

The Summary of Diabetes Self-Care Activities Measure

Results from 7 studies and a revised scale

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OBJECTIVE — To review reliability, validity, and normative data from 7 different studies, involving a total of 1,988 people with diabetes, and provide a revised version of the Summary of Diabetes Self-Care Activities (SDSCA) measure.

RESEARCH DESIGN AND METHODS — The SDSCA measure is a brief self-report questionnaire of diabetes self-management that includes items assessing the following aspects of the diabetes regimen: general diet, specific diet, exercise, blood-glucose testing, foot care, and smoking. Normative data (means and SD), inter-item and test-retest reliability, correlations between the SDSCA subscales and a range of criterion measures, and sensitivity to change scores are presented for the 7 different studies (5 randomized interventions and 2 observational studies).

RESULTS — Participants were typically older patients, having type 2 diabetes for a number of years, with a slight preponderance of women. The average inter-item correlations within scales were high (mean = 0.47), with the exception of specific diet; test-retest correlations were moderate (mean = 0.40). Correlations with other measures of diet and exercise generally supported the validity of the SDSCA subscales (mean = 0.23).

CONCLUSIONS — There are numerous benefits from standardization of measures across studies. The SDSCA questionnaire is a brief yet reliable and valid self-report measure of diabetes self-management that is useful both for research and practice. The revised version and its scoring are presented, and the inclusion of this measure in studies of diabetes self-management is recommended when appropriate.

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Because the vast majority of the day-to-day care inherent in diabetes is handled by patients and their families (1,2), there is an important need for reliable and valid measures of diabetes self-management (3-6). Such measures are useful both for clinicians and educators treating individual patients and for researchers evaluating new approaches to care. Self-report is by far the most practical and cost-effective approach to self-care assessment, and yet is

often seen as undependable. This article summarizes data drawn from 7 different studies on the norms, reliability, validity, and sensitivity to change of the Summary of Diabetes Self-Care Activities (SDSCA) measure, a brief self-report instrument for measuring levels of self-management across different components of the diabetes regimen (7).

Generalizing from past research on diabetes self-management is made difficult by the heterogeneity of self-care measures used.

The least defensible of these is the practice of using measures of diabetes control, such as glycated hemoglobin or physicians' judgments, as indicators of patients' self-care behaviors (5,8-10). Direct methods, including observation of skills such as glucose testing and monitoring (e.g., by pill counts and activity monitors), are labor-intensive and subject to reactivity (10). Patients' self-reports are also open to bias but can be made more reliable (11); for example, by asking specific, nonjudgmental questions in interviews (12) or questionnaires (13). Moreover, the extent to which participants' self-reports of self-care are vulnerable to biases such as social desirability can be assessed with measures that tap constructs, such as the tendency to give self-reports that are self-deceptive (highly desirable but honestly held), and impression management (the conscious tendency to give highly desirable self-reports) (14,15).

Diabetes self-care includes a range of activities (e.g., self-monitoring of blood glucose, eating a low-saturated-fat diet, and checking one's feet) and it is now well established that these different components do not correlate highly (16-18). Because self-care is multidimensional, it is necessary to assess each component separately rather than to combine scores across components (10). However, earlier self-report measures of diabetes self-care, such as the Diabetes Regimen Adherence Questionnaire (19) and the self-report measure of compliance developed by Cerkoney and Hart (20) and used in several subsequent studies (13,21,22), combined responses across the different regimen areas to produce a total adherence or compliance score. In contrast, the self-report measure developed by Orme and Binik (18), adapted from the Rand Corporation diabetic adherence questionnaire (23), assessed the frequency with which behaviors were performed for 5 separate self-care areas. Similarly, Johnson et al. (24) developed a 24-h recall interview to address 13 aspects of the diabetes regimen that form 4 independent factors: exercise, injection, diet type, and eating/testing frequency (25).

The original SDSCA measure (7) assessed 5 aspects of the diabetes regimen:

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Abbreviations: SDSCA, Summary of Diabetes Self-Care Activities.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

general diet, specific diet, exercise, medication taking, and blood-glucose testing. More recent studies using the scale have also included items on foot care and smoking. Similar to the Rand Corporation questionnaire, respondents report on the frequency with which they performed various activities over the previous 7 days. The SDSCA assesses levels of self-care and not adherence or compliance to a prescribed regimen because of the difficulties associated with identifying, for a given patient, a specific unchanging standard against which behavior should be compared (10,26,27).

This article reports on the use of the SDSCA in 7 recent studies in which SDSCA data have not previously been reported, involving 1,988 people with diabetes (28–34). Given earlier studies using this measure (35–37), including a survey of >2,000 people with diabetes across the U.S. (38), the SDSCA is probably the most widely used self-report instrument for measuring diabetes self-management in adults. Moreover, the measure has been successfully adapted for adolescents with type 1 diabetes (39–41). The measure has undergone various modifications, so it is timely to review these developments and provide an updated version based on the accumulated findings and experience of past studies.

