Validation of a New Simple Scale to Measure Symptoms in Atrial Fibrillation- The Canadian Cardiovascular Society Severity in Atrial Fibrillation (CCS-SAF) Scale

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ABSTRACT

Background: Atrial fibrillation (AF) is commonly associated with impaired quality of life. There is no simple validated scale to quantify the functional illness burden of AF. The Canadian Cardiovascular Society Severity in Atrial Fibrillation Scale (CCS-SAF) is a bedside scale, which ranges from Class 0 – 4, from no effect on functional quality of life to a severe effect on life quality. This study was performed to validate the scale.

Methods and results: In 484 patients with documented AF; (62.2 ± 12.5 years of age, 67% male; 62% paroxysmal and 38% persistent/permanent), the SAF Class was assessed and two validated quality of life questionnaires were administered: the SF-36 generic scale and the disease specific AFSS (University of Toronto Atrial Fibrillation Severity Scale). There is a significant linear graded correlation between the SAF Class and measures of symptom severity, physical and emotional components of quality of life, general well-being and health care consumption related to atrial fibrillation. Patients with SAF Class 0 had age and sex standardized SF-36 scores of 0.15 ± 0.16 and -0.04 ± 0.31 (SD units) ie. units away from the mean population score for the mental and physical summary scores, respectively. For each unit increase in SAF Class, there is a 0.36 and 0.40 SD unit decrease in the SF-36 score for the physical and mental components. As the SAF Class increases from 0 to 4, the symptom severity score (range 0 - 35) increases from 4.2 ± 5.0 to 18.4 ± 7.8 (p < 0.0001).

Conclusions: The CCS-SAF scale is a simple semi-quantitative scale that closely approximates patient reported subjective measures of quality of life in AF and may be practical for clinical use.

Key Words: Atrial Fibrillation, Quality of Life
INTRODUCTION

Atrial Fibrillation (AF) is common and impairs quality of life (QOL) as much as some severe chronic illnesses.\(^1\)\(^-\)\(^3\) Since AF is rarely life threatening, making management decisions and gauging response to treatment is most often made on the basis of expected or observed improvement in symptoms and QOL.\(^4\)\(^-\)\(^5\) Measuring QOL is usually done with questionnaires, which are impractical for routine clinical use since they require ample time for completion, complex statistical analyses, and result in multiple scores which can be difficult to interpret. A simple “bedside” composite measure of symptoms and their effect on QOL in individual patients would be useful, and would help standardize the language used to describe the severity of the clinical syndrome in individual patients.\(^6\)

Assessing symptoms in AF can be challenging in that variables such as whether the arrhythmia is paroxysmal or persistent, whether the episodes are frequent or infrequent, and the duration of episodes need to be considered. Symptom scales that incorporate these variables can be cumbersome. Relying on the time-tested practical utilization of the CCS Angina Class and NYHA Congestive Heart Failure Functional Class to quantify symptoms and functional capacity, the Canadian Cardiovascular Society (CCS) Severity of Atrial Fibrillation (CCS-SAF) scale was created by members of the Primary Panel of the Canadian Cardiovascular Society Consensus Conference on Atrial Fibrillation.\(^5\) It is a simple, concise, symptom-based severity scale intended for routine clinical use in patients with AF. The CCS-SAF scale (resulting in “SAF Class”) provides a potentially clinically useful scale for practitioners to assess patient status and to communicate the
severity of the functional consequences of the patient’s symptoms from AF. The basis for development and a detailed description of this scale has been published previously.\(^7\)

The purpose of the current study was to validate the CCS-SAF scale, by using accepted measures of patient-perceived severity of symptoms and impairment of QOL as used in prior studies of AF.\(^6,8-11\)

**METHODS**

A total of 484 English or French speaking patients with a history of electrocardiogram (ECG) documented AF were recruited from Canadian cardiology clinics in Vancouver (n = 89), Calgary (n = 100), London (n = 80), Toronto (n = 101), or Montreal (n = 114). All centers obtained approval from their respective Research Ethics Boards and each patient provided written informed consent. At the time of clinic evaluation, each patient’s SAF Class, age, sex, predominant AF pattern (paroxysmal or persistent/permanent), duration of AF, current treatment strategy and current rate and rhythm control medications were recorded. All patients subsequently completed the SF-36 generic QOL instrument (version 1.0)\(^12\) and the “disease specific” Atrial Fibrillation Severity Scale (AFSS) instrument, at the clinic visit or within a few days.\(^8,11\)

