The Impact of Nocturnal Symptoms Associated With Gastroesophageal Reflux Disease on Health-Related Quality of Life

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**Background:** Two types of reflux episodes have been identified: upright or daytime and supine or nocturnal. The population-based prevalence of symptoms of nocturnal gastroesophageal reflux disease (GERD) and the impact of those symptoms on health-related quality of life (HRQL) have not been established.

**Methods:** A national random-sample telephone survey was conducted to estimate the prevalence of frequent GERD and nocturnal GERD-like symptoms and to assess the relationship between HRQL, GERD, and nocturnal GERD symptoms. Respondents were classified as controls, subjects with symptomatic nonnocturnal GERD, and subjects with symptomatic nocturnal GERD. The HRQL was assessed using the Medical Outcomes Study Short-Form 36 Health Survey (SF-36).

**Results:** The prevalence of frequent GERD was 14%, with an overall prevalence of nocturnal GERD of 10%. Seventy-four percent of those with frequent GERD symptoms reported nocturnal GERD symptoms. Subjects with nonnocturnal GERD had significant decrements on the SF-36 physical and mental component summary scores compared with the US general population. Subjects reporting nocturnal GERD symptoms were significantly more impaired than subjects reporting nonnocturnal GERD symptoms on both the physical component summary (38.94 vs 41.52; \( P < .001 \)) and mental component summary (46.78 vs 49.51; \( P < .001 \)) and all 8 subscales of the SF-36 (\( P < .001 \)). Subjects with nocturnal GERD demonstrated considerable impairment compared with the US general population and chronic disease populations. Subjects with nocturnal GERD had significantly more pain than those with hypertension and diabetes (\( P < .001 \)) and similar pain compared with those with angina and congestive heart failure.

**Conclusions:** Nocturnal symptoms are commonly experienced by individuals who report frequent GERD symptoms. In addition, HRQL is significantly impaired in those persons who report frequent GERD symptoms, and HRQL impairment is exacerbated in those who report nocturnal GERD symptoms.

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SUBJECTS AND METHODS

A national population-based telephone interview survey was conducted in fall 1998. The sample included households and members selected randomly and by convenience (ie, households were contacted at random, but first interviews were based on availability). Random-digit dialing was used to select the sample. At the end of the initial interview, respondents were asked to list the age and sex of all adult permanent household members. Household members were assigned sequential numbers that were then matched to a random number assignment to determine a random respondent. If the original respondent did not match the random respondent, the randomly selected member of the household was then interviewed. If he or she was not available, the household was telephoned again. Among households with 2 completed interviews, only the randomly selected respondent's interview was retained for analysis. To minimize selection bias, two thirds of the calling time was assigned to evening and weekend hours when more people are expected to be home and available for interview. The overall participation rate was 70%.

The objectives of the survey were to estimate the prevalence of frequent GERD symptoms in a nationally projectable sample, estimate the prevalence (type, frequency, and duration of episodes) of nocturnal GERD symptoms in the US general population and to assess the relationship between HRQL and nocturnal GERD symptoms. Basic demographic information, screening questions for presence of symptomatic GERD in the past 3 months, frequency and severity of symptoms, nocturnal symptoms, physician-diagnosed conditions, and HRQL data were collected.

SUBJECTS

Eligible adults had to be older than 18 years, a permanent member of the household being called, able to converse in English, and mentally competent.

Not all study participants were asked all interview questions. Participants who screened negative for presence of GERD symptoms (heartburn and acid regurgitation) were not asked further questions unless they were part of a random selection of control participants. Controls were asked about physician-diagnosed conditions and HRQL. Participants who screened positive for GERD were asked further questions about symptom frequency and impact on everyday life.

GERD CLASSIFICATION

GERD is defined as “any symptomatic condition or histopathologic alteration resulting from episodes of gastroesophageal reflux.” Participants were classified as having symptomatic GERD based on the presence and frequency of heartburn and acid regurgitation. These symptoms are considered to be specific for GERD and are generally accepted for use in population research. The symptomatic group was further subclassified into nocturnal and no nocturnal GERD.

