Prevalence of Lower Urinary Tract Symptoms and Effect on Quality of Life in a Racially and Ethnically Diverse Random Sample

The Boston Area Community Health (BACH) Survey

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Background: Previous studies of lower urinary tract symptoms (LUTS) have focused on men, with few studies including minority populations. The Boston Area Community Health (BACH) Survey is designed to study the prevalence and impact of LUTS among both men and women in a racially, ethnically, and socioeconomically diverse population.

Methods: The BACH Survey used a stratified 2-stage cluster design to randomly sample 5506 adults aged 30 to 79 from the city of Boston, Mass (2301 men, 3205 women, 1770 blacks, 1877 Hispanics, and 1859 whites). Data were obtained using interviewer and self-administered questionnaires. The presence of LUTS was defined as an American Urological Association symptom index score of 8 or above. Quality of life was assessed using the Medical Outcomes Study 12-Item Short Form Survey (SF-12), and a measure of bother was based on the interference of urinary symptoms with various activities. Analyses were weighted to the Boston population using SUDAAN version 9.0 statistical software.

Results: The overall prevalence of LUTS was 18.7% and increased with age (10.5% at age 30-39 years to 25.5% at age 70-79 years) but did not differ by sex or race/ethnicity. Quality of life was significantly reduced among those with LUTS, as measured by the bother of symptoms and the SF-12 component scores. Prevalence of prescription medication use for urinary symptoms was low even among participants with LUTS, with more than 90% of participants reporting no medication use.

Conclusions: In this population-based, racially and ethnically diverse random sample, LUTS were common among both men and women and increased substantially with age. Lower urinary tract symptoms had a negative impact on quality of life across age, sex, and race/ethnic groups.

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Symptoms of voiding dysfunction are common in both aging women and men. The term lower urinary tract symptoms (LUTS) is now universally recognized as the preferred terminology to describe a constellation of symptoms that may be caused by multiple pathologic conditions such as benign prostatic obstruction or detrusor overactivity. Prior studies of the prevalence of LUTS have focused primarily on men, with few studies including minority populations. In addition, prevalence estimates among men based on data from the Third National Health and Nutrition Examination Survey are available by race/ethnic groups but do not include the full spectrum of urinary symptoms. The importance of LUTS to public health is underscored by its impact on quality of life, the high estimates of direct and lost opportunity costs for benign prostatic hyperplasia, and the development of pharmaceuticals and interventions for LUTS. Furthermore, data on the prevalence of pharmacologic therapy for LUTS on a population level are lacking. Consequently, currently available estimates of the health burden ascribed to voiding dysfunction are, at best, imperfect.

The Boston Area Community Health (BACH) Survey addresses these issues by comprehensively measuring LUTS, quality of life, and medication use in a population-based, racially and ethnically diverse random sample of both men and women.
OVERALL DESIGN

The BACH Survey is a population-based, random sample epidemiologic survey of a broad range of urologic symptoms. The study design is a stratified, 2-stage cluster sample. A total of 5506 men and women were recruited (2301 men, 3205 women, 1770 blacks, 1877 Hispanics, and 1859 whites) between April 2002 and June 2005.

STRATIFIED, 2-STAGE CLUSTER SAMPLE

The city of Boston, Mass, was stratified into 12 groups defined by 4 geographic areas (obtained by grouping Boston’s planning districts) and 3 levels of minority density (low-density minority [primarily white], high-density black [at least 25% of the residents were black], and high-density Hispanic [at least 30% of the residents were Hispanic]). Census blocks were randomly sampled from 4266 blocks in the city of Boston by stratum. Households from selected census blocks were identified using a current Boston resident list, which had been geocoded with census tract and block information for each individual. Households were screened either by telephone or by a field visit. Screeners were completed for 36.0% of the selected households, 30.0% of the households refused screening, and 34.0% of the households could not be contacted after at least 16 attempts to reach them by mail, telephone, or field visit. The BACH Survey eligibility criteria included the following: screened eligible from the selected household, competent to sign informed consent, and able to speak English or Spanish well enough to complete the survey. Interviews were completed, with 63.3% of the screener-identified eligible individuals from the selected households.

