33	46.60	40.00	38.08	95.00	63.29	63.29
84.00	59.56	55.00	47.24	44.00	39.71	96.00	64.94	64.94
				100.00		100.00	70.75	70.75

Table D.1 (continued)

Measure			Measure			Measure		
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Measure
Role Limitations Due to Emotional Problems								
0.00	33.99	48.00	47.50	15.00	34.33	95.00	72.49	
33.33	41.96	50.00	48.34	20.00	36.76	100.00	76.92	
33.33	44.39	52.00	49.10	25.00	38.87	Sleep Problems I		
50.00	45.38	55.00	49.80	26.67	39.82	14.29	23.72	
66.67	46.93	56.00	50.54	30.00	40.84	26.67	28.14	
66.67	48.81	60.00	51.95	33.33	41.78	28.89	30.13	
100.00	58.68	64.00	53.51	35.00	42.65	34.29	31.54	
		65.00	54.43	40.00	44.58	35.56	32.62	
		68.00	55.23	45.00	46.66	40.00	34.09	
Energy/Fatigue								
4.00	23.98	70.00	56.05	46.67	47.67	42.22	35.40	
8.00	28.75	72.00	56.96	46.67	47.74	44.44	36.34	
13.33	31.21	75.00	57.93	50.00	48.87	46.67	37.21	
16.00	33.57	76.00	58.87	53.33	50.01	46.67	37.87	
20.00	35.77	80.00	61.24	55.00	50.99	48.89	38.57	
24.00	37.68	84.00	64.32	60.00	52.97	50.00	39.02	
26.67	38.57	85.00	66.07	65.00	54.92	51.11	39.62	
28.00	39.31	88.00	67.43	66.67	55.85	53.33	40.24	
30.00	40.00	92.00	70.39	66.67	55.92	53.33	40.62	
32.00	40.86	96.00	73.07	70.00	56.92	55.56	41.27	
35.00	41.70	100.00	77.41	73.33	57.95	56.67	41.68	
SF-36™ Vitality								
36.00	42.52			75.00	59.04	57.78	42.47	
40.00	44.28	0.00	24.08	80.00	62.15	60.00	43.63	
44.00	45.92	5.00	28.68	85.00	65.75	62.22	44.61	
45.00	46.63	10.00	31.48	86.67	67.24	64.00	45.14	
46.67	46.70	13.33	32.99	90.00	69.13	64.44	45.71	

Table D.1 (continued)

Measure			Measure			Measure		
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score
65.00	46.36	93.33	66.98	63.33	44.67	31.25	30.42	31.25
66.67	46.86	95.56	69.78	63.33	45.36	37.50	32.07	37.50
67.50	47.26	97.78	72.33	66.67	45.75	40.63	33.32	40.63
68.89	47.82	100.00	76.88	66.67	46.60	42.86	33.87	42.86
70.00	48.38	Sleep Problems II			47.31	43.75	34.59	43.75
71.11	48.99	0.00	22.86	70.00	47.96	45.83	35.31	45.83
72.50	49.63	23.33	27.75	72.00	48.60	46.88	36.11	46.88
73.33	50.14	26.67	29.76	73.33	49.26	50.00	37.54	50.00
73.33	50.71	32.00	31.30	73.33	50.09	53.13	38.69	53.13
75.00	50.83	33.33	32.75	76.67	50.41	53.57	39.15	53.57
75.56	51.48	36.67	33.76	76.67	51.21	56.25	39.80	56.25
77.50	52.16	36.67	34.42	80.00	52.86	57.14	40.39	57.14
77.78	52.88	40.00	35.30	83.33	55.02	58.33	40.41	58.33
80.00	54.31	43.33	36.25	83.33	56.29	59.38	41.10	59.38
82.22	55.82	43.33	36.91	86.67	57.82	60.71	41.81	60.71
84.00	56.64	46.67	37.55	88.00	59.40	62.50	42.68	62.50
84.44	57.56	46.67	38.13	90.00	60.79	64.29	43.52	64.29
85.71	58.52	48.00	38.43	93.33	64.12	65.00	43.58	65.00
86.67	59.53	50.00	39.18	95.00	66.32	65.63	44.32	65.63
88.00	60.67	53.33	39.94	96.67	68.26	67.86	45.09	67.86
88.89	61.85	53.33	40.68	100.00	74.34	68.75	45.84	68.75
90.00	63.08	56.00	41.33	Physical/Psychophysio- logic Symptoms			71.43	46.62
91.11	64.22	56.67	41.65	21.88	22.95	71.88	47.40	71.88
92.00	65.54	56.67	42.34	28.13	28.05	75.00	48.97	75.00
92.50	65.63	60.00	43.48			78.13	50.50	78.13