Symptomatic GERD

Respondents were asked if they had any of the 4 symptoms in the last 3 months: heartburn or burning sensation in the chest; burning sensation or burning pain in the throat; fluid or food come back into the throat or mouth; and an acid, bitter, or sour taste in the mouth. These items were derived from the GERD Symptom Assessment Scale, a previously validated symptom questionnaire for GERD. Participants symptomatic for GERD were those who responded positively to 1 of the 4 symptom questions and who reported experiencing any one of the GERD symptom(s) at least once a week (n = 1284). Presence of symptoms once a week or more has been used in prior population surveys to define those with frequent GERD. This group was asked about severity and frequency of symptoms, questions for nocturnal GERD, and HRQL.

Nocturnal GERD

Respondents were asked if they had any of these symptoms in the last 3 months: awakened at night by GERD symptoms, awakened at night by coughing or choking because of fluid, an acid or bitter taste or food in the throat, having GERD symptoms when lying down to sleep at night, and...
waking up in the morning with GERD symptoms. Symptoms were chosen through expert clinical consensus, since there is no standardized clinical definition of the symptoms of nocturnal GERD. The nocturnal GERD group (n = 945), a subgroup of the symptomatic GERD group, was defined as those people who met the case definition for symptomatic GERD and who responded positively to 1 of the nocturnal GERD symptoms questions. This group was asked additional questions regarding the number of nights and times nocturnal GERD symptoms occurred. Respondents classified in the nocturnal GERD group also answered questions regarding the impact of nocturnal GERD on their lives.

Controls
Randomly selected subjects (n = 268) who did not meet the screening criteria for GERD were also asked about physician-diagnosed conditions and HRQL. These subjects served as a control group for comparison with the subjects symptomatic for GERD and nocturnal GERD.

HEALTH-RELATED QUALITY OF LIFE
Participants completed the SF-36, a 36-item instrument designed to measure generic health status. The SF-36 has 8 sub-scales: physical function, role limitations—physical, vitality, general health perceptions, pain, social function, role limitations—emotional, and mental health. Two overall summary scores (physical and mental component summary scores) can also be obtained. The reliability and validity of the SF-36 subscale and summary scores have been demonstrated in the general population and several chronic disease groups (eg, hypertension, type 2 diabetes mellitus, congestive heart failure, clinical depression, and angina). Subscale and summary scores range from 0 to 100, where higher scores reflect a better quality of life. Normative general population data are available for the SF-36 and were used in the analyses.

NUMBER OF GERD SYMPTOMS REPORTED
Two symptom scores were constructed based on the number of GERD-related symptoms reported. The GERD symptom score consisted of the total number of the 4 GERD-related symptoms per respondent. The nocturnal GERD symptom score consisted of the total number of the 4 nocturnal GERD-related symptoms per respondent. These 2 scores range from 0 to 4, with higher scores indicating a greater number of GERD-related symptoms.

Three other measures of the impact of nocturnal GERD symptoms on everyday life were included in the survey. Respondents were requested to rate their level of discomfort with overall nocturnal GERD symptoms on a 0 to 10 scale, with higher scores indicating greater discomfort. Frustration with sleep loss was rated on a 7-point scale, with lower scores reflecting greater frustration. Worry and concern about nocturnal GERD symptoms were evaluated using 2 items, both rated on 7-point scales, with lower scores reflecting more worry and concern. These 2 items were totaled and divided by 2, resulting in a score ranging from 1 to 7.