The AFSS questionnaire is a disease specific measure of quality of life in atrial fibrillation. It includes questions regarding the frequency, overall severity, and duration of symptomatic AF episodes (given the variable nature of symptoms in AF, the questions apply to both paroxysmal and persistent AF); the presence and severity of individual symptoms possibly attributable to AF (such as palpitations, dyspnea,
dizziness, weakness, or chest pain [symptoms subscale]); overall well-being (scored on a Likert scale from 0 to 10); and cardioversion, specialist appointments, emergency room visits, and hospitalizations in the prior year.

The SF-36 questionnaire is a generic QOL scale with minimal overlap to the AFSS items. It assesses health-related QOL on 8 domains, pertaining to physical health (4 domains) and mental health (4 domains), and has been used extensively in health research for measuring life quality.\textsuperscript{2,6,9,12} Questionnaires were scored using previously published scoring algorithms.\textsuperscript{9,12} The authors had full access to the data and take full responsibility for its integrity. All authors have read and agree to the manuscript as written.

The CCS-SAF Scale

The Canadian Cardiovascular Society (CCS) Severity of Atrial Fibrillation (SAF) scale\textsuperscript{7} is analogous to the CCS Angina scale. The SAF scale is determined by: (S), symptoms attributable to AF, (A), association between symptoms (palpitations, dyspnea, dizziness/syncope, chest pain, weakness/fatigue) and documentation of AF or therapies for AF (i.e. therapy associated symptoms), and (F), functional consequences of these symptoms on the patient’s daily function and quality of life. The SAF Class is then rated on a scale from 0 (asymptomatic) to 4 (severe impact of symptoms on QOL and activities of daily living) (Appendix 1).
No specific training on using the SAF scale was provided, beyond access to the original publication describing the scale design and objectives and the description of the scale listed in the Appendix.

The number of individuals recording the SAF Class was deliberately large in order to increase the generalizability of the SAF classification, and ranged from 1 to 6 individuals (raters) per site. These raters consisted of electrophysiologists, electrophysiology fellows, nurse practitioners and nurses who normally provided care in the arrhythmia clinic at each study center. A total of 17 individuals performed the SAF Class rating for this study.

**Statistical Analysis**

Given the large number of analyses, two sided p values < 0.01 were considered to be statistically significant. Patient characteristics and questionnaire scores were described using the mean and standard deviation (SD) or by the median and inter-quartile range (IQR) if the variable was highly skewed. Age and duration of AF were compared among the SAF scale scores by one-way ANOVA after applying a log transformation to duration. Patient sex, AF pattern, cause of AF and treatment strategy were compared among SAF scale scores using chi squared and Fisher’s exact test. The SAF scales were related to QOL outcomes (subscales of the SF-36 and AFSS) by linear regression, and were described using Spearman’s correlation coefficient. Age and sex standardized scores on each scale were obtained by subtracting the mean score of the general population for that age group and gender and dividing by the standard deviation.
of the general population\textsuperscript{13} for that age group and sex. A multivariable linear regression analysis with the AFSS global well-being score as the outcome variable was used to examine the contribution of the SAF Class to overall QOL, while controlling for factors such as age, sex, AF pattern, cause of AF, AF duration, treatment strategy, center and medications used (patients taking any combination of beta blocker, calcium blocker or digoxin vs. patients taking any combination of sotalol, amiodarone, flecainide or propafenone). Variables measuring health utilization were described using the median and IQR and were tested for differences among SAF Class using the Kruskal-Wallis test.

**RESULTS**

Patients were 62.2 ± 12.5 years of age, 67% were male, 62% had paroxysmal AF, and the median AF duration was 48 months (Table 1), 49% had idiopathic AF with 30% of patients having AF associated with hypertension, 7% with coronary artery disease (CAD), 9% with valvular disease, and 5% with nonischemic cardiomyopathy as their primary cardiac diagnosis. There were no significant differences in diagnosis associated with AF among the SAF Class groupings. For the entire cohort, the number of patients managed by rate control was greater than those managed by rhythm control (48% vs. 42% respectively, \( p < 0.0001 \)) (Table 2). Patients with higher SAF Class were significantly more likely to be treated using a rhythm control than using a rate control strategy (Table 2).
Relationship between SAF Class and the AFSS

A summary of AFSS QOL outcome scores as grouped by SAF score, are shown in Table 3.