Table D.1 (continued)

Measure		Measure		Measure		Measure	
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score
78.57	51.21	41.67	39.69	75.00	45.96	24.96	39.33
79.17	51.27	43.75	40.71	87.50	49.80	25.00	39.97
81.25	52.26	50.00	42.53	100.00	59.76	26.54	40.12
82.14	53.29	56.25	44.60	Role Functioning: Able to Work		28.54	40.51
84.38	54.07	58.33	45.79	0.00	33.85	29.95	40.94
85.71	54.85	62.50	47.12	100.00	56.19	30.67	41.26
87.50	55.89	66.67	48.34	Role Functioning: Able to Do Housework		32.11	41.68
89.29	57.00	66.67	48.48	0.00	28.28	33.33	41.99
90.63	58.30	68.75	49.99	100.00	54.60	33.68	42.41
92.86	59.66	75.00	54.37	Current Health		34.95	42.74
93.75	61.38	81.25	59.31	0.00	22.61	35.68	43.01
95.00	63.45	83.33	61.28	3.57	27.82	37.15	43.29
96.88	65.10	83.33	61.44	7.14	30.45	37.25	43.69
100.00	71.01	87.50	64.54	9.95	31.56	37.50	44.06
Social Activity Limitations Due to Health		91.67	69.16	10.68	32.67	39.25	44.28
6.25	24.51	93.75	70.95	12.25	33.74	39.29	44.54
8.33	28.19	100.00	76.34	15.82	34.58	40.82	44.89
12.50	29.74	SF-36™ Social Functioning		17.82	35.46	41.63	45.18
16.67	31.01	0.00	21.59	17.82	36.17	42.82	45.39
18.75	32.44	12.50	27.51	17.86	36.77	44.14	45.62
25.00	34.90	25.00	31.84	21.39	37.63	44.39	45.88
31.25	36.98	37.50	35.69	22.96	38.48	44.39	46.26
33.33	37.85	50.00	39.09	24.95	38.74	47.71	46.55
37.50	38.74	62.50	42.37			47.96	47.04
						49.96	47.39

Table D.1 (continued)

Measure			Measure			Measure		
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score
37.15	41.43	66.80	52.28	0.00	24.05	37.50	44.62	37.50
37.50	41.58	67.15	52.99	4.95	28.37	39.95	44.83	39.95
39.95	42.05	68.75	53.59	5.00	30.21	41.80	45.09	41.80
40.00	42.57	71.44	53.71	8.25	31.27	42.15	45.69	42.15
40.19	42.69	71.80	54.10	9.95	32.63	44.95	46.37	44.95
42.15	43.28	71.80	54.61	10.00	34.03	45.25	46.62	45.25
43.69	43.87	72.15	55.53	12.44	34.42	46.80	46.76	46.80
44.95	44.37	75.00	56.34	14.95	35.32	47.15	47.27	47.15
46.44	44.91	76.80	57.11	16.58	36.30	49.92	47.86	49.92
47.15	45.53	76.80	57.93	17.15	36.68	50.00	48.15	50.00
49.94	46.05	77.15	58.54	19.95	37.67	52.15	48.79	52.15
49.95	46.29	77.25	59.10	20.25	38.59	53.58	49.39	53.58
50.00	46.59	80.00	59.32	24.92	38.92	54.95	49.62	54.95
52.15	47.26	81.80	60.09	24.95	39.71	56.80	49.90	56.80
52.69	47.88	81.80	60.99	24.95	40.35	57.15	50.40	57.15
54.95	48.08	82.15	61.73	27.15	40.67	58.25	50.75	58.25
56.80	48.39	83.50	62.27	28.58	40.99	61.33	50.89	61.33
57.15	49.03	85.00	62.57	29.95	41.50	61.92	51.12	61.92
58.50	49.63	86.80	63.86	31.19	42.03	62.15	51.62	62.15
61.80	49.82	87.15	65.46	32.15	42.45	62.15	52.19	62.15
61.92	50.05	89.75	66.39	33.25	42.83	65.00	52.45	65.00
62.15	50.54	91.80	67.84	34.95	43.22	66.67	52.55	66.67
62.15	51.19	92.15	69.75	36.92	43.66	66.80	52.84	66.80
65.19	51.65	96.80	71.70	37.15	43.98	66.80	53.15	66.80
66.80	51.96	100.00	76.28	37.15	44.42	67.15	53.54	67.15

