



Published in final edited form as:  
*Heart Dis.* 2002 ; 4(4): 206–211.

## The Seattle Angina Questionnaire: Reliability and Validity in Women With Chronic Stable Angina

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### Abstract

Angina pectoris causes substantial psychological and functional disability and adversely affects health-related quality of life, particularly in women. Studies of cardiac disease-specific quality of life in women with coronary artery disease and angina are limited because little reliability and validity data for these instruments exist for women. Therefore, the purpose of this study was to examine reliability and validity of the Seattle Angina Questionnaire (SAQ), a cardiac disease-related quality-of-life measure, in a sample of women with chronic stable angina. A secondary analysis was performed on SAQ data from 175 women with a confirmed diagnosis of CAD and angina pectoris. The majority of the women were older, white, living with their spouse, had a previous acute myocardial infarction, and had undergone revascularization. The Cronbach  $\alpha$  was used to assess reliability of the SAQ's five subscales, and factor analysis was used to assess the SAQ's validity. Results suggest that the SAQ is a reliable and valid quality-of-life measure in women with CAD. The physical limitations subscale factored into two separate factors, suggesting that the subscale measures two domains of physical function: self-care and exercise tolerance/mobility. Future research is needed to determine whether examining different combinations of SAQ items might provide a more sensitive assessment of cardiac disease-specific quality of life in women.

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Chronic stable angina, the chest pain or discomfort associated with myocardial ischemia, is a major health problem in the United States. An estimated 6,000,000 Americans have angina, 4,000,000 of whom are women.<sup>1</sup> Anginal symptoms cause substantial psychological<sup>2</sup> and functional disability<sup>3–5</sup> and adversely affect health-related quality of life,<sup>6,7</sup> particularly in women.<sup>3</sup> Studies of cardiac disease-specific quality of life in women with coronary artery disease (CAD) are limited because research instruments used in studies often were developed and tested in predominantly male samples, and little reliability and validity data for these instruments exist for women.

The Seattle Angina Questionnaire (SAQ), developed by Spertus and first reported in the literature in 1994,<sup>8,9,10,11</sup> increasingly is being used to measure cardiac disease-specific quality of life in patients with CAD and angina.<sup>12,13,14</sup> The SAQ was initially developed and evaluated in predominantly elderly male samples from a Veterans Administration hospital,<sup>10</sup> and no reliability and validity data solely for women have been reported for the SAQ. Therefore, the purpose of this study was to examine reliability and validity of the SAQ in a sample of women with chronic stable angina.

## MATERIALS AND METHODS

### Sample

A secondary data analysis was performed after pooling women's data from three descriptive studies of patients with chronic stable angina. Subjects had participated in only one of the three studies. Procedures and major findings for these studies are described elsewhere.<sup>15,16</sup> The 175 women subjects were cardiac outpatients who had been treated in clinical facilities affiliated with a large academic health center in the southeastern United States. All women had 1) a confirmed history of CAD and angina pectoris documented in the medical record or the academic health center's interventional and cardiac surgery services data bank, and 2) reported one or more episodes of angina in the previous 6 months. Subjects were excluded from participating in the primary studies if they had experienced coronary artery bypass grafting, percutaneous transluminal coronary angioplasty (PTCA), or acute myocardial infarction within the previous 6 months. All studies from which the data for this secondary analysis were drawn were approved by the Human Investigations Committee.

### Instruments

The SAQ is a self-report instrument with 19 items that, when scored according to the author's recommendations, yields five subscale scores: physical limitation, angina stability, angina frequency, treatment satisfaction, and disease perception.<sup>11</sup> Table 1 provides subscale definitions and shows which items contribute to each of the subscales. The possible range of scores for each of the five subscales is 0 to 100, with higher scores indicating better quality of life. A change of 10 points in any of the subscales is considered to be clinically important.<sup>11</sup> The SAQ was completed by a trained research assistant in a telephone interview format for 40 of the subjects, and the remainder of the participants self-administered the questionnaire in a cardiology clinic. Along with the SAQ, information about demographic and clinical variables was obtained.