RESEARCH DESIGN AND METHODS

Overview of studies

Of the 7 studies, 5 were interventions and 2 (30,31) were observational. Of the 5 intervention studies, only 1 was a group-based study and targeted both diet and exercise (33). The remaining interventions, all targeting various aspects of dietary change, were delivered one-on-one by either research staff (32), dietitians and research staff (28,29), or clinical staff (34).

The intervention studies were conducted in a variety of settings. Two (31,33) were conducted at Oregon Research Institute; 1 (32) was conducted in the offices of 2 internists who were part of a large medical group; 1 study (29) included 39 physicians from 12 medical practices and was conducted in a hospital wellness center setting; 1 study was conducted in an HMO primary care setting (34); and 2 studies (28,30) were conducted via the Internet. Three (28,30,31) of the studies were convenience samples, whereas 4 (29,32–34) were more representative, drawing respondents from lists of primary care patients.

The SDSCA has been administered as a self-completion questionnaire in paper-and-pencil form (31,33,34), via a touch-screen computer (29,32), and over the Internet (28,30).

Statistical analysis

Statistical software package SPSS for Windows version 9.0 (SPSS, Chicago) was used for all analyses. The characteristics and normative data for each study sample are expressed as means \pm SD and percentages. The SDSCA scales are based on items that, in some studies, were worded, responded to, and scored slightly differently from each other. Some of the variations in items were based on the time frame of the study, such as looking at the previous month instead of the previous 7 days. Most of the wording differences between studies were trivial. In studies conducted during the early 1990s, we worded the first diet item as follows: "Over the last 7 days, how often did you follow your recommended diet?" In more recent studies, we have changed from recommended "diet" to recommended "eating plan." To provide more standardization across the 7 studies, all response formats were converted to percentages. For example, a 5-point scale with the anchors 1 = never through 5 = always was converted to percentages as follows: 1 = 0, 2 = 25, 3 = 50, 4 = 75, and 5 = 100%. Pearson's correlation coefficients were computed to evaluate the magnitude of association between baseline and post-test (test-retest) and between SDSCA scales and criterion variables (validity coefficients). Inter-item correlations were also used to assess relationships among items within a scale (inter-item correlations). Inter-item correlations were chosen rather than coefficient α because coefficient α is influenced by both the number of items as well as the relationship among items. We wanted to use an index that was independent of number of items because the various SDSCA scales had different numbers of items and some scales had a small number of items.

Sensitivity to change was assessed 2 ways. First, we calculated a responsiveness index as described by Kristal et al. (42). Responsiveness scores are similar to effect size measures (43) in that they compare change in an intervention condition with change in a control condition, and larger scores are better. For the randomized intervention studies, the mean change in the control group was subtracted from the mean change in the intervention group and

divided by the square root of the sum of the variances of change scores in the control and intervention groups. Second, 2-tailed Student's *t* tests were used to evaluate change from baseline to post-test assessment among participants in the treatment condition of each intervention study that targeted change on a given behavior.

RESULTS — All of the participants were adults, and the large majority had type 2 diabetes for a number of years. The mean ages of the 7 samples ranged from 45 to 67 years of age and average diabetes duration ranged from 6.3 to 13.0 years (Table 1). In 6 of the 7 studies, there were slightly more women than men. The proportion of participants taking insulin ranged widely from 15.5 to 67%. The means and SDs for each subscale for each study provide information for comparative purposes (higher percentages indicate better self-care on all scales). These means show considerable consistency across studies with patients typically reporting higher levels of dietary than exercise self-care, and the highest levels of self-care reported for medication taking and blood-glucose testing. Mean levels computed across all 7 studies (weighted for sample size) for each scale were as follows: general diet: mean = 58.6, SD = 28.7, *n* = 1,409; specific diet: mean = 67.5, SD = 16.9, *n* = 973; exercise: mean = 34.3, SD = 31.9, *n* = 883; blood-glucose testing: mean = 69.0, SD = 34.9, *n* = 685; medication taking: mean = 95.0, SD = 15.4, *n* = 218; and foot care: mean = 47.1, SD = 21.4, *n* = 407. The internal consistency of the scales, assessed by average inter-item correlations, was acceptable (mean = 0.47) except for specific diet, which was consistently unreliable (*r* = 0.07–0.23). Test-retest correlations over 3–4 months were examined for the observational studies and for control groups in the intervention studies. All but 3 were significant, although the magnitude of these correlations tended to be moderate (mean *r* = 0.40, *r* = –0.05 [for medications] to 0.78 [for glucose testing]). Correlations among the SDSCA scales measuring different regimen behaviors in each study (not shown in Table 1 but available from the authors) were generally low and consistent with previous research (mean *r* = 0.23).