There was a significant positive linear relationship between the SAF Class and the AFSS severity and symptom subscales (r = 0.38, p < 0.001 and r = 0.51, p < 0.001, respectively). There was an over four-fold increase in symptom score between SAF Class 0 and 4 and a significant negative linear relationship between the SAF Class and the AFSS global well being score (r = -0.37, p < 0.001). In contrast, there was no linear relation between SAF score and (subjective) AF frequency or duration.

Relationship between the SAF Class and the SF-36

The SF-36 QOL outcome scores, for the individual subscales and the summary mental and physical scales, as grouped by SAF Class, are shown in Tables 4a and 4b.

There was a significant negative linear relationship between SAF Class and each of six SF-36 subscales (physical functioning, bodily pain, general health, vitality, social functioning, and mental health, and the two summary scales (physical and mental health). For the individual subscales, correlations ranged from -0.24 (bodily pain) to -0.42 (social functioning); all correlations were significant (all p < 0.001). The ‘role physical’ and ‘role emotional’ scales showed a similar pattern, but correlations cannot be calculated as these are categorical scales.
SF-36 scores for each SAF Class were compared to age and sex standardized scores for published healthy control populations. The control population SAF scores in this comparison are arbitrarily set to 0, and differences from healthy controls are expressed in SD (standard deviation) units. Patients with SAF Class 0 had age and sex standardized SF-36 scores of 0.15 ± 0.16 and -0.04 ± 0.31 (SD units) for the mental and physical summary scores respectively, thus very similar to healthy controls. As the SAF Class increases, there is a progressive linear decrease in SF-36 score of 0.36 and 0.40 SD units for the summary physical and mental components, respectively, for each unit increase in SAF Class (p < 0.001) (Figures 1 and 2).

**Relationship between the SAF and age and gender**

There was no evidence of a relationship between the SAF Class and age (r = -0.078), however women had higher SAF Class than men (p < 0.001). The mean score for women was 2.25 (95% CI 2.08 – 2.43) whereas the mean score for men was 1.71 (95% CI 1.59 – 1.83). The AFSS symptom severity score was also higher for women (mean = 6.08, 95% CI 5.74 – 6.42) than for men (mean = 5.04, 95% CI 4.77 – 5.32) (p < 0.001).

**Multivariable analysis**

The inverse relationship between SAF Class and global well-being (Table 3), as measured by the AFSS, was not affected by sex, age, medications used, AF duration, AF cause, treatment strategy, nor study center. However, in addition to SAF Class (p < 0.0001) there was an independent effect of AF pattern (p = 0.0002) on AFSS global well-being score. For a given SAF Class, patients with persistent/permanent AF scored
0.66 points lower on the AFSS global well-being scale compared to patients with paroxysmal AF.

Similarly, the relation between the SAF Class and the age and sex standardized SF-36 physical component summary was independent of sex, AF cause, AF pattern, AF duration, treatment strategy, medications, and study center. In the multivariable analysis, an increase of one SAF Class was, on average, equivalent to a 0.37 point decrease in the age and sex standardized physical component summary, independent of the other variables in the model ($p < 0.0001$). In addition to SAF Class there was a significant independent effect of primary diagnosis associated with AF ($p = 0.0005$): for a given value of SAF Class and pattern of AF, patients with CAD and nonischemic cardiomyopathy had lower physical component summary scores (an average of 0.60 points on the overall scale) compared to patients with hypertension. For a given value of the SAF Class and cause of AF, patients with persistent/permanent AF had SF-36 physical summary scores 0.35 SD units lower than patients with paroxysmal AF. There was no evidence of an interaction between SAF Class and AF pattern; however, both patterns show a parallel (inverse) linear relation between SAF Class and standardized SF-36 score.