### Analysis of Seattle Angina Questionnaire Scores

Data were analyzed using statistical program software (SPSS version 10.0). The SAQ is scored so that when subjects mark responses "limited or did not do for other reasons" on questions 1a to 1h or "my doctor has not prescribed pills" for question 5, the answer is coded as "6" and then set to "missing" when the subscales are calculated. This creates cells with missing data in the inter-item correlation matrix. To address this problem, the SAQ scoring rules recommend mean substitution of the subject's mean to impute the missing values. For example, for the physical limitation subscale, the subject's mean value of the non-missing items in the same exertional level (low, medium, high) is imputed for the

missing value. If more than four items are missing from the physical limitations subscale, the scoring rules recommend that a score not be calculated for the subscale.

The SAQ scoring rules also recommend subject's mean substitution for the treatment satisfaction subscale if up to two of the four items are missing, and for the disease perception subscale if only one of the three items is missing. Mean substitution is not possible for the angina stability subscale as it has only one item, and the SAQ scoring rules do not recommend mean substitution for the angina frequency scale as it has only two items. When pooling the data, the original sample size was 184. However, we included only the 175 women subjects who had data for all items after the sample data were imputed according to the SAQ's scoring rules.

Frequencies were obtained for all categorical variables and measures of central tendencies were calculated for all continuous variables. Confirmatory factor analysis was performed using principal component analysis to extract factors with eigenvalues greater than one. The extracted factors were then rotated in an oblique method, called "direct oblimin" in SPSS, which yields a correlated factor solution. The factor pattern matrix was used to interpret the factors.

## RESULTS

Table 2 summarizes the demographic and clinical characteristics of the women, and Table 3 provides the sample means and SD for individual SAQ items and subscales. The sample ranged in age from 35 to 92 years and had a mean age of 64.2 years (SD 12.0). CAD had been diagnosed for a mean of 8.3 years (SD 7.6). The majority of women were older, white, living with their spouse, had a previous myocardial infarction and/or had undergone revascularization, and had a history of hyperlipidemia, hypertension, and a family member with CAD. The mean SAQ subscale scores indicated women had the highest quality of life in the area of treatment satisfaction and the lowest in physical limitation.

### Reliability of the Seattle Angina Questionnaire

Internal consistency reliability coefficients were calculated for the four SAQ subscales that have more than one item. Because mean substitution of the subject's mean can artificially increase internal consistency reliability coefficients, Cronbach coefficient  $\alpha$  values were calculated both before and following the imputation procedures described above. The results for unimputed and imputed data were almost identical, so only the results for the imputed data are reported. Internal consistency reliability coefficients were as follows for this sample: physical limitation (0.91), angina frequency (0.69), treatment satisfaction (0.72), and disease perception (0.67). Item-to-total statistics, including "alpha if item deleted," suggested that removing items would not improve internal consistency for the subscales, with one exception: removing the question "How bothersome is it for you to take your pills for chest pain, chest tightness of angina as prescribed?" from the treatment satisfaction subscale would have increased the coefficient  $\alpha$  from 0.72 to 0.84.

### Validity of the Seattle Angina Questionnaire

Five factors demonstrated eigenvalues greater than 1 and they accounted for 70.2% of the total instrument variance. Table 3 shows the factor loadings for the 19 SAQ items. A factor loading of 0.50 was used as the criterion for including items with a specific factor.<sup>17</sup> The only exception was question 4 (“Over the past 4 weeks, on average, how many times have you had to take nitros [nitroglycerine tablets] for your chest pain, chest tightness, or angina?”), which did not load on any factor at a level of 0.50. Question 4 had its largest factor loading of -0.41 on factor III, and therefore was included on that factor. Only one item, question 11 (“How often do you worry that you may have a heart attack or die suddenly?”) loaded at 0.50 on more than one factor; it was retained on factor III because it loaded highest on that factor.

In examining the factor analysis summary, factor I accounted for 32% of the total variance. Factor I comprised items 1d, 1e, 1f, 1g, 1h, and 1i, which are six of the nine items in the SAQ physical limitations subscale. All the items represented physical activities with middle and high levels of exertional requirements. Factor II accounted for 15.4% of the total variance and included questions 6, 7, and 8, which are three of the four items in the treatment satisfaction subscale.

Factor III accounted for 10% of the total variance and included questions 2, 3, 4, 9, 10, and 11. This factor might be described as angina pattern and disease perception because it incorporated all items on the angina stability, frequency, and disease perception subscales.