The SDSCA subscales were correlated with participant characteristics within each study (age, insulin status, sex, number of comorbid conditions, and diabetes duration). Overall, there were very few significant correlations. Only one trend emerged across

Table 1—Sample characteristics, reliability estimates, normative data, and test-retest results

Study	n	Sample characteristics	Reliability estimates			Average values	Test-retest	
			Scale*	Items (n)	Inter-item correlations (r)		Interval	r
Glasgow et al., 1992 (33)	105	100% type 2 diabetes	General diet	2	0.66	64.9 ± 21.2	3 months	0.58†
		Mean age = 67, SD = 5 years	Specific diet	3	0.20	77.8 ± 11.9		0.42‡
		63% women	Exercise	3	0.72	55.2 ± 32.4		0.42‡
		27% on insulin	Blood-glucose	2	0.75	73.0 ± 35.1		0.30§
		Mean diabetes duration = 9.4, SD = 8.6 years	testing					
		Mean education level = partial college	Medications	1		96.3 ± 15.9%		
		Mean SES = 2.9 (scale 1–5 with 5 highest)	Foot care	N/C				
		Ethnicity not collected	% Smokers	N/C				
Glasgow et al., 1998 (32)	201	79.4% type 2 diabetes	General diet	2	0.57	67.0 ± 20.8	3 months	0.55†
		Mean age = 62, SD = 11 years	Specific diet	3	0.23	78.3 ± 16.5		0.47†
		60% women	Exercise	3	0.80	39.1 ± 33.0		0.55†
		67% on insulin	Blood-glucose	2	0.69	77.5 ± 30.7		0.64†
		Mean diabetes duration = 13, SD = 11.1 years	testing					
		Mean occupation level = semiskilled	Medications	1		99.8 ± 8.9		
		Mean education level = partial college	Foot care	N/C				
		96.8% Caucasian	% Smokers	N/C		10.1%		
Glasgow et al., 1999 (30)	260	63.0% type 2 diabetes	General diet	2	0.71	55.8 ± 32.4	N/C	
		Mean age = 45, SD = 12 years	Specific diet	3	0.17	63.4 ± 20.0		
		49% women	Exercise	1		32.7 ± 33.1		
		54% on insulin	Blood-glucose	1		64.5 ± 42.4		
		Mean duration = 9.5, SD = 10.7 years	testing					
		Income, education not collected	Medications	N/C				
		87.7% Caucasian	Foot care	5	0.24	31.6 ± 17.4		
			% Smokers	N/C		13.8%		
Glasgow and Toobert, 2000 (29)	321	100% type 2 diabetes	General diet	2	0.67	48.1 ± 30.8	3 months	0.67†
		Mean age = 59, SD = 9 years	Specific diet	3	0.11	62.9 ± 17.8		0.61†
		57% women	Exercise	2	0.47	24.7 ± 27.9		0.42†
		15.5% on insulin	Blood-glucose	N/C				
		Mean duration = 6.3, SD = 6.2	testing					
		Employment = 53.6% not working (retired)	Medications	N/C				
		Mean occupation = semiskilled	Foot care	N/C				
		Mean SES = 2.2 of 5 (5 is highest class)	% Smokers	N/C		15.0%		
Glasgow et al., 2000 (31)	65	100% type 2 diabetes	General diet	N/C			4 months	
		Mean age = 62, SD = 11 years	Specific diet	N/C				
		51% women	Exercise	N/C				
		Mean duration = 8.5, SD = 8.2 years	Blood-glucose	2	0.69	81.6 ± 29.7		0.78†
		Mean income = \$10,000–\$29,999	testing					
		91.3% Caucasian	Medications	N/C				
			Foot care	5	0.30	29.4 ± 17.9		0.46‡
			% Smokers	N/C		6.4%		
Wagner et al. 1999 (34)	876	% type 2 diabetes (Not collected)	Cigarettes/day	1		19.3 ± 11.6 cigarettes	N/C	
		Mean age = 66, SD = 14.9 years	General diet	1		64.8 ± 32.2		0.55†
		51.8% women	Specific diet	N/C				
		% on insulin (not asked)	Exercise	1		1.6 ± 0.8 h		0.44†
		Mean duration = 9.5, SD = 9.2 years	Blood-glucose	1		3.8 ± 2.7 days/week		0.71†
		Average income = \$15,000–\$24,999 (n = 100)	testing					
	Medications	N/C		6.6 ± 1.5 days/week	–0.05			
	Foot care	1		4.8 ± 2.4 days/week	0.47†			

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Table 1—Continued

Study	n	Sample characteristics	Reliability estimates			Average values	Test-retest	
			Scale*	Items (n)	Inter-item correlations (r)		Interval	r
Wagner et al., 1999 (continued)		96.7% Caucasian	% Smokers	N/C				
Feil et al., 2000 (28)	160	100% type 2 Mean age = 59.3, SD = 9.4 53.1% women % on insulin = 35.6 Mean duration = 10.3, SD = 7.8 years % finished college = 25.7 Mean income = \$30,000–\$50,000 100% Caucasian	Cigarettes/day	N/C				
			General diet	2	0.67	52.2 ± 34.7	3 months	0.25
			Specific diet	3	0.07	62.3 ± 18.3		0.45§
			Exercise	1		39.4 ± 32.9		
			Blood-glucose testing	2	0.70	59.6 ± 36.7		0.47‡
			Foot care	2	0.29	71.6 ± 28.8		0.59†
			Medications	2	0.23	94.3 ± 15.0		0.08
			% Smokers			12.7%		
			Cigarettes/day	N/C				