SF-20 Current Health

Table D.1 (continued)

Measure		Measure		Measure		Measure	
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score
Health Distress							
70.25	54.03	0.00	22.58	68.00	43.76	34.09	33.98
71.80	54.39	10.00	27.48	70.00	44.32	35.01	34.83
71.80	54.66	20.00	29.79	72.00	44.89	38.70	35.56
72.15	55.15	23.33	31.27	73.33	45.39	40.18	36.25
74.95	55.68	26.67	32.38	76.00	45.91	41.21	36.87
76.80	56.34	30.00	33.60	76.67	46.53	43.35	37.43
76.80	56.96	33.33	34.30	80.00	47.68	44.59	37.97
77.15	57.51	33.33	34.95	83.33	48.93	46.87	38.47
77.25	58.06	36.67	35.58	85.00	49.63	48.10	38.94
78.58	58.25	40.00	36.21	86.67	50.38	49.52	39.40
81.80	59.07	43.33	37.10	88.00	51.15	50.20	39.83
81.80	59.81	45.00	37.49	90.00	51.84	51.30	40.23
82.15	60.34	46.67	37.95	92.00	52.51	52.81	40.63
86.33	61.05	46.67	38.46	93.33	53.42	53.81	41.02
86.80	62.52	50.00	38.90	96.00	54.39	54.46	41.38
86.92	63.96	53.33	39.37	96.67	55.56	55.32	41.74
87.15	64.39	53.33	39.80	100.00	62.94	56.18	42.09
91.67	65.12	56.67	40.40	Factor Score:		57.70	42.43
91.80	65.62	56.67	40.77	Physical Health		58.18	42.76
91.80	66.69	60.00	41.40	0.62	23.37	59.35	43.08
94.67	68.56	63.33	42.17	20.36	28.15	59.90	43.39
96.00	69.57	63.33	42.65	26.33	30.32	60.65	43.71
96.80	70.77	66.67	42.96	29.43	31.83	61.68	44.01
100.00	75.59	66.67	43.39	29.85	32.99	61.92	44.30

Table D.1 (continued)

Measure			Measure			Measure		
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score
62.93	44.60	77.84	51.13	87.89	58.26	22.91	30.32	
64.23	44.89	78.23	51.39	88.39	58.62	26.09	31.83	
64.38	45.17	78.40	51.64	88.84	58.98	29.09	32.99	
65.83	45.45	78.79	51.89	89.44	59.37	29.88	33.98	
66.08	45.73	79.48	52.15	89.75	59.77	32.02	34.83	
66.85	46.00	79.94	52.41	90.16	60.17	34.99	35.56	
67.55	46.27	80.33	52.67	90.26	60.60	35.42	36.25	
68.39	46.54	80.90	52.93	90.94	61.06	37.20	36.87	
68.83	46.80	81.07	53.20	91.24	61.53	39.02	37.43	
69.44	47.07	81.63	53.46	91.61	62.03	40.53	37.97	
69.63	47.33	81.95	53.73	92.15	62.57	41.32	38.47	
70.44	47.59	82.45	54.00	92.64	63.13	42.35	38.94	
71.37	47.85	82.84	54.27	93.04	63.75	43.21	39.40	
71.70	48.11	83.30	54.55	93.41	64.44	44.07	39.83	
72.50	48.36	83.61	54.83	93.94	65.17	44.82	40.23	
73.06	48.61	84.43	55.11	94.48	66.02	45.95	40.63	
73.91	48.87	84.81	55.40	94.92	67.01	46.76	41.02	
74.20	49.12	85.17	55.70	95.62	68.17	47.77	41.38	
74.95	49.37	85.31	55.99	96.49	69.68	49.44	41.74	
75.01	49.62	85.92	56.29	97.76	71.85	50.25	42.09	
75.67	49.87	86.16	56.61	99.35	76.63	50.60	42.43	
76.25	50.12	86.38	56.92	Factor Score:		50.98	42.76	
76.78	50.38	86.71	57.24	Mental Health		51.83	43.08	
76.87	50.63	87.36	57.57	7.73	23.37	53.52	43.39	
77.18	50.88	87.86	57.91	20.95	28.15	54.12	43.71	

Table D.1 (continued)