Factor IV accounted for 7.4% of the total variance and included items 1a, 1b, and 1c, the first three items of the physical limitation subscale, which represented physical activities with the lowest level of exertional requirements. Factor V accounted for 5.4% of the total variance and included only one item, question 5 (“How bothersome is it for you to take your pills for chest pain, chest tightness, or angina as prescribed?”). According to the scoring instructions, this item should belong with the treatment satisfaction subscale. However, it did not load with other items on the subscale, suggesting that question 5 does not share common variance with the other treatment-satisfaction items.

## DISCUSSION

Overall, the results indicate that the SAQ is a reliable and valid instrument in women. The physical limitation sub-scale demonstrated a good internal consistency of 0.91. The angina frequency subscale had an internal consistency of 0.69. Because coefficient  $\alpha$  is a result of both inter-item correlations and test length,<sup>17</sup> the lower internal consistency for the angina frequency subscale may be a result of the subscale length of only two items. Internal consistency reliability is higher in scales with larger numbers of items.<sup>17</sup> Using the Spearman-Brown prophecy formula discussed by Nunnally and Bernstein<sup>17</sup> and assuming the average inter-item correlation would be the same on a longer test, it can be extrapolated that if the angina frequency subscale had contained six items rather than two items, the coefficient  $\alpha$  would have been 0.87.

The treatment satisfaction scale demonstrated an internal consistency of 0.72, but interestingly, question 5 (about how bothersome it is to take pills as prescribed) is not internally consistent with the other items. Removing question 5 from the subscale would raise the internal consistency to a very satisfactory 0.84. One potential explanation for why this item lowered the internal consistency of the treatment satisfaction scale may be that the responses to the item had low variance. A total of 120 women (68.6%) gave the same answer for question 5, responding that it was “not bothersome at all” to take prescribed oral medication for angina.

The disease perception subscale had fair internal consistency. One characteristic of the subscale items that may have reduced the internal consistency is that they all have different response sets for subjects' answers. For example, the response representing the lowest quality of life or a score of “1” is “it has severely limited my enjoyment of life” for question 9, “not satisfied at all” for question 10, and “I can't stop worrying about it” for question 11. Internal consistency reliability of this subscale would also be improved if the number of items in the subscale was increased. The fact that item 11 double loaded on factors III and IV raises a question as to its appropriate subscale placement. This item deserves further observation in subsequent reliability and validity studies.

As for validity of the SAQ, no previously reported factor analyses of the SAQ were found with which we could compare our results. However, the observed factor structure in this sample was generally consistent with the SAQ's theoretically proposed subscales. Items tended to cluster with other items in the same subscale. However, there were some important differences in the factor structure for the women's data as compared to the proposed structure of the SAQ. First, the physical limitations subscale factored into two parts: the middle and high exertional requirements items shared common variance on factor I and the low exertional requirements shared common variance on factor III. The low-level activities in factor III include self-care activities such as dressing and showering. Difficulty performing these basic tasks of daily life may reflect a different domain of physical limitation than the physical activities on factor I. For example, the Women's Health and Aging Study categorized self-reported physical disability into four domains: 1) mobility and exercise tolerance, 2) upper extremity function, 3) higher-functioning tasks such as using the telephone and shopping for personal items, and 3) basic self-care tasks such as showering and dressing.<sup>18</sup> Older women requiring assistance with self-care tasks demonstrated much poorer performance in objective measures of cardiopulmonary fitness than women who did not require assistance with self-care.<sup>19</sup> The items on factor I appear to reflect the mobility and exercise tolerance domain, while the items on factor III reflect the basic self-care domain.

Angina frequency, stability, and disease perception items loaded on the same factor, suggesting that women's anginal patterns were closely related to their perceptions of heart disease. This close relationship between symptom frequency and disease perception may reflect the population from which the sample was drawn. The women in this study were recruited from a large academic cardiac referral center and a majority had previously undergone PTCA. Angina symptom recurrence is key in monitoring the need for further

coronary intervention in PTCA patients<sup>20</sup>; thus, in this sample the relationship between symptoms and disease perception may have been more salient.