The relationship between the subjective AF severity and the SAF Class is complex. The relationship between SAF Class and AF subjective severity is positive, but the slope depends on age and AF pattern. The slope is steeper for older individuals and those with persistent/permanent AF, ($p = 0.004$ and $p = 0.002$ respectively), such that at
higher SAF Classes, patients who are older or have persistent/permanent AF have higher (worse) severity scores.

To test for consistency of SAF Class rating between study centers, we examined the interaction between study site and SAF Class in predicting the Physical Component Summary (PCS) of the SF-36 questionnaire. The correlation between SAF Class and PCS was significant for each center and there was no significant difference in slope or intercept across study centers (p = 0.33). This finding indicates there was no evidence of difference between groups of SAF Class raters or study site in the SAF Class assessment.

**Hospitalizations, ER, and Specialist Visits in AF Patients**

As SAF Class increased, a greater proportion of patients reported having had electrical cardioversion, more emergency room visits, specialist appointments, and hospitalizations in the prior 1 year period (p < 0.001; Table 5).

**DISCUSSION**

This study demonstrates that a simple semi-quantitative scale of the functional consequence of symptoms during AF correlates highly with mental and physical aspects of QOL, patient perceived severity of AF, the degree of symptoms judged from a validated questionnaire, and general well-being. In contrast, the SAF Class is not well correlated with the subjective “atrial fibrillation burden” as defined by the frequency and duration of perceived episodes of AF.
Although AF is seldom immediately life-threatening, it imposes a substantial QOL burden on many patients.\textsuperscript{2,6,11,14} On the other hand, many other patients with AF are minimally symptomatic or completely asymptomatic.\textsuperscript{15} At present, there is no easily applied, convenient way to classify such patients for ease of communication, and to help place into context the potential risks and benefits of various therapies for AF. With respect to the semi-quantitative Class categorization, the SAF scale is analogous to the NYHA Congestive Heart Failure Functional Class and the Canadian Cardiovascular Society Angina Severity Class. These widely used bedside scales have proven to be very useful for everyday clinical use and for research purposes, despite the relatively poor correlation between NYHA Functional Class and objective measures of physical function.\textsuperscript{16-17}

The purpose of the SAF scale is to provide a summarized, objective assessment of the patient’s subjective state, for which there is no gold standard. It is therefore difficult to test the validity of this new scale, other than with respect to its relationship to a frequently used generic measure of QOL.\textsuperscript{14}, and a previously validated disease-specific questionnaire used in research studies of patients with AF.\textsuperscript{8,11} The initial assessment in this classification scheme consists of confirming that the reported symptoms are, in fact, associated with the presence of AF. This is particularly important in the case of paroxysmal AF, where administering some questionnaires in the absence of arrhythmic episode may lead to under-estimation of the illness burden for AF. Although the SAF scale applies equally to persistent and paroxysmal AF, the independence of the SAF
scale and pattern of AF (paroxysmal vs. persistent/permanent) suggests that it may be useful to specify the AF pattern when describing the SAF Class.

Another important component of the SAF classification is the requirement to relate the symptoms associated with AF to the patient’s functionality, with respect to the effect of the symptoms on the patient’s general QOL. The SAF Class thus incorporates the nature and subjective severity of symptoms as well as their effect on the patient’s social, physical, and emotional well-being. The scale explicitly does not attempt to discriminate between physical, social and emotional factors and can be evaluated without including the rhythm status of the patient at the time of evaluation.

The CCS-SAF scale is somewhat similar to a scale proposed by the European Heart Rhythm Association (EHRA),\(^6\) which assigns AF patients into four EHRA Classes, based on symptoms and their effect on daily activity. This proposed scale, which has not been validated, applies only “during presumed arrhythmia episodes” and thus requires additional qualifiers with respect to the frequency of symptoms.\(^6\)