Measure		Measure		Measure		Measure	
Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score	Raw Score	Normalized t-score
55.70	44.01	67.94	48.87	76.17	53.46	83.08	58.98
56.35	44.30	68.31	49.12	76.67	53.73	83.47	59.37
57.18	44.60	68.94	49.37	77.37	54.00	83.54	59.77
57.46	44.89	69.44	49.62	77.38	54.27	84.05	60.17
58.12	45.17	69.48	49.87	77.83	54.55	84.60	60.60
59.50	45.45	70.46	50.12	78.46	54.83	84.91	61.06
60.18	45.73	70.88	50.38	78.63	55.11	85.29	61.53
60.81	46.00	71.57	50.63	78.88	55.40	85.76	62.03
61.40	46.27	71.95	50.88	79.53	55.70	86.29	62.57
62.24	46.54	72.39	51.13	79.76	55.99	86.52	63.13
63.03	46.80	73.09	51.39	79.92	56.29	86.91	63.75
63.38	47.07	73.49	51.64	80.61	56.61	87.21	64.44
64.25	47.33	73.70	51.89	81.10	56.92	87.70	65.17
64.70	47.59	74.31	52.15	81.43	57.24	88.41	66.02
65.37	47.85	74.71	52.41	81.72	57.57	89.31	67.01
66.24	48.11	75.18	52.67	82.18	57.91	90.31	68.17
66.61	48.36	75.75	52.93	82.49	58.26	90.51	69.68
67.43	48.61	75.88	53.20	82.76	58.62	92.69	71.85
						92.75	76.63

Table D.2
Means for T-Scores on Measures by Age, Education, Gender, Illness Severity

Measure	k	Age					Education			Gender		Illness Severity	
		18-44	45-64	65-74	75+	Less than HS Dipl. or Higher	HS Grad	Female	Male	Not Severe	Severe		
Physical Functioning	10	54.83	49.91	46.86	44.05	44.94	50.93	48.95	51.60	51.87	43.99		
Satisfaction with Physical Ability	1	50.49	49.57	50.21	49.42	48.47	50.29	49.50	50.76	52.18	46.73		
Mobility	2	51.27	50.24	49.62	46.55	45.76	50.80	48.79	51.85	52.45	45.94		
Effects of Pain	6	49.31	49.95	50.86	50.02	48.13	50.35	48.90	51.66	52.34	47.65		
Pain Severity	5	49.66	49.70	50.69	50.21	47.65	50.44	48.89	51.70	51.87	48.29		
SF-36™ Pain	2	50.14	49.76	50.45	49.22	47.41	50.49	48.91	51.67	52.07	47.51		
RAND Pain	2	50.07	49.87	50.44	49.11	47.49	50.48	48.89	51.70	52.14	47.44		
Role Limitations Due to Physical Health	7	51.57	50.20	49.27	46.41	46.80	50.60	48.95	51.60	52.39	45.27		
SF-36™ Role Limitations Due to Physical Health	4	51.69	50.10	49.20	46.56	47.49	50.47	49.02	51.49	52.35	45.53		
Cognitive Functioning	6	47.18	50.64	52.24	50.45	48.19	50.35	49.40	50.92	52.91	49.44		
Mental Health Index I	32	44.69	49.95	54.33	54.54	50.29	49.95	48.64	52.07	53.87	50.65		
Psychological Distress I	22	44.82	50.04	54.31	53.96	49.88	50.02	48.59	52.15	53.99	50.69		
Depression/Behavioral-Emotional Control I	13	44.66	50.26	54.28	53.84	49.86	50.03	48.59	52.15	54.01	50.74		
Anxiety I	7	45.63	49.81	53.77	53.71	49.70	50.06	48.79	51.84	53.29	50.78		
Psychological Well-Being I	10	45.00	49.72	54.10	54.92	51.11	49.79	48.85	51.75	53.33	50.67		
Positive Affect I	7	45.12	49.72	54.13	54.59	50.97	49.81	48.85	51.75	53.30	50.75		
Feelings of Belonging	3	45.55	49.91	53.38	54.69	51.20	49.77	49.07	51.42	52.74	50.59		
Mental Health Index II	17	44.74	49.92	54.28	54.68	50.16	49.97	48.74	51.93	53.78	50.74		
Psychological Distress II	12	44.92	50.03	54.20	53.98	49.84	50.03	48.72	51.95	53.85	50.81		
Depression/Behavioral-Emotional Control II	8	45.75	49.94	53.55	53.76	50.02	50.00	48.98	51.55	53.25	50.61		
Anxiety II	4	44.85	50.19	54.22	53.59	49.73	50.05	48.75	51.91	53.87	50.76		