The greatest weakness of the SAQ from a psychometric perspective was question 5: “How bothersome is it for you to take your pills for chest pain, chest tightness or angina as prescribed?” The item substantially lowered the internal consistency of the treatment satisfaction subscale, probably because of its low variance in women. Moreover, in the factor analysis, question 5 did not load with the other treatment satisfaction items, nor with any other items on the entire SAQ instrument, suggesting that the item does not really measure treatment satisfaction. Perceptions of how bothersome it is to take a drug may be more accurately described as patient self-management<sup>21</sup> or perceptions of how the *patient* is managing his or her heart disease as compared to treatment satisfaction, which focuses on perceptions of how *health professionals* are managing the patient’s heart disease.

## CONCLUSION

The SAQ remains an important instrument to assess cardiac disease-specific quality of life in patients with CAD and angina pectoris. The results of this study support the reliability and validity of the SAQ in women with chronic stable angina. However, further investigation of the psychometric properties of the SAQ in women is warranted, including whether the instrument would be stronger psychometrically if question 5 was removed from the questionnaire. In addition, examining different clusters of SAQ items to form subscales suggested by the factor analysis, such as “difficulty performing basic self-care activities” or “angina pattern and disease perception,” might provide more sensitive assessments of cardiac disease-specific quality of life in women.

## Acknowledgments

Supported by grants from the National Institute for Nursing Research, National Institutes of Health (R29NR04425) and the American Heart Association, Southeastern Affiliate.

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TABLE 1

## Seattle Angina Questionnaire subscale definitions and items

Subscale	Subscale Items
<i>Physical limitation</i> : measures how common daily activities representing low, medium, and high exertional requirements are limited by angina	<p>The following is a list of activities that people often do during the week. . . . Indicate how much limitation you have had due to chest pain, chest tightness or angina over the past 4 weeks.</p> <p>Question 1A—Dressing yourself</p> <p>Question 1B—Walking indoors on level ground</p> <p>Question 1C—Showering</p> <p>Question 1D—Climbing a hill or flight of stairs without stopping</p> <p>Question 1E—Gardening, vacuuming, or carrying groceries</p> <p>Question 1F—Walking more than a block at a brisk pace</p> <p>Question 1G—Running or jogging</p> <p>Question 1H—Lifting or moving heavy objects (e.g. furniture, children)</p> <p>Question 1J—Participating in strenuous sports (e.g. swimming, tennis)</p>
<i>Angina stability</i> : measures whether angina has changed in frequency when patient performs his or her most strenuous level of activity	Question 2—Compared with 4 weeks ago, how often do you have chest pain, chest tightness or angina when doing your most strenuous level of activity?
<i>Angina frequency</i> : measures frequency of angina over the previous 4 weeks	<p>Question 3—Over the past 4 weeks on average, how many times have you had chest pain, chest tightness or angina?</p> <p>Question 4—Over the past 4 weeks on average, how many times have you had to take nitros (nitroglycerine tablets) for your chest pain, chest tightness, or angina?</p>
<i>Treatment satisfaction</i> : measures patient satisfaction with current angina treatment	<p>Question 5—How bothersome is it for you to take your pills for chest pain, chest tightness or angina?</p> <p>Question 6—How satisfied are you that everything possible is being done to treat your chest pain, chest tightness or angina?</p> <p>Question 7—How satisfied are you with the explanations your doctor has given you about your chest pain, chest tightness, or angina?</p> <p>Question 8—Overall, how satisfied are you with the current treatment of your chest pain, chest tightness or angina?</p>
<i>Disease perception</i> : measures concern about angina in relation to quality of life and possibility of death	<p>Question 9—Over the past 4 weeks, how much has your chest pain, chest tightness, or angina interfered with your enjoyment of life?</p> <p>Question 10—If you had to spend the rest of your life with your chest pain, chest tightness or angina the way it is right now, how would you feel about this?</p> <p>Question 11—How often do you worry about a heart attack or dying suddenly?</p>



**TABLE 2**

## Demographic and clinical characteristics (n = 175)

Variable	n (%)
Years with CAD	08.3 (7.6)*
Race	
White	127 (72.6%)
Black	45 (25.7%)
Other	03 (1.7%)
Living situation	
Lives alone	36 (20.6%)
Lives with spouse	95 (54.3%)
Other	44 (25.1%)
Cardiac treatments and events	
Coronary artery bypass surgery	58 (33.1%)
Percutaneous transluminal coronary angioplasty	136 (77.7%)
Acute myocardial infarction	101 (57.7%)
Cardiac risk factors	
Current smoking	24 (13.7%)
History of hyperlipidemia	145 (82.9%)
History of diabetes	64 (36.6%)
History of hypertension	133 (76.0%)
Family history of CAD	136 (77.7%)

\* Data are mean (SD).