In this validation study, each unit of change in SAF Class corresponded to almost one half SD units (and 10 or more units on individual subscales) of change in summary and individual components of the SF-36 classification; a one half SD unit (or 3 - 5 units on the subscales) change is considered a moderate to moderately large effect size in QOL research,\(^{18}\) and thus reflects a substantial, and clinically significant difference in life quality between each of the various SAF Classes. Importantly, the linear relationship
between SF-36 score and the SAF Class applies to the individual components of each SF-36 subscale including, for example, general health, physical functioning, social functioning, vitality and mental health. The “step sizes” (with respect to SD units of change in the domains of the SF-36) between the individual SAF Classes are approximately equal, indicating a near linearity of the relationship between SAF Class and the various subjective measures of symptoms and life quality. This is unlike the NYHA classification, where in clinical practice the distinction between Class II and Class III functional status is often difficult. The SAF Class did not show a linear relationship with the AFSS frequency or duration score. The SAF scale does not attempt to capture the patients’ AF burden, but rather, the functional impact that the disease can have on QOL. The concept of “AF burden” (frequency x duration) as an index of the severity of the illness can belie the fact that infrequent or brief but very symptomatic AF episodes can have an important impact on a patient’s functional status.

LIMITATIONS

The SAF Class is imperfectly correlated to generic QOL measures in the SF-36 and specific AF related symptoms on the AFSS. This presumably occurs because the SAF scale captures, by design, all components of the AF syndrome (including, for example, symptom severity during AF, adverse effects of treatment administered, and the physical and psychological consequences of the disease state) whereas the generic QOL measures capture only components of the AF “illness burden”. These relationships are similar to those between the NYHA functional class and a disease
specific questionnaire of heart failure symptom severity, the Kansas City Cardiomyopathy questionnaire, which are moderately correlated \( r = -0.38 \).^{19}

There were a higher proportion of patients with idiopathic AF in this study than other studies therefore the patients may not be completely representative of all patient with AF seen in clinical practice. This study does not assess the relationship of SAF Class to outcomes such as hospitalization, cardioversions, or mortality; it also does not assess the effect of specific drugs or anticoagulation on SAF Class or quality of life. We also did not measure test-retest reliability, or intra- or inter-rater reliability. All of the above limitations need to be addressed in future studies.

**CLINICAL IMPLICATIONS**

The SAF classification is primarily intended for routine clinical use, and it may be helpful to incorporate this simple scale into the assessment of patients with AF in clinical settings. The consistency of the relationship between SAF Class and measures of subjective QOL across centers suggests that this scale is easily applied and easily learned without the need for extensive training and experience. It could also be potentially useful in research studies as a measure of therapy effect,\(^{20}\) as an aid to the risk benefit calculations inherent in the delivery of complex therapies for AF, and as a tool in monitoring patient progress over time.
ACKNOWLEDGMENTS

The Canadian Cardiovascular Society (CCS) Severity of Atrial Fibrillation (SAF) Scale was formally approved by the CCS Council and the CCS Atrial Fibrillation Guidelines Primary Panel in October 2005. We wish to acknowledge the help and support of the CCS Council and we are grateful for the secondary review of the CCS-SA scale by members of the CCS Atrial Fibrillation Guidelines Primary Panel: Dr. Stuart J. Connolly, Dr. Sean P. Connors, Dr. Louise Harris, Dr. Brett G. Heilbron, Dr. George J. Klein, Dr. Pierre Page, Dr. Christopher S. Simpson and Dr. Mario Talajic.

We are grateful to Theresa Aves for her assistance.

CONFLICT OF INTEREST DISCLOSURES

None.
REFERENCES


Figure Legends

Figure 1. Age and sex standardized SF-36 mental component summary (MCS) for patients in SAF Classes 0 – 4. Standardized score of 0 is equivalent to the mean value for the general population, corrected for age and sex. Each unit corresponds to a change of 1 SD in the summary score. Negative values indicate worse quality of life. SAF Class vs. standardized MCS (p < 0.001). Note that the SAF Class is a discrete, not a continuous variable.

Figure 2. Age and Sex Standardized SF-36 Physical Component Summary (PCS) for Patients in SAF Classes 0 – 4. Standardized score of 0 is equivalent to the mean value for the general population, corrected for age and sex. Each unit corresponds to a change of 1 SD in the summary score. Negative values indicate worse quality of life. SAF Class vs. standardized PCS (p < 0.001). Note that the SAF Class is a discrete, not a continuous variable.
### Table 1. Demographic Data