Because of design requirements, the BACH Survey subjects had unequal probabilities of selection into the study. For analyses to be representative of the city of Boston, it was necessary to weight observations inversely proportional to their probability of selection into the study.14 Weights were further post-stratified to the population of Boston according to the US 2000 Census.

DATA COLLECTION

Data were obtained during a 2-hour, in-person interview, conducted by a trained bilingual phlebotomist-interviewer generally in the subject’s home. All protocols and informed consent procedures were approved by the institutional review board of the New England Research Institutes. Information was obtained on medical and reproductive history, major comorbid conditions, lifestyles, psychosocial factors, medical care utilization, and detailed self-reported major symptoms of different urogynecologic conditions.

ASSESSMENT AND DEFINITION OF LUTS

Lower urinary tract symptoms were assessed using the American Urological Association symptom index (AUA-SI). The AUA-SI is a validated instrument with excellent test-retest reliability; it is widely used and has a validated and reliable Spanish version.15,16 For the purposes of this analysis, the presence of LUTS was defined as an AUA-SI symptom score of 8 or above (moderate or severe). The AUA-SI, originally developed as a symptom index for benign prostatic hyperplasia,16 is widely used in epidemiologic studies to quantify urinary symptoms. Although, to our knowledge, there are no studies validating the AUA-SI in women, studies conducted among both healthy individuals and patients with voiding difficulties have shown that women have AUA-SI scores similar to those of age-matched men.17-20 These results demonstrate that LUTS are not benign prostatic hyperplasia or sex specific. In addition, the AUA-SI has been used in epidemiologic studies of LUTS in women.3,10 Symptoms were further categorized as voiding (obstructive) symptoms (incomplete emptying, intermittency, weak stream, and hesitancy) and storage (irritative) symptoms (frequency, urgency, and nocturia), and a score was computed for each group.

BOther and quality of life

The bother of LUTS was assessed by a validated quality-of-life questionnaire for benign prostatic hyperplasia.21 A bother score was obtained by summing the scores from 7 questions (scores for answers to each question ranged from 0 [none of the time] to 4 [all of the time]) on the interference of urinary symptoms with various activities. Quality of life was assessed using the Medical Outcomes Study 12-item Short Form Survey (SF-12).22 Both the physical component score (PCS-12) and mental health component score (MCS-12) were obtained. These scores were standardized to have a mean (SD) of 50 (10).

MEDICATION USE

Medication use, prescription and over the counter, was recorded by asking patients to bring in all medications that they were taking. Prescription medications for LUTS were divided into 4 categories: nonselective α-blockers (doxazosin mesylate, terazosin hydrochloride, and prazosin hydrochloride), selective α-blockers (tamsulosin hydrochloride and alfuzosin hydrochloride), anticholinergic agents (tolterodine tartrate, oxybutynin chloride, and imipramine hydrochloride), and a 5α-reductase inhibitor (finasteride).

COVARIATES

Age was categorized into the following 10-year age groups: 30 to 39 years, 40 to 49 years, 50 to 59 years, 60 to 69 years, and 70 to 79 years. Self-reported race/ethnicity was defined as black, Hispanic, and white.

STATISTICAL ANALYSIS

Prevalence of LUTS was estimated as the proportion of subjects with an AUA-SI score of 8 or above and was reported overall, by age, sex, and race/ethnicity (black, white, and Hispanic). Age trends were assessed overall and by sex and race/ethnicity. Means of the AUA-SI, voiding and storage symptom scores, and bother score were compared by age, sex, race, and ethnicity. The impact of LUTS was assessed by comparing the means of the bother score and the physical and mental component scores of the SF-12 among those with and without LUTS overall and by age, sex, socioeconomic status, and race/sex groups. Prevalence of prescription medication use was reported overall by sex and by AUA-SI score (<8 or ≥8).