CAD = coronary artery disease.

TABLE 3

Individual SAQ items and SAQ subscales (n = 175)

Item/Subscale	Mean (SD)
Limitation in activities due to angina	
1a. Dressing yourself	4.56 (0.88)
1b. Walking indoors on level ground	4.25 (1.08)
1c. Showering	4.48 (0.99)
1d. Climbing a hill or a flight of stairs without stopping	2.34 (1.34)
1e. Gardening, vacuuming, or carrying groceries	2.65 (1.41)
1f. Walking more than a block at a brisk pace	2.28 (1.35)
1g. Running or jogging	1.69 (1.20)
1h. Lifting or moving heavy objects	1.87 (1.32)
1i. Participating in strenuous sports	1.77 (1.29)
2. Compared with 4 weeks ago, how often do you have chest pain, chest tightness or angina when doing your most strenuous level of activity?	2.94 (1.11)
3. On average, how many times have you had chest pain, chest tightness or angina?	3.81 (1.32)
4. On average, how many times have you had to take nitros for your chest pain, chest tightness or angina?	4.47 (1.35)
5. How bothersome is it for you to take your pills for chest pain, chest tightness, or angina as prescribed?	4.47 (0.95)
6. How satisfied are you that everything possible is being done to treat your chest pain, chest tightness, or angina?	4.18 (0.90)
7. How satisfied are you with the explanations your doctor has given you about your chest pain, chest tightness or angina?	4.15 (0.99)
8. Overall, how satisfied are you with the current treatment of your chest pain, chest tightness or angina?	4.18 (0.84)
9. Over the past 4 weeks, how much has your chest pain, chest tightness, or angina interfered with your enjoyment of life?	3.25 (1.26)
10. If you had to spend the rest of your life with your chest pain, chest tightness, or angina the way it is right now, how would you feel about this?	2.87 (1.24)
11. How often do you worry that you may have a heart attack or die suddenly?	3.19 (1.27)
Physical limitation subscale	47.0 (23.0)
Angina stability subscale	48.6 (27.8)
Angina frequency subscale	62.8 (23.4)
Treatment satisfaction subscale	81.1 (16.9)
Disease perception subscale	52.5 (24.3)

\* Possible range for items 1a to 1i, 2 and 5 to 11 is 1 to 5. Possible range for items 3 and 4 is 1 to 6. Possible range for each of the subscales is 0 to 100.

SAQ = Seattle Angina Questionnaire.

TABLE 4

Factor loadings for SAQ items (n = 175)

SAQ Items	Factor I: Physical Limitation in Activities Requiring Middle to Higher Levels of Exertion	Factor II: Treatment Satisfaction	Factor III: Angina Pattern and Disease Perception	Factor IV: Physical Limitation With Activities Requiring Lower Levels of Exertion (Self-Care Activities)	Factor V: Perceptions of How Bothersome It Is to Take Oral Medication for Angina
1A	-.03	.11	.06	-.87	.01
1B	.10	-.04	-.16	-.68	-.16
1C	.03	-.02	.02	-.87	.10
1D	<b>.75</b>	-.06	-.09	-.15	-.02
1E	<b>.76</b>	.08	-.04	-.18	-.06
1F	<b>.75</b>	-.01	.11	-.17	.10
1G	<b>.98</b>	.02	.06	.12	-.02
1H	<b>.97</b>	.02	-.01	.11	-.01
1I	<b>.94</b>	-.01	.02	.10	.02
2	-.08	-.10	-.77	.12	.12
3	.07	-.04	-.79	-.10	.07
4	.09	-.08	-.41	-.30	-.02
5	.08	.17	-.35	.03	<b>.78</b>
6	-.01	<b>.88</b>	-.02	.01	.01
7	-.05	<b>.85</b>	.09	-.02	-.08
8	.06	<b>.87</b>	.01	-.01	.17
9	.14	.04	-.51	-.31	.01
10	-.06	.31	-.63	-.12	-.13
11	.13	.14	-.57	.09	-.55

Items clustering in each factor are in bold.