<table>
<thead>
<tr>
<th>SAF Class</th>
<th>0 (n=58)</th>
<th>1 (n=135)</th>
<th>2 (n=129)</th>
<th>3 (n=126)</th>
<th>4 (n=36)</th>
<th>Total (N=484)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>64.8 ± 12.3</td>
<td>62.7 ± 12.4</td>
<td>61.4 ± 11.5</td>
<td>60.9 ± 13.1</td>
<td>63.7 ± 13.8</td>
<td>62.2 ± 12.5</td>
<td>0.28</td>
</tr>
<tr>
<td><strong>Sex (% Male)†</strong></td>
<td>86.2</td>
<td>69.6</td>
<td>72.9</td>
<td>55.6</td>
<td>41.7</td>
<td>66.7</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>AF Pattern (% paroxysmal)†</strong></td>
<td>25.9</td>
<td>60.7</td>
<td>72.9</td>
<td>69.1</td>
<td>61.1</td>
<td>62.0</td>
<td>&lt; 0.001</td>
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<tr>
<td><strong>AF Duration (months)</strong></td>
<td>51</td>
<td>48</td>
<td>48</td>
<td>48</td>
<td>60</td>
<td>48</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>(median, IQR)</strong>*</td>
<td>12 - 93</td>
<td>10 - 108</td>
<td>18 - 96</td>
<td>26 - 96</td>
<td>36 - 110</td>
<td>18 - 96</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: IQR = Interquartile Range

* P value attained by one-way ANOVA
† P value attained by chi square test
Table 2. Atrial Fibrillation Management Strategy

<table>
<thead>
<tr>
<th>SAF Class</th>
<th>Rate Control (%)*</th>
<th>Rhythm Control (%)*</th>
<th>Neither Strategy (%)</th>
<th>Both Strategies (%)</th>
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<tr>
<td>0 (n=58)</td>
<td>75.9</td>
<td>17.2</td>
<td>5.2</td>
<td>1.7</td>
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<tr>
<td>1 (n=135)</td>
<td>56.3</td>
<td>33.3</td>
<td>8.2</td>
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<tr>
<td>2 (n=129)</td>
<td>38.0</td>
<td>49.6</td>
<td>7.0</td>
<td>5.4</td>
</tr>
<tr>
<td>3 (n=126)</td>
<td>40.5</td>
<td>49.2</td>
<td>6.4</td>
<td>4.0</td>
</tr>
<tr>
<td>4 (n=36)</td>
<td>38.9</td>
<td>58.3</td>
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<td>2.8</td>
</tr>
<tr>
<td>Total (N=484)</td>
<td>48.4</td>
<td>41.7</td>
<td>6.4</td>
<td>3.5</td>
</tr>
</tbody>
</table>

* Rate vs. rhythm control attained by chi square test (p < 0.001)
Table 3. AFSS QOL for All Patients by SAF Class

<table>
<thead>
<tr>
<th>SAF Class</th>
<th>0 (n=58)</th>
<th>1 (n=135)</th>
<th>2 (n=129)</th>
<th>3 (n=126)</th>
<th>4 (n=36)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF Frequency (range 0-10)*,†</td>
<td>7.7 ± 3.5</td>
<td>6.2 ± 3.5</td>
<td>5.2 ± 3.0</td>
<td>6.3 ± 3.0</td>
<td>6.9 ± 3.3</td>
<td>0.36</td>
</tr>
<tr>
<td>AF Duration (range 1-10)*,†</td>
<td>8.4 ± 3.0</td>
<td>6.4 ± 3.3</td>
<td>5.9 ± 2.7</td>
<td>6.7 ± 2.6</td>
<td>7.1 ± 2.2</td>
<td>0.35</td>
</tr>
<tr>
<td>AF Severity (range 1-10)*,†</td>
<td>3.0 ± 2.4</td>
<td>5.0 ± 2.2</td>
<td>5.6 ± 2.2</td>
<td>6.1 ± 2.1</td>
<td>7.2 ± 1.7</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Global Well Being (range 1-10)*</td>
<td>8.0 ± 1.3</td>
<td>7.4 ± 1.4</td>
<td>6.9 ± 1.9</td>
<td>6.1 ± 2.1</td>
<td>4.8 ± 2.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Symptoms (range 0-35)*,†</td>
<td>4.2 ± 5.0</td>
<td>7.7 ± 6.3</td>
<td>10.7 ± 7.2</td>
<td>14.1 ± 6.9</td>
<td>18.4 ± 7.8</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