DATA ANALYSIS
We compared HRQL (as measured by the SF-36 subscale and component summary scores) of our sample of persons with frequent GERD-like symptoms with the primary care and chronic disease population sample from the MOS using t tests. We also compared mean physical component summary and mental component summary scores for the GERD sample and US general population stratified by age in 10-year age groups (18-24 years, 25-34 years, up to 65-74 years) and sex. Pearson product moment correlations were used to examine the relationship between selected GERD symptom indicators and the HRQL scores. Analysis of variance, adjusting for sex, age, and comorbidity, was used to examine the relationship between GERD symptom severity and mean HRQL scores. Statistically significant overall mean differences were followed by t tests between pairs of symptom severity groups, with adjustments for multiple comparisons. Given the large number of statistical tests, statistical significance and interpretation of findings were based on P < .001.

RESULTS
Overall, 66% of respondents were female, 40% of the respondents were younger than 40 years, 35% were between the ages of 40 and 59 years, and 24% of the respondents were older than 60 years (2% refused to provide their age). Approximately 82% of the respondents were white. The study sample, compared with the US general population, consisted of more females and more elderly (Statistical Abstract of the United States, 1997).

The crude prevalence of symptomatic and nocturnal frequent GERD stratified by sex, age, and race is presented in Table 1. A higher percentage of women experience GERD symptoms. Approximately 15% of women and 13% of men surveyed had symptomatic GERD symptoms. The prevalence of nocturnal GERD was somewhat lower, with 11% of women and 9% of men affected. Of the 1284 persons with symptomatic GERD, 945 (74%) had symptoms of nocturnal GERD. The remaining analysis is limited to 1284 persons with symptomatic GERD and 268 controls.

The demographic characteristics of these subgroups are shown in Table 2. More than 80% of the respondents were white, and almost 70% were female. The mean age of symptomatic subjects was 45.1 years. Subjects without nocturnal GERD symptoms were slightly older than subjects with nocturnal GERD and controls,
The most common nocturnal symptoms were “experi-
cation or burning pain in throat (31%) (data not shown).
Back in throat or mouth (42%); and burning sensa-
bitter, or sour taste in mouth (59%); fluid or food com-
most common GERD symptom (87%) followed by acid,
of sex, race, or percentage working full-time for pay.
were no significant differences between groups in terms
but this difference was not statistically significant. There
Heartburn or burning sensation in the chest was the
most common GERD symptom (87%) followed by acid,
sour taste in mouth (59%); fluid or food coming
back in throat or mouth (42%); and burning sensa-
tion or burning pain in throat (31%) (data not shown).
The most common nocturnal symptoms were “experienced
GERD symptoms when laid down to sleep at night”
not stated (71) 7.0 (5) 8.5 (6)
Overall (6089) 10.9 (660) 14.7 (993)
Male
Age, y
18-29 (654) 8.7 (57) 12.1 (79)
30-39 (635) 11.2 (71) 14.2 (90)
40-49 (627) 11.6 (73) 16.3 (102)
50-59 (456) 8.6 (39) 11.4 (52)
≥ 60 (708) 6.4 (45) 9.6 (68)
Not stated (32) 0.0 (0) 0.0 (0)
Race
White (2515) 9.4 (237) 12.9 (325)
Nonwhite (530) 7.7 (41) 10.6 (56)
Not stated (67) 10.4 (7) 14.9 (10)
Overall (3112) 9.2 (285) 12.6 (391)
GERD indicates gastroesophageal reflux disease.
*Analysis of covariance, adjusting for age, sex, and comorbidity.
†P < .001, comparing nocturnal GERD and controls.
‡P < .001, comparing nonnocturnal GERD and controls.
§P < .001, comparing nonnocturnal GERD and nocturnal GERD.
The Figure shows SF-36 scores for GERD subjects with
nocturnal symptoms compared with published norma-
tive data for the general US population adjusted for age
and sex. Although most scores for the US population were
slightly higher than those for subjects with nonnoctur-
nal GERD (data not shown), the differences were not gen-
eral statistically significant. Nonnocturnal GERD sub-
jects had significantly impaired vitality compared with
control subjects (P < .001). The physical component and mental component summary scores