Multiple imputation methods were used to impute missing values on all variables with missing values.21 χ² Tests were used for comparison of proportions, and Wald F tests were used for comparisons of means, with a significance level set at P<.05. To account for the unequal probability of each respondent being selected, all analyses were weighted. Statistical analyses were conducted using SAS (SAS Institute Inc, Cary, NC) and SUDAAN (Research Triangle Institute, Research Triangle Park, NC) statistical software.
Data were collected on 5506 subjects (2301 men and 3205 women). Prevalence rates of LUTS (AUA-SI score ≥8) overall and by age, sex, and race/ethnicity are presented in Table 1. The overall prevalence was 18.7% and did not vary significantly by sex (18.7% among men and 18.6% among women; \( P = .96 \)) or by race/ethnicity (19.3% among blacks, 16.2% among Hispanics, and 18.9% among whites; \( P = .26 \)). Prevalence of LUTS increased by age from a rate of 10.5% at age 30 to 39 years to about 26% at 50 years and older ( \( P < .001 \)). Age trends were similar by sex (Figure 1) until age 60 years but diverged for the 60- to 69-year age group, in which prevalence among men peaked at around 35%, whereas it decreased slightly among women to about 21%. Age trends were similar by race/ethnicity.

Similar results were observed when using the AUA-SI as a continuous measure, with mean scores increasing by age (Table 1). Although differences by sex and race/ethnicity were statistically significant, actual differences in mean AUA-SI score were small, with a clinically insignificant difference of 0.4 in mean AUA-SI score between men and women and mean scores ranging between 3.68 and 4.43 for race/ethnicity categories. When examining voiding and storage symptoms separately, Table 1 shows that mean voiding scores are significantly higher in men compared with women (1.53 and 1.28, respectively; \( P = .04 \)), whereas the mean storage score is higher among women compared with men (3.21 vs 2.56; \( P < .001 \)). Mean voiding scores were comparable by race/ethnicity groups, whereas mean storage score differed by race/ethnicity ( \( P < .001 \)), with a lower mean among Hispanics (2.41) compared with blacks (3.03) and whites (2.94). As expected, both mean voiding score and mean storage score increased with age ( \( P < .001 \) for both).

The impact of LUTS on quality of life was assessed by comparing the bother score and both PCS-12 and MCS-12 scores among those with and without LUTS, overall and by sex and race/ethnicity (Table 2). The bother score was strongly correlated with the AUA-SI score; therefore, mean bother scores were significantly higher for those with LUTS compared with those without LUTS. Mean PCS-12 and MCS-12 scores were significantly lower among those with LUTS, with a difference of about half a standard deviation. These results were consistent by age, sex, and race/ethnicity. In addition, results were not altered after adjusting for the presence of self-reported comorbid conditions (cardiovascular disease, diabetes, and cancer). Adjusting for depressive symptoms assessed by the Center for Epidemiological Studies Depression scale, the difference in mean MCS-12 score was reduced but remained statistically significant (data not shown).

### Table 1. Weighted Prevalence Rate of LUTS (AUA-SI Score ≥8) and Weighted Mean of AUA-SI, Voiding, and Storage Scores by Age, Sex, and Race (the Boston Area Community Health Survey)