* Mean ± standard deviation; the range of possible scores for each subscale of the AFSS is listed below each subscale.
† Increasing scores indicate increasing symptoms and severity, except for global well-being, where higher scores indicate better well-being (P values refer to the slope of the regression line).
Table 4a. SF-36 QOL Subscales for All Patients

<table>
<thead>
<tr>
<th>SAF Class</th>
<th>0 (n=58)</th>
<th>1 (n=135)</th>
<th>2 (n=129)</th>
<th>3 (n=126)</th>
<th>4 (n=36)</th>
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</thead>
<tbody>
<tr>
<td>Physical Function*,†</td>
<td>79.1 ± 23.2</td>
<td>74.0 ± 25.2</td>
<td>69.9 ± 26.9</td>
<td>59.6 ± 28.5</td>
<td>44.0 ± 30.6</td>
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<tr>
<td>Role Physical*,†</td>
<td>74.6 ± 38.2</td>
<td>64.1 ± 41.2</td>
<td>51.1 ± 44.7</td>
<td>33.2 ± 40.4</td>
<td>15.0 ± 31.0</td>
</tr>
<tr>
<td>Bodily Pain*,†</td>
<td>83.8 ± 22.5</td>
<td>75.1 ± 24.2</td>
<td>70.5 ± 27.0</td>
<td>65.3 ± 27.6</td>
<td>57.8 ± 30.5</td>
</tr>
<tr>
<td>General Health*,†</td>
<td>71.6 ± 18.2</td>
<td>65.6 ± 19.0</td>
<td>60.1 ± 22.0</td>
<td>55.2 ± 23.3</td>
<td>46.1 ± 24.5</td>
</tr>
<tr>
<td>Vitality*,†</td>
<td>66.8 ± 18.7</td>
<td>58.5 ± 21.5</td>
<td>51.3 ± 23.3</td>
<td>44.0 ± 22.2</td>
<td>30.6 ± 26.3</td>
</tr>
<tr>
<td>Social Function*,†</td>
<td>88.6 ± 20.6</td>
<td>82.4 ± 21.1</td>
<td>72.2 ± 25.2</td>
<td>65.3 ± 24.7</td>
<td>50.0 ± 26.7</td>
</tr>
<tr>
<td>Role Emotional*,†</td>
<td>88.9 ± 26.2</td>
<td>74.4 ± 36.2</td>
<td>67.7 ± 39.6</td>
<td>50.9 ± 44.2</td>
<td>34.3 ± 42.5</td>
</tr>
<tr>
<td>Mental Health*,†</td>
<td>82.8 ± 11.6</td>
<td>76.2 ± 14.1</td>
<td>70.5 ± 18.7</td>
<td>67.3 ± 18.9</td>
<td>56.8 ± 25.7</td>
</tr>
</tbody>
</table>

* Mean ± SD; the range of scores for each subscale is 0-100 (with higher scores indicating better quality of life)
† There is a significant inverse relation between SAF Class and the SF-36 component and summary scales (p < 0.001)

Table 4b. SF-36 QOL Component Summaries for All Patients

<table>
<thead>
<tr>
<th>SAF Class</th>
<th>0 (n=58)</th>
<th>1 (n=135)</th>
<th>2 (n=129)</th>
<th>3 (n=126)</th>
<th>4 (n=36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Component Summary *,†</td>
<td>47.8 ± 10.3</td>
<td>46.0 ± 10.3</td>
<td>43.6 ± 11.2</td>
<td>39.3 ± 10.9</td>
<td>34.2 ± 10.2</td>
</tr>
<tr>
<td>Mental Component Summary *,†</td>
<td>55.1 ± 6.3</td>
<td>50.7 ± 8.8</td>
<td>47.7 ± 10.5</td>
<td>44.6 ± 10.5</td>
<td>38.8 ± 13.9</td>
</tr>
</tbody>
</table>

* Mean ± SD; the range of scores for each subscale is 0-100 (with higher scores indicating better quality of life)
† There is a significant inverse relation between SAF Class and the SF-36 component and summary scales (p < 0.001)
Table 5. AFSS Health Utilization for All Patients