**Table 2. Distribution of Demographic Characteristics Among Selected Subgroups**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Nonnocturnal GERD (n = 339)</th>
<th>Nocturnal GERD (n = 945)</th>
<th>All Symptomatic GERD (n = 1284)</th>
<th>Controls (n = 268)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>47.2 (17.1)</td>
<td>44.4 (15.0)</td>
<td>45.1 (15.6)</td>
<td>45.7 (18.2)</td>
</tr>
<tr>
<td>Sex, % female</td>
<td>58.7</td>
<td>69.8</td>
<td>69.5</td>
<td>63.4</td>
</tr>
<tr>
<td>Race, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>86.4</td>
<td>83.7</td>
<td>84.4</td>
<td>82.1</td>
</tr>
<tr>
<td>Black</td>
<td>7.7</td>
<td>7.5</td>
<td>7.6</td>
<td>9.0</td>
</tr>
<tr>
<td>Other</td>
<td>5.9</td>
<td>8.8</td>
<td>8.0</td>
<td>8.9</td>
</tr>
<tr>
<td>Working for pay full-time, %</td>
<td>51.3</td>
<td>52.5</td>
<td>52.2</td>
<td>49.2</td>
</tr>
</tbody>
</table>

*GERD indicates gastroesophageal reflux disease.

**Table 3. Adjusted Medical Outcomes Study Short-Form 36 Health Survey Scores for Nocturnal Gastroesophageal Reflux Disease (GERD), Nonnocturnal GERD, and Control Groups**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Nocturnal GERD (n = 945)</th>
<th>Nonnocturnal GERD (n = 339)</th>
<th>Controls (n = 268)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>63.28 (1.52)†</td>
<td>68.46 (1.90)†</td>
<td>68.60 (2.03)</td>
</tr>
<tr>
<td>Role limitations—physical</td>
<td>52.69 (2.40)§</td>
<td>63.67 (3.00)†</td>
<td>66.75 (3.21)§</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>53.90 (1.61)†§</td>
<td>62.81 (2.02)‡</td>
<td>68.60 (2.16)§</td>
</tr>
<tr>
<td>General health</td>
<td>47.66 (1.38)¶</td>
<td>52.56 (1.73)‡¶</td>
<td>58.50 (1.85)¶</td>
</tr>
<tr>
<td>Vitality</td>
<td>41.06 (1.44)§¶</td>
<td>46.88 (1.81)¶†§</td>
<td>53.76 (1.94)§¶</td>
</tr>
<tr>
<td>Social functioning</td>
<td>70.16 (1.62)§¶</td>
<td>75.81 (2.02)¶‡</td>
<td>77.94 (2.16)§¶</td>
</tr>
<tr>
<td>Role limitations—emotional</td>
<td>69.47 (2.16)§¶</td>
<td>80.11 (2.70)¶‡</td>
<td>80.64 (2.87)§¶</td>
</tr>
<tr>
<td>Mental health</td>
<td>66.02 (1.27)§¶</td>
<td>71.42 (1.60)¶‡</td>
<td>74.28 (1.70)§¶</td>
</tr>
<tr>
<td>Physical component summary</td>
<td>38.94 (0.70)§¶</td>
<td>41.52 (0.86)¶‡</td>
<td>43.16 (0.92)§¶</td>
</tr>
<tr>
<td>Mental component summary</td>
<td>46.78 (0.72)§¶</td>
<td>49.51 (0.89)¶‡</td>
<td>51.07 (0.95)§¶</td>
</tr>
</tbody>
</table>

*Analysis of covariance, adjusting for age, sex, and comorbidity.
†P < .001, comparing nonnocturnal GERD and nocturnal GERD.
‡P < .001, comparing nonnocturnal GERD and controls.
§P < .001, comparing nocturnal GERD and controls.