Table D.2 (continued)

Measure	k	Age					Education			Gender		Illness Severity	
		18-44	45-64	65-74	75+	Less than HS Dipl.	HS Grad or Higher	Female	Male	Not Severe	Severe		
Psychological Well-Being II	5	45.03	49.62	54.15	55.19	50.92	49.83	48.88	51.71	53.20	50.83		
Positive Affect II	4	45.00	49.69	54.17	54.95	50.75	49.86	48.88	51.71	53.18	50.97		
Mental Health Index III	5	45.12	49.87	54.12	54.18	50.14	49.97	48.69	52.00	53.65	50.74		
Role Limitations Due to Emotional Problems	3	47.13	50.65	52.30	50.67	49.17	50.15	48.98	51.55	53.09	49.98		
Energy/Fatigue	5	48.75	50.18	51.40	49.52	47.95	50.38	48.46	52.35	53.08	46.65		
SF-36™ Vitality	4	48.43	50.24	51.56	49.91	48.16	50.34	48.43	52.40	53.05	46.82		
Sleep Problems I	9	48.01	50.33	51.69	50.49	48.12	50.35	48.96	51.59	53.11	47.35		
Sleep Problems II	6	47.49	50.20	52.23	51.01	48.68	50.25	48.70	51.99	52.78	48.34		
Physical/Psychophysiological Symptoms	8	48.70	49.82	51.52	50.75	47.15	50.52	48.52	52.25	52.84	47.67		
Social Activity Limitations Due to Health	4	47.19	49.83	52.89	51.43	48.93	50.20	49.44	50.85	53.52	48.22		
SF-36™ Social Functioning	2	47.24	50.45	52.22	50.92	48.96	50.20	49.00	51.53	53.80	48.44		
Role Functioning: Able to Work	1	51.94	49.90	48.86	46.91	44.14	50.99	49.50	50.73	51.93	45.25		
Role Functioning: Able to Do Housework	1	50.14	49.63	50.60	49.24	48.04	50.36	49.40	50.90	52.35	46.30		
Current Health	7	50.00	49.18	50.92	50.32	47.56	50.46	49.45	50.83	52.77	45.03		
RAND General Health	5	50.13	49.37	50.55	50.29	48.04	50.37	49.62	50.58	52.42	44.55		
SF-36™ General Health	5	50.08	49.38	50.58	50.29	48.05	50.36	49.65	50.54	52.43	44.48		
SF-20 CurrentHealth	5	50.01	49.20	50.75	50.66	47.50	50.47	49.38	50.94	52.79	44.83		
Health Distress	6	48.41	49.61	51.78	51.50	47.88	50.39	49.08	51.41	53.05	47.46		
Factor Score: Physical Health	-	51.27	49.89	49.71	47.71	45.97	50.77	48.82	51.80	53.01	44.75		
Factor Score: Mental Health	-	44.96	50.05	54.11	54.03	49.89	50.02	48.77	51.88	53.91	50.17		

Table D.3

Standard Deviations for T-Scores on Measures by Age, Education, Gender, Illness Severity