<table>
<thead>
<tr>
<th>SAF Class</th>
<th>0 (n=58)</th>
<th>1 (n=135)</th>
<th>2 (n=129)</th>
<th>3 (n=126)</th>
<th>4 (n=36)</th>
<th>Total (N=484)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who have had Cardioversion*,‡</td>
<td>24 (41.4%)</td>
<td>56 (41.8%)</td>
<td>54 (42.9%)</td>
<td>70 (55.6%)</td>
<td>23 (63.9%)</td>
<td>227 (47.3%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Number of Cardioversions*;‡</td>
<td>2.4 ± 1.7</td>
<td>3.0 ± 2.8</td>
<td>2.4 ± 2.2</td>
<td>2.9 ± 3.4</td>
<td>2.9 ± 3.0</td>
<td>2.8 ± 2.8</td>
<td>0.82</td>
</tr>
<tr>
<td>No of ER visits (in 1 year)†</td>
<td>0.3 ± 0.7</td>
<td>0.8 ± 1.8</td>
<td>1.0 ± 1.2</td>
<td>1.7 ± 1.8</td>
<td>2.6 ± 3.1</td>
<td>1.1 ± 1.8</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>No of Hospitalization (in 1 year)†</td>
<td>0.1 ± 0.3</td>
<td>0.3 ± 0.7</td>
<td>0.4 ± 0.8</td>
<td>0.9 ± 1.3</td>
<td>2.1 ± 3.1</td>
<td>0.6 ± 1.3</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>No of Specialist visits (in 1 year)†</td>
<td>1.1 ± 1.0</td>
<td>1.5 ± 1.7</td>
<td>1.8 ± 1.7</td>
<td>2.3 ± 1.7</td>
<td>2.8 ± 2.4</td>
<td>1.8 ± 1.8</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

* P value attained by chi square test
† P value attained by Kruskal-Wallis test
‡ Number of cardioversions per patient in those who had one or more cardioversions
Figure 1

![Graph showing the relationship between SAF Class and Standardized SF-36: MCS.](image-url)
Figure 2

![Graph showing the relationship between standardized SF-36: PCS and SAF Class.](http://circep.ahajournals.org/)

- The x-axis represents SAF Class, ranging from 0 to 4.
- The y-axis represents standardized SF-36: PCS, ranging from 0 to -2.
- The graph includes error bars for each data point, indicating variability.

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Validation of a New Simple Scale to Measure Symptoms in Atrial Fibrillation: The Canadian Cardiovascular Society Severity in Atrial Fibrillation (CCS-SAF) Scale

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Canadian Cardiovascular Society
Severity of Atrial Fibrillation (SAF) Scale

**Step 1 – Symptoms**
Identify the presence of the following symptoms:
- Palpitation
- Dyspnea
- Dizziness, presyncope, or syncope
- Chest pain
- Weakness or fatigue

**Step 2 – Association**
Is AF, when present, associated with the above-listed symptoms (A-E)?

For example: Ascertain if any of the above symptoms are present during AF and likely caused by AF (as opposed to some other cause).

**Step 3 – Functionality**
Determine if the symptoms associated with AF (or the treatment of AF) affect the patient’s functionality (subjective quality of life).
# CCS-SAF Class Definitions

## Class 0
Asymptomatic with respect to AF

## Class 1
Symptoms attributable to AF have **minimal** effect on patient’s general QOL.
- minimal and/or infrequent symptoms, or
- single episode of AF without syncope or heart failure

## Class 2
Symptoms attributable to AF have a **minor** effect on patient’s general QOL.
- mild awareness of symptoms in patients with persistent/permanent AF, or
- rare episodes (e.g. less than a few per year) in patients with paroxysmal or intermittent AF

## Class 3
Symptoms attributable to AF have a **moderate** effect on patient’s general QOL.
- moderate awareness of symptoms on most days in patients with persistent/permanent AF, or
- more common episodes (e.g. more than every few months) or more severe symptoms, or both, in patients with paroxysmal or intermittent AF

## Class 4
Symptoms attributable to AF have a **severe** effect on patient’s general QOL.
- very unpleasant symptoms in patients with persistent/paroxysmal AF and/or
- frequent and highly symptomatic episodes in patients with paroxysmal or intermittent AF and/or
- syncope thought to be due to AF and/or
- congestive heart failure secondary to AF