**COMPARISON OF SUBJECTS WITH GERD SYMPTOMS AND THE US GENERAL POPULATION**

The Figure shows SF-36 scores for GERD subjects with nocturnal symptoms compared with published normative data for the general US population adjusted for age and sex. Although most scores for the US population were slightly higher than those for subjects with nonnocturnal GERD (data not shown), the differences were not generally statistically significant. Nonnocturnal GERD subjects had significantly impaired vitality compared with the US population and significantly fewer role limitations due to emotional functioning (P < .001). The physical component and mental component summary scores
show that nonnocturnal GERD subjects had significantly impaired HRQL compared with the US general population (P<.001).

In contrast, GERD subjects with nocturnal symptoms had significantly more impaired HRQL compared with the US general population (Figure). Nocturnal GERD subjects were significantly more impaired on all domains of the SF-36 (P<.001) with the exception of role limitations–emotional. The greatest differences (9-12 points) between nocturnal GERD subjects and the general population were in physical functioning, role limitations–physical, pain, general health perceptions, and vitality. Nocturnal GERD subjects also showed significant impairment on the physical component summary score (P<.001).

### COMPARISON OF SUBJECTS WITH GERD AND OTHER CHRONIC DISEASES

Comparisons of mean SF-36 scores for nocturnal GERD subjects and patients with other chronic diseases (eg, hypertension, type 2 diabetes mellitus, congestive heart failure, clinical depression, and angina) are presented in Table 4. Compared with patients with hypertension, nocturnal GERD subjects have significantly more pain and more impaired vitality, social functioning, and mental health (P<.001). Nocturnal GERD subjects have significantly fewer physical limitations compared with patients with diabetes but significantly more pain and more impaired vitality and mental health (P<.001). Patients with congestive heart failure have significantly more impaired physical functioning (P<.001) but have similar pain, vitality, social functioning, and mental health as subjects with nocturnal GERD. Clinically depressed patients also have more impaired physical functioning than nocturnal GERD subjects and more impaired general health perceptions, vitality, social functioning, role limitations, and mental health (P<.001). Nocturnal GERD subjects have significantly better physical functioning and general health perceptions compared with patients with angina (P<.001), but they have similar pain, vitality, social functioning, and mental health.

### NOCTURNAL GERD SYMPTOM MEASURES AND HRQL

Other measures of nocturnal GERD, such as discomfort with nocturnal GERD symptoms, frustration with sleep loss, and worry and concern about symptoms, were associated with HRQL. Correlations between these nocturnal GERD measures and the SF-36 subscale and summary scores were significant at P<.001. The number of nocturnal GERD symptoms was most strongly associated with mental health (r = −0.24), pain (r = −0.23), and general health perceptions (r = −0.23). Discomfort and distress because of symptoms was most highly correlated with vitality (r = −0.27), pain (r = −0.26), and mental health (r = −0.26). Frustration with symptoms was most strongly associated with impaired vitality (r = 0.34), social functioning (r = 0.34), and mental health (r = 0.34), whereas concern and worry about symptoms were most correlated with general health perceptions (r = 0.35) and mental health (r = 0.35). In general, concern and worry about symptoms were most strongly correlated with decrements in HRQL.

### Table 5

Table 5 shows SF-36 scores adjusted for age, sex, and comorbidities by the number of nocturnal GERD symptoms present. Subjects with a greater number of nocturnal GERD symptoms reported significantly more impaired HRQL compared with subjects with fewer symptoms (P<.001). Similarly, subjects with a greater number of GERD symptoms reported having lower HRQL, as reflected by significantly lower scores on all domains of the SF-36, compared with subjects with fewer symptoms (P<.001).