<table>
<thead>
<tr>
<th>Variable</th>
<th>No.*</th>
<th>Prevalence, % (SE)</th>
<th>AUA-SI Score, Mean (SE)</th>
<th>Voiding Score, Mean (SE)</th>
<th>Storage Score, Mean (SE)</th>
<th>( P ) value (F test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>30-39</td>
<td>1406</td>
<td>10.5 (1.4)</td>
<td>3.05 (0.16)</td>
<td>0.93 (0.10)</td>
<td>2.12 (0.09)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>40-49</td>
<td>1500</td>
<td>18.3 (1.7)</td>
<td>4.29 (0.20)</td>
<td>1.39 (0.10)</td>
<td>3.90 (0.12)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>50-59</td>
<td>1290</td>
<td>26.1 (1.9)</td>
<td>5.30 (0.23)</td>
<td>1.86 (0.13)</td>
<td>3.44 (0.12)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>60-69</td>
<td>844</td>
<td>26.5 (2.3)</td>
<td>5.55 (0.26)</td>
<td>1.74 (0.16)</td>
<td>3.81 (0.16)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>70-79</td>
<td>466</td>
<td>25.5 (2.9)</td>
<td>5.39 (0.35)</td>
<td>1.84 (0.18)</td>
<td>3.55 (0.21)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>P value (F test)</td>
<td></td>
<td></td>
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<tr>
<td>Sex</td>
<td></td>
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</tr>
<tr>
<td>Men</td>
<td>2301</td>
<td>18.7 (1.3)</td>
<td>4.08 (0.16)</td>
<td>1.53 (0.10)</td>
<td>2.56 (0.08)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Women</td>
<td>3205</td>
<td>18.6 (1.2)</td>
<td>4.49 (0.14)</td>
<td>1.28 (0.07)</td>
<td>3.21 (0.09)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>P value (F test)</td>
<td></td>
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<tr>
<td>Race/ethnicity</td>
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<tr>
<td>Black</td>
<td>1770</td>
<td>19.3 (1.5)</td>
<td>4.30 (0.17)</td>
<td>1.26 (0.09)</td>
<td>3.03 (0.11)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1877</td>
<td>16.2 (1.6)</td>
<td>3.68 (0.19)</td>
<td>1.27 (0.09)</td>
<td>2.41 (0.13)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>White</td>
<td>1859</td>
<td>18.9 (1.3)</td>
<td>4.43 (0.16)</td>
<td>1.49 (0.10)</td>
<td>2.94 (0.09)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>P value (F test)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>5506</td>
<td>18.7 (0.9)</td>
<td>4.30 (0.11)</td>
<td>1.40 (0.06)</td>
<td>2.90 (0.06)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Abbreviations: AUA-SI, American Urological Association symptom index; LUTS, lower urinary tract symptoms.

*Unweighted total frequencies.
Among those with LUTS, mean bother score increased with age, whereas mean PCS-12 score decreased with age overall. No age trend was noted for the MCS-12. Mean bother score was significantly higher among women compared with men (7.55 vs 4.81; \( P < .001 \)). Differences in mean bother scores by race/ethnicity were smaller (7.13, 5.09, and 6.04 for blacks, Hispanics, and whites, respectively; \( P = .03 \)). Mean PCS-12 score was significantly higher among men compared with women; however, the difference in scores was small (4.49 for men and 4.24 among women; \( P = .02 \)).

Overall, reported medication use was low (3.5% among men and 2.0% among women; \( P = .02 \)). Men primarily reported use of \( \alpha \)-blockers, whereas anticholinergic use was reported mainly by women (Table 3). Although the proportion reporting medication use was higher among those with an AUA-SI score of 8 or above compared with those with an AUA-SI score lower than 8 (9.8% vs 2.1% among men \( P < .001 \) and 7.2% vs 1.0% among women \( P < .001 \)), more than 90% of participants without LUTS did not report use of any prescription medication (Figure 2). There was no difference by sex in the proportion using medications among those with an AUA-SI score of 8 or above (\( P = .26 \)). Among those with an AUA-SI score lower than 8, the difference by sex was statistically significant but small (2.1% among men vs 1.0% among women; \( P = .009 \)).

**COMMENT**

The BACH Survey is a population-based study of the prevalence of LUTS, the associated impact on quality of life, and the extent of pharmacological management in a racially and ethnically diverse sample of both men and women. Overall, nearly 1 of 5 participants reported experiencing moderate to severe LUTS, and as expected, prevalence increased with age. Results were similar by sex and race/ethnicity. Increased severity of LUTS was associated with greater limitations of daily activities, and significant decrements in physical and mental well-being in every age, sex, and race/ethnicity category.