Average values are mean percentages ± SD unless otherwise specified. *For scale items, see the APPENDIX; wording varied slightly across studies. † $P < 0.001$; ‡ $P < 0.01$; § $P < 0.05$. N/C, Not collected; SES, socioeconomic status.

the studies: in 4 of the 7 studies, older people had better scores on general diet and this correlation was modest (range 0.18–0.20). Social desirability was assessed in only 1 of the 7 studies (33) and correlated moderately with general diet ($r = 0.35$), specific diet ($r = 0.29$), and glucose testing ($r = 0.30$), but less so with exercise ($r = 0.12$) and medication taking ($r = 0.16$).

Table 2 shows the correlations between the dietary and exercise subscales and criterion variables. For dietary comparisons, criterion measures were derived from 3- or 4-day food records, food-frequency questionnaires (42,44), the Food Habits Questionnaires (45), and the Block Fat Screener (46). For exercise, comparisons were with the Stanford 7-Day Recall (47), the Physical Activity Scale for the Elderly (48), exercise self-monitoring data (33), or attendance at an exercise class. These correlations were all significant and some of the dietary correlations were as high as those reported between much longer state-of-the-art measures. Table 2 also shows the sensitivity to change of the SDSCA subscales assessed using the responsiveness index (42), where available. Responsiveness to change results varied widely and ranged from small to large. Student's *t* tests evaluating pre-to-post change among intervention conditions revealed significant improvement on SDSCA scales in 6 of the 9 comparisons.

CONCLUSIONS — Together, these 7 studies demonstrate that the SDSCA is a multidimensional measure of diabetes self-management with, for the most part, adequate internal and test-retest reliability, and

evidence of validity and sensitivity to change. The small number of significant correlations between the SDSCA subscales and participant characteristics demonstrates that the SDSCA can be generalized to different diabetes subpopulations including insulin status, sex, number of comorbid conditions, and diabetes duration.

Test-retest reliability was moderate across these studies and may be an underestimate. Four of the 5 studies in which it was assessed were interventions and, for these control groups, the assessment process itself constitutes a modest self-monitoring intervention. Moreover, by having volunteered for a randomized control trial, these participants have demonstrated a commitment to making behavioral changes. Both of these factors could have produced some behavioral changes over the test-retest interval in these patients, resulting in lowered stability. Alternatively, it may be that self-care behaviors vary over time in response to changing personal and environmental factors.

The validity estimates for diet and exercise were based on multiple methods of self-report (e.g., food records and self-monitoring). Previous studies have reported significant correlations of SDSCA subscales with other criterion measures (7). Together, these correlations are evidence for the validity of this self-report scale, although more correlations with other criteria and for additional SDSCA subscales should be examined in future studies. Like many other self-report measures of self-care behavior (49), the SDSCA seems to be subject to some social desirability bias. Therefore, administration of a measure and adjust-

ment for response set bias is recommended.

The 7 studies reported here had several limitations. All were studies of adults with diabetes, although they included a large age range. However, the SDSCA has been used successfully with people as young as 12 years of age (40). Other than a study by Ruggiero et al. (38), data are lacking from samples including significant numbers of minority participants.

The specific diet scale was the least internally reliable of the subscales. This finding is consistent with earlier factor analytic work by Johnson et al. (25), which failed to identify a single multi-item factor for diet. It appears that, like the diabetes regimen itself, the various components of a healthy diet are not highly correlated, and to obtain an accurate assessment of eating patterns, it is necessary to measure these components separately. This can be done in brief with the individual items from the SDSCA depending on the dietary targets of the intervention or treatment program.

The inconsistent number of questionnaire items and constructs in each of the 7 studies constitutes a weakness of this analysis. However, in spite of shifting numbers of items and constructs throughout the 18 years of research with this instrument, the validity and reliability are remarkably stable.