This population-based study found that the prevalence of frequent GERD symptoms was 14%, with women reporting slightly higher rates of GERD symptoms than men. These prevalence rates are comparable to other epidemiologic studies in which, depending on the definition, 9% to 15% of the population suffers from GERD. No previous epidemiologic studies have estimated the prevalence of nocturnal GERD symptoms. We found that the overall prevalence of nocturnal GERD symptoms was 10%, with 74% of persons with GERD symptoms fitting the criteria for nocturnal GERD. Based on these prevalence rates, it is estimated that close to 38 million Americans experience GERD symptoms every week and more than 27 million have nocturnal GERD symptoms. Treatment of nocturnal GERD may be especially difficult, since gastric acid secretion typically peaks around midnight and, despite high doses of a proton pump inhibitor, a subset of patients continues to experience nocturnal acid breakthrough. Recent research has demonstrated that presence of GERD symptoms, especially nocturnal manifestations, is an important risk factor for esophageal adenocarcinoma.

As expected, persons with nocturnal GERD reported more impaired HRQL compared with the controls. The mean differences exceeded 10 points for 5 (62%) of the 8 SF-36 subscales, and a 10-point difference is generally viewed as clinically significant. Physical component and mental component summary scores were both 4 points lower in subjects with nocturnal GERD. The nocturnal GERD respondents had mean physical component summary scores (mean = 38.9) that were more than 1 SD below the norm (mean = 50.0) for the US general
population. More importantly, persons with nocturnal GERD reported impaired functioning and well-being compared with those with GERD without nocturnal symptoms. These differences were observed across all 8 subscale scores of the SF-36, with the greatest impairments in pain and role limitations due to physical problems. All these mean differences were equal to or larger than 5 points, which may also be clinically significant, although some were not large.

The nonnocturnal GERD group was more impaired than controls on measures of pain, vitality, general health, and mental health. These findings are comparable to those seen in previous comparisons of generic health status scores between those with GERD and the general population. The nonnocturnal GERD group was more impaired than controls on measures of pain, vitality, general health, and mental health. These findings are comparable to those seen in previous comparisons of generic health status scores between those with GERD and the general population.

We demonstrated that respondents with frequent GERD and nocturnal symptoms have decreased HRQL compared with the US general population. These results were consistent in both men and women and across all age groups. The largest impairments were related to pain and role limitations–emotional; respondents with nocturnal GERD reported lower levels of physical functioning, psychological well-being, social functioning, vitality, and health perceptions. Most of these differences were clinically significant, although some were not large.

These HRQL impairments are comparable to those observed in samples of patients with GERD from clinical trials. In general, previous studies in GERD patients have shown that the largest improvements in HRQL attributable to treatment are in the areas of pain relief, improved psychological well-being, social functioning, and vitality. Dimenas et al and others have found that GERD patients report significantly worse mental health than the general population.

Health status research studies have consistently shown the effect of chronic medical and psychiatric conditions on HRQL. Persons reporting GERD and nocturnal GERD symptoms appear to have decrements in HRQL similar to those of persons with other chronic diseases. Those in the nocturnal GERD symptom group report more pain than persons with diabetes and hyper-