Prevalence estimates among men from the BACH Survey are comparable with results from previous studies conducted either in the United States (the Olmsted County Study [OCS] of Urinary Symptoms\( ^6 \) among white men and the Flint Men’s Health Study [FMHS]\( ^7 \) among black men), and in Sweden,\( ^8 \) Norway,\( ^7 \) and the UrEpik study\( ^7 \) (combining surveys from the Netherlands, France, United Kingdom, and South Korea). Prevalence rates among women younger than 60 years are slightly higher in the BACH Survey compared with the UrEpik study, whereas among women 60 years and older, the UrEpik study rates are higher. Prevalence rates among women from the UrEpik study consistently increase with age, whereas rates from the BACH Survey remain stable after age 50 years. Results from the BACH Survey are also consistent with reports from the Third National Health and Nutrition Examination Survey in that there were no differences by race in the prevalence of 4 urinary symptoms (incomplete emptying, hesitancy, weak stream, and nocturia).\( ^7 \)

Our findings are similar to those in the published literature when comparing the physical and mental health component scores of the SF-12 between those with and without LUTS, with consistently lower mean values.
score among those with LUTS by age, sex, and race/ethnicity groups. The reduction, due to LUTS, in mean PCS-12 score is comparable with the effect of other chronic disease such as diabetes, hypertension, and heart disease.25,26 The reduction in mean MCS-12 score among those with LUTS seems to be due primarily to the presence of depressive symptoms. Results from the Health Professionals Follow-up Study and the OCS using the SF-36 show poorer quality of life in terms of daily activities and anxiety and depressive mood among men with LUTS. Similar results were reported from an international study combining data from 4 countries (United States, France, Scotland, and Japan), in which worse quality of life correlated with increased severity of LUTs after adjusting for age.9 Studies including women have reported comparable results, with a higher mean bother score among women compared with men but no difference in the correlation between quality of life and severity of LUTS. A study comparing results from the OCS and the FMHS showed that more bother was reported by black men.27 Results from the present study show a lower mean bother score among black men compared with white men, with Hispanic men having the lowest mean bother score. Interference with daily activities among patients with chronic conditions is often cited as a metric for health impact. Our results show a strong correlation between the prevalence of LUTs and bother of these symptoms, with significantly higher mean bother scores among those with LUTS across age, sex, and race/ethnicity groups. These effects on daily lives are supported by reports of lost productivity and increased medical care for voiding dysfunction.12,28

Pharmacologic therapy, as a whole, is more readily accepted by patients and thus often recommended by health care providers as the initial treatment for LUTS.29 Our finding that 3.5% of men and 2.0% of women were currently taking some form of oral therapy for LUTS, though seemingly low, is not surprising when our prevalence estimates are also considered. The prevalence of prescription medication use among those with LUTS is, at less than 10% (9.8% among men and 7.2% among women), lower compared with the use of antihypertensive medication among US adults with hypertension (approximately 60%).30 Previous studies conducted among men and women older than 50 years have shown that more than 50% of patients with moderate to severe LUTS do not seek medical attention and more than 80% are not actively treated, with 17% of British men,31 13.3% of Danish men,32 and 9.5% of Danish women receiving treatment for voiding problems.32 We observed similar results among BACH participants older than 50 years, with 15.5% of men and 9.5% of women currently receiving pharmacologic therapy. Some studies have suggested that these symptoms are accepted as part of aging, not all patients are troubled by them and do not feel the need to be treated or have chosen watchful waiting over drug treatment.33,34 This suggests that there is a need to better inform patients about their condition and treatment possibilities and general practitioners about the high prevalence and underreporting of LUTS in the general population.

The rate of reported use of pharmacologic therapy was higher among men despite a comparable severity of LUTS among men and women and less bother reported by men. Although decision making at the individual patient level was not evaluated, we identified a different spectrum of symptoms between men and women. These data highlight a different pattern of LUTS among men and women. Mean voiding score was significantly higher among men, whereas mean storage score was significantly higher among women. This supports the notion that LUTS are associated with benign prostatic obstruction in men and detrusor overactivity in women.