Revised SDSCA Scale

On the basis of these data, a revised version of the SDSCA is provided in the APPENDIX, along with the scoring method. The revised SDSCA consists of a core set of 11 items that have all been used in previous studies along with the expanded list of 14 addi-

Table 2—Validity coefficient (r) and sensitivity to change for the diet and exercise scales of the SDSCA sensitivity to change

Study/scale	Criterion variables	r	Responsiveness index	Within-group change*
Glasgow et al., 1992 (33)	General diet		0.43	0.032†
		Average of Block Fat Screener and food record: caloric intake	-0.23†	
	Specific diet		0.03	0.308
		Average Block Fat Screener and food records: % calories from fat	-0.25†	
	Exercise		0.05	0.580
	Min per day (Stanford Recall)	0.20‡		
	Attendance	0.22‡		
	Exercise self-monitoring	0.58§		
Glasgow et al., 1998 (32)	General diet		0.33	0.004†
		Kristal FHQ total score	-0.53§	
	Specific diet		-0.05	0.087
		4-day food record percent calories from fat	-0.33§	
	Kristal FHQ total score	-0.52§		
Glasgow and Toobert, 2000 (29)	General diet		-0.09	0.000§
		Kristal FHQ total score	-0.54§	
		Block Fat Screener total score	-0.34§	
	Specific diet		0.04	0.005†
		Kristal FHQ total score	-0.44§	
	Block Fat Screener total score	0.29§		
Glasgow et al. (In press) (31)	General diet		NA	
		Block Fat Screener total score	-0.51§	
	Specific diet		NA	
	Block Fat Screener total score	-0.51§		
Feil et al., 2000 (28)	General diet			0.000§
		Block Fat Screener total score	-0.03	
		Kristal FHQ total score	-0.31§	
		Kristal FHQ total score	-0.27§	
	Specific diet		-0.01	0.000§
	Kristal FHQ total score	-0.28§		
	Block Fat Screener total score	-0.40§		

*P values for *t* tests evaluating pre- to postchange among intervention conditions; †*P* < 0.01; ‡*P* < 0.05; §*P* < 0.001. FHQ, Food Habits Questionnaire.

tional questions that may be of use to researchers or clinicians. The revised version of the SDSCA differs from the versions tested in each of the 7 studies in that the scoring is simplified, and the best items are retained. Criteria used for selecting items for the revised version were as follows: 1) consistency in mean values across studies, 2) sufficient variability and lack of ceiling or floor effects, 3) temporal stability, 4) internal consistency, 5) predictive validity, 6) sensitivity to change, 7) ease of scoring, and 8) ease of interpretation.

The revised version also includes items on foot care adapted from Litzelman et al. (49), an important aspect of the diabetes regimen that was not included in the original SDSCA. It also includes items on cigarette smoking. Although not usually viewed

as part of the diabetes regimen, given the greatly increased risk of cardiovascular diseases among diabetes patients (50), it is important to know a patient's smoking status so that appropriate advice can be given. (The scales on foot care and smoking would need to be modified or deleted for children with diabetes.)

Three other changes have been made in the revised version of the SDSCA and are as follows: 1) the recommended version does not include questions on medication taking because of strong ceiling effects and a lack of variability among respondents contributing to lowered test-retest reliability for these items (Table 1); 2) in spite of the moderate-to-high validity of the specific diet scale, we have suggested dropping the scale from the revised version

because it lacks internal consistency; and 3) one of the specific diet questions, "On how many of the last 7 days did your meals include sweets?" has been modified because it no longer adequately reflects current standards of medical nutrition therapy (51), which focuses on flexibility in meal planning and counting carbohydrates. To bring this diet item up to date, we have refocused this item on carbohydrates rather than sweets and added it to the list of expanded items.

To simplify the scoring and interpretation of the revised SDSCA Scale, we propose using the metric "days per week" instead of percentages. Therefore, comparisons of data based on the new questionnaire with previous research would need to be converted to percentages.

Self-care measure

The strengths of the 11 core items of the revised SDSCA include their brevity and ease of scoring, which make them practical to use both clinically and in research. Their use in past research provides valuable information on norms, reliability, and validity, against which new data can be evaluated. The revised questionnaire is preliminary, and it needs replication and use in other samples. We have deliberately placed the SDSCA in the public domain and encourage its use.

Additional self-care items are also provided that address questions of clinical interest, but for which little or no reliability and validity data are available. Six additional items address self-care recommendations. These may be useful for clarifying patient understanding of self-management goals, as well as for evaluating congruence between perceived recommendations and reported levels of self-care (adherence). The expanded version of the SDSCA may be used when a particular question is of interest to study investigators or when time permits.

APPENDIX

The Summary of Diabetes Self-Care Activities

The questions below ask you about your diabetes self-care activities during the past 7 days. If you were sick during the past 7 days, please think back to the last 7 days that you were not sick.

Diet

How many of the last SEVEN DAYS have you followed a healthful eating plan?

0 1 2 3 4 5 6 7

On average, over the past month, how many DAYS PER WEEK have you followed your eating plan?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products?

0 1 2 3 4 5 6 7

Exercise

On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking).

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work?

0 1 2 3 4 5 6 7

Blood Sugar Testing

On how many of the last SEVEN DAYS did you test your blood sugar?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you test your blood sugar the number of times recommended by your health care provider?

0 1 2 3 4 5 6 7

Foot Care

On how many of the last SEVEN DAYS did you check your feet?

0 1 2 3 4 5 6 7

On how many of the last SEVEN DAYS did you inspect the inside of your shoes?

0 1 2 3 4 5 6 7

Smoking

Have you smoked a cigarette—even one puff—during the past SEVEN DAYS?