### Table 4. Mean Medical Outcomes Study Short-Form 36 Health Survey Scores for Nocturnal Gastroesophageal Reflux Disease (GERD), Hypertension, Type 2 Diabetes, Congestive Heart Failure, Clinical Depression, and Angina Groups*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Nocturnal GERD</th>
<th>Hypertension</th>
<th>Type 2 Diabetes</th>
<th>Congestive Heart Failure</th>
<th>Clinical Depression</th>
<th>Angina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>76.5</td>
<td>73.4</td>
<td>67.7†</td>
<td>47.5†</td>
<td>71.6†</td>
<td>63.2†</td>
</tr>
<tr>
<td>Role limitations–physical</td>
<td>62.1</td>
<td>62.0†</td>
<td>56.8†</td>
<td>34.4†</td>
<td>44.4†</td>
<td>44.2†</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>62.1</td>
<td>72.3†</td>
<td>68.5†</td>
<td>62.7</td>
<td>58.8</td>
<td>61.6</td>
</tr>
<tr>
<td>General health</td>
<td>62.5</td>
<td>63.3</td>
<td>56.1†</td>
<td>47.1†</td>
<td>52.9†</td>
<td>52.0†</td>
</tr>
<tr>
<td>Vitality</td>
<td>48.9</td>
<td>58.3†</td>
<td>55.7†</td>
<td>44.3</td>
<td>40.1†</td>
<td>48.5</td>
</tr>
<tr>
<td>Social functioning</td>
<td>79.2</td>
<td>86.7†</td>
<td>82.0</td>
<td>71.3</td>
<td>57.2†</td>
<td>80.3</td>
</tr>
<tr>
<td>Role limitations–emotional</td>
<td>75.2</td>
<td>76.7</td>
<td>75.6</td>
<td>65.7†</td>
<td>38.9†</td>
<td>70.2</td>
</tr>
<tr>
<td>Mental health</td>
<td>70.7</td>
<td>77.9†</td>
<td>76.7†</td>
<td>74.7</td>
<td>46.3†</td>
<td>73.0</td>
</tr>
<tr>
<td>Physical component summary</td>
<td>45.1</td>
<td>44.3</td>
<td>41.5†</td>
<td>34.5†</td>
<td>45.0</td>
<td>38.6†</td>
</tr>
<tr>
<td>Mental component summary</td>
<td>48.2</td>
<td>52.2†</td>
<td>51.9†</td>
<td>50.4</td>
<td>34.8†</td>
<td>50.4</td>
</tr>
</tbody>
</table>

*Norms for hypertension, type 2 diabetes mellitus, congestive heart failure, clinical depression, and angina were obtained from the SF-36 Health Survey: Manual and Interpretation Guide.

### Table 5. Adjusted Medical Outcomes Study Short-Form 36 Health Survey Scores by Number of Nocturnal Gastroesophageal Reflux Disease (GERD) Symptoms*

<table>
<thead>
<tr>
<th>Scale</th>
<th>No. of Nocturnal GERD Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>80.5 (1.2) 77.4 (1.1) 76.5 (1.4) 71.5 (1.8) 65.0 (2.6)</td>
</tr>
<tr>
<td>Role limitations–physical</td>
<td>79.9 (1.9) 75.5 (1.8) 69.4 (2.2) 59.4 (2.9) 50.9 (4.2)</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>71.1 (1.3) 66.5 (1.2) 62.5 (1.4) 55.4 (1.9) 55.4 (2.8)</td>
</tr>
<tr>
<td>General health</td>
<td>68.2 (1.1) 66.6 (1.0) 63.3 (1.2) 57.3 (1.7) 55.2 (2.4)</td>
</tr>
<tr>
<td>Vitality</td>
<td>54.9 (1.2) 53.4 (1.1) 48.7 (1.3) 43.6 (1.7) 44.0 (2.5)</td>
</tr>
<tr>
<td>Social functioning</td>
<td>85.1 (1.3) 84.0 (1.2) 79.3 (1.4) 73.4 (1.9) 70.9 (2.8)</td>
</tr>
<tr>
<td>Role limitations–emotional</td>
<td>88.8 (1.8) 83.6 (1.7) 76.6 (2.0) 71.7 (2.7) 64.7 (3.8)</td>
</tr>
<tr>
<td>Mental health</td>
<td>76.6 (1.0) 75.2 (1.0) 70.9 (1.1) 66.2 (1.5) 61.1 (2.2)</td>
</tr>
<tr>
<td>Physical component summary</td>
<td>47.3 (0.5) 46.0 (0.5) 45.1 (0.6) 42.5 (0.8) 40.9 (1.2)</td>
</tr>
<tr>
<td>Mental component summary</td>
<td>51.6 (0.6) 51.0 (0.5) 48.4 (0.6) 46.5 (0.9) 44.7 (1.2)</td>
</tr>
</tbody>
</table>

*Analysis of covariance, adjusting for age, sex, and comorbidity. Data are presented as mean (SE).