Measure	k	Age					Education			Gender		Illness Severity	
		18-44	45-64	65-74	75+	Less than HS Dipl.	HS Grad or Higher	Female	Male	Not Severe	Severe		
Physical Functioning	10	9.32	9.53	9.03	9.34	10.31	9.66	10.16	9.54	8.96	9.00		
Satisfaction with Physical Ability	1	10.09	10.00	9.86	10.08	11.44	9.68	10.30	9.49	9.37	9.47		
Mobility	2	8.60	9.98	10.43	11.74	12.34	9.28	10.83	8.25	7.85	11.89		
Effects of Pain	6	9.89	10.16	9.83	10.14	11.32	9.70	10.01	9.75	9.00	9.88		
Pain Severity	5	9.25	10.28	10.40	10.11	11.38	9.66	10.05	9.68	9.50	9.73		
SF-36™ Pain	2	9.27	10.31	10.28	10.29	11.26	9.66	10.04	9.71	9.44	10.02		
RAND Pain	2	9.27	10.27	10.32	10.35	11.21	9.68	10.02	9.73	9.41	9.95		
Role Limitations Due to Physical Health	7	9.67	10.16	9.72	10.12	10.54	9.78	10.08	9.66	9.11	9.77		
SF-36™ Role Limitations Due to Physical Health	4	9.63	9.96	10.06	10.04	10.18	9.90	9.97	9.87	9.42	9.31		
Cognitive Functioning	6	10.53	9.97	8.97	9.19	9.98	9.97	10.18	9.65	9.19	9.22		
Mental Health Index I	32	9.40	9.38	8.63	9.39	10.14	9.98	9.95	9.72	8.76	9.05		
Psychological Distress I	22	9.45	9.42	8.83	9.16	10.19	9.97	9.94	9.70	8.79	9.35		
Depression/Behavioral-Emotional Control I	13	9.57	9.54	8.53	8.89	9.87	10.03	10.02	9.58	8.64	9.18		
Anxiety I	7	9.49	9.60	9.22	9.36	10.51	9.90	10.03	9.67	9.20	9.45		
Psychological Well-Being I	10	9.37	9.50	8.63	9.61	10.25	9.94	9.99	9.76	8.86	9.07		
Positive Affect I	7	9.45	9.34	8.85	9.72	10.56	9.88	9.97	9.79	8.94	8.95		
Feelings of Belonging	3	9.61	9.96	8.54	9.29	10.18	9.95	9.97	9.88	9.09	9.98		
Mental Health Index II	17	9.35	9.35	8.68	9.58	10.20	9.96	10.02	9.67	8.77	9.02		
Psychological Distress II	12	9.47	9.46	8.77	9.36	10.07	9.99	9.95	9.77	8.88	9.04		
Depression/Behavioral-Emotional Control II	8	9.51	9.65	9.23	9.46	10.57	9.89	10.10	9.65	9.22	9.23		
Anxiety II	4	9.65	9.57	8.54	9.00	9.79	10.04	10.02	9.66	8.68	9.10		
Psychological Well-Being II	5	9.24	9.37	8.86	9.68	10.50	9.90	10.16	9.51	8.77	9.22		
Positive Affect II	4	9.27	9.40	8.83	9.67	10.55	9.89	10.11	9.58	8.84	9.15		

Table D.3 (continued)

Measure	k	Age					Education			Illness Severity	
		18-44	45-64	65-74	75+	Less than HS Dipl.	HS Grad or Higher	Female	Male	Not Severe	Severe
Mental Health Index III	5	9.51	9.42	8.84	9.53	10.32	9.94	9.94	9.76	8.98	9.22
Role Limitations Due to Emotional Problems	3	10.28	9.83	9.11	9.93	10.50	9.90	10.12	9.62	8.63	10.16
Energy/Fatigue	5	9.66	10.20	9.90	10.17	10.40	9.88	9.92	9.66	9.60	9.50
SF-36™ Vitality	4	9.72	10.15	9.85	10.08	10.06	9.95	9.95	9.60	9.56	9.38
Sleep Problems I	9	9.98	9.91	9.62	10.37	11.19	9.73	10.05	9.72	9.19	9.44
Sleep Problems II	6	9.69	9.89	9.69	10.48	11.41	9.69	9.99	9.68	9.24	9.95
Physical/Psychophysiologic Symptoms	8	9.84	9.94	9.92	10.37	11.01	9.72	9.86	9.79	9.55	9.96
Social Activity Limitations Due to Health	4	9.32	9.66	10.00	10.70	10.74	9.84	10.25	9.55	8.48	9.80
SF-36™ Social Functioning	2	10.10	9.87	9.30	10.09	10.97	9.79	10.06	9.71	8.12	10.04
Role Functioning: Able to Work	1	8.08	10.08	10.82	11.85	12.63	9.12	10.38	9.37	8.10	12.39
Role Functioning: Able to Do Housework	1	9.89	10.31	9.46	10.62	11.40	9.68	10.48	9.16	7.37	12.25
Current Health	7	9.68	9.99	10.09	10.57	10.79	9.78	10.15	9.72	9.16	9.68
RAND General Health	5	10.34	10.24	9.33	9.81	10.40	9.88	10.27	9.55	9.15	9.56
SF-36™ General Health	5	10.24	10.21	9.45	9.90	10.51	9.86	10.29	9.52	9.14	9.58
SF-20 Current Health	5	9.70	10.03	9.92	10.80	10.72	9.79	10.18	9.64	9.19	9.53
Health Distress	6	10.61	9.73	9.42	9.58	10.78	9.80	10.18	9.56	8.90	9.32
Factor Score: Physical Health	-	9.45	10.28	10.13	9.81	10.66	9.68	10.06	9.64	9.24	9.20
Factor Score: Mental Health	-	9.62	9.47	8.65	9.32	10.22	9.96	9.98	9.74	8.79	8.93

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