0. No
1. Yes. If yes, how many cigarettes did you smoke on an average day?
Number of cigarettes: _____

Additional Items for the Expanded Version of the Summary of Diabetes Self-Care Activities.

Self-Care Recommendations

1A. Which of the following has your health care team (doctor, nurse, dietitian, or diabetes educator) advised you to do? Please check all that apply:

- a. Follow a low-fat eating plan
 b. Follow a complex carbohydrate diet
 c. Reduce the number of calories you

- eat to lose weight
 d. Eat lots of food high in dietary fiber
 e. Eat lots (at least 5 servings per day) of fruits and vegetables
 f. Eat very few sweets (for example: desserts, non-diet sodas, candy bars)
 g. Other (specify):
 h. I have not been given any advice about my diet by my health care team.

2A. Which of the following has your health care team (doctor, nurse, dietitian or diabetes educator) advised you to do? Please check all that apply:

- a. Get low level exercise (such as walking) on a daily basis.
 b. Exercise continuously for a least 20 minutes at least 3 times a week.
 c. Fit exercise into your daily routine (for example, take stairs instead of elevators, park a block away and walk, etc.)
 d. Engage in a specific amount, type, duration and level of exercise.
 e. Other (specify):
 f. I have not been given any advice about exercise by my health care team.

3A. Which of the following has your health care team (doctor, nurse, dietitian, or diabetes educator) advised you to do? Please check all that apply:

- a. Test your blood sugar using a drop of blood from your finger and a color chart.
 b. Test your blood sugar using a machine to read the results.
 c. Test your urine for sugar.
 d. Other (specify):
 e. I have not been given any advice either about testing my blood or urine sugar level by my health care team.

4A. Which of the following medications for your diabetes has your doctor prescribed? Please check all that apply.

- a. An insulin shot 1 or 2 times a day.
 b. An insulin shot 3 or more times a day.
 c. Diabetes pills to control my blood sugar level.
 d. Other (specify):
 e. I have not been prescribed either insulin or pills for my diabetes.

Diet

5A. On how many of the last SEVEN DAYS did you space carbohydrates evenly through the day?

0 1 2 3 4 5 6 7

Medications

6A. On how many of the last SEVEN DAYS, did you take your recommended diabetes medication?

0 1 2 3 4 5 6 7

OR

7A. On how many of the last SEVEN DAYS did you take your recommended insulin injections?

0 1 2 3 4 5 6 7

8A. On how many of the last SEVEN DAYS did you take your recommended number of diabetes pills?

0 1 2 3 4 5 6 7

Foot Care

9A. On how many of the last SEVEN DAYS did you wash your feet?

0 1 2 3 4 5 6 7

10A. On how many of the last SEVEN DAYS did you soak your feet?

0 1 2 3 4 5 6 7

11A. On how many of the last SEVEN DAYS did you dry between your toes after washing?

0 1 2 3 4 5 6 7

Smoking

12A. At your last doctor's visit, did anyone ask about your smoking status?

0. No

1. Yes

13A. If you smoke, at your last doctor's visit, did anyone counsel you about stopping smoking or offer to refer you to a stop-smoking program?

0. No

1. Yes

2. Do not smoke.

14A. When did you last smoke a cigarette?

More than two years ago, or never smoked

One to two years ago

Four to twelve months ago

One to three months ago

Within the last month

Today

Scoring Instructions for the Summary of Diabetes Self-Care Activities

Scores are calculated for each of the five

regimen areas assessed by the SDSCA: Diet, Exercise, Blood-Glucose Testing, Foot-Care, and Smoking Status.

Step 1:

For items 1–10, use the number of days per week on a scale of 0–7. Note that this response scale will not allow for direct comparison with the percentages provided in Table 1.

Step 2: Scoring Scales

General Diet = Mean number of days for items 1 and 2.

Specific Diet = Mean number of days for items 3, and 4, reversing item 4 (0=7, 1=6, 2=5, 3=4, 4=3, 5=2, 6=1, 7=0).

Given the *low inter-item correlations for this scale*, using the individual items is recommended.

Exercise = Mean number of days for items 5 and 6.

Blood-Glucose Testing = Mean number of days for items 7 and 8.

Foot-Care = Mean number of days for items 9 and 10.

Smoking Status = Item 11 (0 = non-smoker, 1 = smoker), and number of cigarettes smoked per day.

Scoring for Additional Items

Recommended regimen = Items 1A - 4A, and items 12A - 14A, no scoring required.

Diet = Use total number of days for item 5A.

Medications = Use item 6A - OR - 7A AND 8A, use total number of days for item 6A, use mean number of days if both 7A and 8A are applicable.

Foot-Care = Mean number of days for items 9A - 11A, after reversing 10A and including items 9 and 10 from the brief version.