### Table 3. Prevalence of Prescription Drug Use by Sex (the Boston Area Community Health Survey)*

<table>
<thead>
<tr>
<th>Prescription Drug Use</th>
<th>Men No.</th>
<th>Men % (SE)</th>
<th>Women No.</th>
<th>Women % (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonselective α-blockers (doxazosin mesylate, terazosin hydrochloride, and prazosin hydrochloride)</td>
<td>65</td>
<td>1.68 (0.29)</td>
<td>5</td>
<td>0.03 (0.03)</td>
</tr>
<tr>
<td>Selective α-blockers (tamsulosin hydrochloride and alfuzosin hydrochloride)</td>
<td>37</td>
<td>1.37 (0.27)</td>
<td>1</td>
<td>0.07 (0.07)</td>
</tr>
<tr>
<td>Anticholinergic agents (tolterodine tartrate, oxybutynin chloride, and imipramine hydrochloride)</td>
<td>15</td>
<td>0.37 (0.14)</td>
<td>56</td>
<td>2.01 (0.38)</td>
</tr>
<tr>
<td>5α-Reductase inhibitor (finasteride)</td>
<td>12</td>
<td>0.41 (0.14)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>3.51 (0.45)</td>
<td>60</td>
<td>2.04 (0.38)</td>
</tr>
</tbody>
</table>

*Note that dutasteride use was not reported by any participant.
over, our data are consistent in that men were mostly treated with α-blockers and 5α-reductase inhibitors, whereas women were almost always treated with an anti-cholinergic agent. Thus, the sex disparity in the use of prescription drug use may, in fact, reflect the greater availability and demonstrated efficacy of agents for benign prostatic hyperplasia rather than a sex-based discrimination.

There are many strengths to this study. The BACH Survey is a community-based, random sample of men and women across a broad age range (30-79 years) and includes large numbers of minority participants representative of both the African American and Hispanic populations. The BACH Survey is a study of self-reported urinary symptoms and thus captures undiagnosed urologic conditions, resulting in more accurate prevalence estimates of LUTS in the population. The use of the AUA-SI to quantify urinary symptoms is both a strength and a limitation in this study. The AUA-SI is a widely used validated instrument for quantifying urinary symptoms in men but is not a validated measure in women. However, previous studies have demonstrated that the AUA-SI is not sex or condition specific. Another criticism may stem from the fact that the BACH Survey was limited geographically to the Boston area. A comparison of sociodemographic and health-related variables from the BACH Survey with other large regional (Boston BRFSS [Behavioral Risk Factor Surveillance System]) and national (National Health and Nutrition Examination Survey, National Health Interview Survey, and national BRFSS) has shown that BACH estimates are comparable on health-related variables, suggesting that results can be generalized to the US population as a whole. Finally, it can be argued that our prevalence estimates are confounded by active therapies; however, our data suggest an overall low rate of prescription medication use, and when such patients were excluded, our primary findings and conclusions were not affected (data not shown).

The BACH Survey reveals a high prevalence of voiding dysfunction reflected as LUTS among both women and men. More importantly, the presence of moderate to severe LUTS is strongly associated with limitations in daily activities as well as decrements in quality of life. Furthermore, we describe a greater propensity for men to be currently treated with a prescription medication for LUTS than for women, despite comparable symptom severities and greater limitations in daily activities among women. These findings indicate that LUTS constitute a substantial burden in the general population.

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26. Wells KB, Sherbourne CD. Functioning and utility for current health of patients with depression or chronic medical conditions in managed, primary care practices. *Arch Gen Psychiatry*. 1999;56:897-904.


**Correction**

Error in Table. In the Review Article by Reid et al titled “Oxycodone for Cancer-Related Pain: Meta-analysis of Randomized Controlled Trials,” published in the April 24 issue of the *Archives* (2006;166:837-843), an error occurred on page 839 in Table 1. In that table, in the row pertaining to the study by Hagen and Babul, 17 1997, and the column titled “Intervention,” the hydromorphone-oxycodone ratio should have been listed as 0.24 rather than 1.6.