†Control subjects and subjects without nocturnal GERD symptoms.

‡Overall test of between-group differences by number of nocturnal GERD symptoms.

§†P < .001 compared with nocturnal GERD.
tension and have comparable pain levels to those with angina. Social functioning is also impaired. Respondents who reported nocturnal GERD symptoms also were more likely to experience more psychological distress and interference with social activities. Similarly, Revicki et al also demonstrated that GERD patients had worse emotional well-being and more pain-related problems compared with other chronic medical disease groups.

Generic HRQL scores varied significantly by the number of symptoms reported in GERD and nocturnal GERD symptoms. Significant, although small to moderate, correlations were observed between GERD-related symptoms and the HRQL measures. However, smaller correlations are often observed in large sample studies compared with small sample studies because of statistical and distributional reasons. Patients with a greater number of GERD-related symptoms, especially nocturnal symptoms, report more impairments in functioning and well-being. These results support the discriminant validity of the SF-36 in GERD populations. The largest differences were seen in measures of pain, mental health, vitality, and social functioning. These results are consistent with the findings of several clinical trials that evaluated the impact of treatments for GERD on HRQL. In these clinical trials, the largest and most consistent significant effects were seen on measures of pain, mental health, and social functioning. The present study results and those of Revicki et al and Chal et al indicate that the SF-36 is responsive enough to detect differences in HRQL in patients with GERD.

This study has several limitations. First, the comparisons of mean SF-36 subscale and summary scores for the US and chronic disease normative groups and the GERD sample were based on published data. There are differences between the MOS and our sample on demographic characteristics that may have affected the findings. Participants in the MOS were by definition patients, whereas our study was a population-based national random sample. The MOS population is slightly older and contains a smaller percentage of females than the present study sample. Unfortunately, it was not possible to control for age, sex, race/ethnicity, and education in the comparisons between the GERD and chronic disease groups from the MOS. Since the chronic disease groups were for the most part older than the study sample, they were more likely to have worse SF-36 scores. Therefore, when the nocturnal GERD group reported significantly lower scores, these are probably true differences, since we would expect (other things being equal) that older persons would have lower scores across most SF-36 domains. Furthermore, differences in SF-36 summary scores were seen between the GERD and US general population after stratifying by age and sex groups. Second, there may be differences in severity of comorbidity between this study sample and participants in the MOS chronic disease groups. Severity and extent of comorbidity would likely attenuate HRQL scores. Third, the study population consisted of a 70:30 male-female ratio, significantly different from the US general population. This may have added some bias to the study results. Finally, the structure of the survey made it impossible to identify only individuals with nocturnal GERD-related symptoms. Thus, we could only draw conclusions regarding those individuals with frequent GERD-related symptoms who also had nocturnal symptoms rather than discussing impairment of HRQL that is directly associated with nocturnal reflux.

An important strength of this study is that it is population based rather than clinic based. Most patients with GERD do not seek medical care, so studies limited to clinic-based populations do not address the broader population of GERD. Therefore, these results may be generalizable to the larger general population and reflect the burden of illness for those persons experiencing frequent GERD and nocturnal GERD symptoms.

In conclusion, nocturnal symptoms and problems are very common in persons with frequent symptoms of GERD. The presence of nocturnal GERD symptoms exacerbates the impact of this medical condition on HRQL across all domains of functioning and well-being. Persons with nocturnal symptoms associated with GERD experience significant impairments in HRQL compared with the US general population. The effect of nocturnal GERD symptoms on HRQL is greatest on measures of pain, psychological well-being, and social functioning. The frequency and number of GERD-related symptoms are directly associated with patient functioning and well-being, and the impact of nocturnal symptoms adds to this impairment in HRQL. Effective medical treatment for GERD and nocturnal symptoms will likely improve patient functioning and well-being that is HRQL.

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