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References

1. Etzwiler DD: Diabetes translation: a blueprint for the future. *Diabetes Care* 17 (Suppl. 1):1–4, 1994
2. Funnell MM, Anderson RM, Arnold MS, Barr PA, Donnelly M, Johnson PD, Taylor-Moon D, White NA: Empowerment: an

idea whose time has come. *Diabetes Educ* 17:37–41, 1991

3. Bradley C (Ed.): *Handbook of Psychology and Diabetes*. Chur, Switzerland, Harwood Academic, 1994, p. 351–375
4. Goodall TA, Halford WK: Self-management of diabetes mellitus: a critical review. *Health Psychol* 10:1–8, 1991
5. Johnson SB: Health behavior and health status: concepts, methods and applications. *J Pediatr Psychol* 19:129–141, 1994
6. McNabb WL: Adherence in diabetes: can we define it and can we measure it? *Diabetes Care* 20:215–218, 1997
7. Toobert DJ, Glasgow RE: Assessing diabetes self-management: the summary of diabetes self-care activities questionnaire. In *Handbook of Psychology and Diabetes*. Bradley C, Ed. Chur, Switzerland, Harwood Academic, 1994, p. 351–375
8. Glasgow RE: Outcomes of and for diabetes education research. *Diabetes Educ* 25 (Suppl. 6):74–88, 1999
9. Glasgow RE, Osteen VL: Evaluating diabetes education: are we measuring the most important outcomes? *Diabetes Care* 15: 1423–1432, 1992
10. Johnson SB: Methodological issues in diabetes research. *Diabetes Care* 15:1658–1667, 1992
11. Abraham CS, Hampson SE: A social cognition approach to health psychology: philosophical and methodological issues. *Psychol Health* 11:223–241, 1996
12. Freund A, Johnson SB, Silverstein J, Thomas J: Assessing daily management of childhood diabetes using 24-h recall interviews: reliability and stability. *Health Psychol* 10:200–208, 1991
13. Hanson C, Henggeler S, Harris M, Mitchell K, Carle D, Burghen G: Associations between family members' perceptions of the health care system and the health of youths with insulin-dependent diabetes mellitus. *J Pediatr Psychol* 13:543–554, 1988
14. Herbert JR, Yunsheng M, Clemow L, Ockene IS, Saperia G, Stanek III EJ, Merriam PA, Ockene JS: Gender differences in social desirability and social approval bias in dietary self-report. *Am J Epidemiol* 146: 1046–1055, 1997
15. Kristal A, Andrilla CH, Koepsell TD, Diehr PH, Cheadle A: Dietary assessment instruments are susceptible to intervention-associated response set bias. *J Am Diet Assoc* 98: 40–43, 1998
16. Glasgow RE, Eakin EG: Issues in diabetes self-management. In *The Handbook of Behaviour Change*. 2nd ed. Shumaker SA, Chron EB, Ockene JK, McBee WL, Eds. New York, Springer, 1998, p. 435–461
17. Rubin RR, Peyrot M: Psychosocial problems and interventions in diabetes. *Diabetes Care* 15:1640–1657, 1992
18. Orme CM, Binik YM: Consistency of adherence across regimen demands. *Health*

- Psychol* 8:27–43, 1989
19. Brownlee-Duffeck M, Peterson L, Simonds JF, Goldstein D, Kilo C, Hoette S: The role of health beliefs in the regimen adherence and metabolic control of adolescents and adults with diabetes mellitus. *J Consult Clinical Psychol* 55:139–144, 1987
 20. Cerkoney KA, Hart LK: The relationship between the health belief model and compliance of persons with diabetes mellitus. *Diabetes Care* 3:594–598, 1980
 21. Hanson C, Henggeler S, Burghen G: Model of associations between psychosocial variables and health-outcome measures in adolescents with IDDM. *Diabetes Care* 10:752–758, 1987
 22. Schlenk EA, Hart LK: Relationship between health locus of control, health value, and social support and compliance of persons with diabetes mellitus. *Diabetes Care* 7: 566–574, 1984
 23. Marquis K, Ware J: *Measures of Diabetic Patient Knowledge, Attitudes and Behavior Regarding Self-Care*. Santa Monica, CA, Rand Corporation, 1979
 24. Johnson SB, Silverstein J, Rosenbloom A, Carter R, Cunningham W: Assessing daily management of childhood diabetes. *Health Psychol* 5:545–564, 1986
 25. Johnson SB, Tomer A, Cunningham WR: Adherence in childhood diabetes: results of a confirmatory factor analysis. *Health Psychol* 9:493–501, 1990
 26. Glasgow RE, Anderson RM: In diabetes care, moving from compliance to adherence is not enough: something entirely different is needed. *Diabetes Care* 22:2090–2092, 1999
 27. Glasgow RE, Wilson W, McCaul KD: Regimen adherence: a problematic construct in diabetes research. *Diabetes Care* 8:300–301, 1984
 28. Feil EG, Glasgow RE, Boles S, McKay HG: Who participates in Internet-based self-management support programs? A study among novice computer users in a primary care setting. *Diabetes Educator*. In press
 29. Glasgow RE, Toobert DJ: Brief, computer-assisted diabetes dietary self-management counseling: effects on behavior, physiologic outcomes, and quality of life. *Medical Care*. In press
 30. Glasgow RE, Barrera M Jr, McKay HG, Boles SM: Social support, self-management, and quality of life among participants in an Internet-based diabetes support program: a multidimensional investigation. *CyberPsychology Behavior* 2:271–281, 1999
 31. Glasgow RE, Strycker LA, Toobert DJ, Eakin E: The Chronic Illness Resources Survey: a social-ecologic approach to assessing support for disease self-management. *J Behav Med*. In press
 32. Glasgow RE, La Chance P, Toobert DJ, Brown J, Hampson SE, Riddle MC: Long term effects and costs of brief behavioral dietary intervention delivered in the medical office. *Patient Educ Counsel* 32:175–184, 1998
 33. Glasgow RE, Toobert DJ, Hampson SE, Brown JE, Lewinsohn PM, Donnelly J: Improving self-care among older patients with type II diabetes: the “Sixty Something...” study. *Patient Educ Counsel* 19:61–74, 1992
 34. Wagner EH, Grothaus LC, Sandhu M, Galvin MS, McGregor M, Coleman EA: Diabetes clinics in primary care: a system-wide randomized trial. *Diabetes Care*. In press
 35. Nouwen A, Gingras J, Talbot F, Bouchard S: The development of an empirical psychosocial taxonomy for patients with diabetes. *Health Psychol* 16:263–271, 1997
 36. Talbot F, Nouwen A, Gingras J, Gosselin M, Audet J: The assessment of diabetes-related cognitive and social factors: the Multidimensional Diabetes Questionnaire. *J Behav Med* 20:291–312, 1997
 37. Toobert DJ, Glasgow RE, Nettekoven LA, Brown JE: Behavioral and psychosocial effects of intensive lifestyle management for women with coronary heart disease. *Patient Educ Counsel* 35:177–188, 1998
 38. Ruggiero L, Glasgow RE, Dryfoos JM, Rossi JS, Prochaska JO, Orleans CT, Prokhorov AV, Rossi SR, Greene GW, Reed GR, Kelly K, Chobanian L, Johnson S: Diabetes self-management: self-reported recommendations and patterns in a large population. *Diabetes Care* 20:568–576, 1997
 39. Schafer LC, Glasgow RE, McCaul KD, Dreher M: Adherence to IDDM regimens: relationship to psychosocial variables and metabolic control. *Diabetes Care* 6:493–498, 1983
 40. Skinner TC, Hampson SE: Social support and personal models of diabetes in relation to self-care and well-being in adolescents with type I diabetes mellitus. *J Adolescence* 21:703–715, 1998
 41. Skinner TC, Hampson SE: Social support and personal models of diabetes as predictors of self-care and well-being: a longitudinal study of adolescents with diabetes. *J Pediatr Psychol*. In press
 42. Kristal A, Beresford SAA, Lazovich D: Assessing change in diet-intervention research. *Am J Clin Nutr* 59 (Suppl. 1): 185S–189S, 1994
 43. Smith ML, Glass GV: Meta-analysis of psychotherapy outcome studies. *Am Psychol* 32:752–760, 1977
 44. Block G: Health Habits and History Questionnaire: diet history and other risk factors. Washington, DC, National Cancer Institute, National Institutes of Health, 1988
 45. Kristal AR, Shattuck AL, Henry HJ: Patterns of dietary behavior associated with selecting diets low in fat: reliability and validity of a behavioral approach to dietary assessment. *J Am Diet Assoc* 90:214–220, 1990
 46. Block G, Clifford C, Naughton MD, Henderson M, McAdams M: A brief dietary screen for high fat intake. *J Nutr Ed* 21:199–207, 1989
 47. Blair SN, Haskell WL, Ho P, Paffenbarger RS, Vranizan KM, Farquhar JW, Wood PD: Assessment of habitual physical activity by a seven-day recall in community survey and controlled experiments. *Am J Epidemiol* 122:794–804, 1985
 48. Washburn RA, Smith KW, Jette AM, Janney CA: The Physical Activity Scale for the Elderly (PASE): development and evaluation. *J Clin Epidemiol* 46:153–162, 1993
 49. Litzelman DK, Slemenda CW, Langefeld CD, Hays LM, Welch MA, Bild DE, Ford ES, Vinicor F: Reduction of lower extremity clinical abnormalities in patients with non-insulin-dependent diabetes mellitus. *Ann Intern Med* 119:36–41, 1993
 50. Haire-Joshu D, Glasgow RE, Tibbs TJ: Smoking and diabetes. *Diabetes Care* 22: 1887–1898, 1999
 51. American Diabetes Association: Nutrition recommendations and principles for people with diabetes mellitus (Position Statement). *Diabetes Care* 21 (Suppl. 1):S32–S35, 1998