JAOA ORIGINAL CONTRIBUTION

Self-Reported Physical Health, Mental Health, and Comorbid Diseases Among Women With Irritable Bowel Syndrome, Fibromyalgia, or Both Compared With Healthy Control Respondents

Peter Przekop, DO, PhD; Mark G. Haviland, PhD; Yan Zhao, MD, PhD; Keiji Oda, MPH; Kelly R. Morton, PhD; and Gary E. Fraser, MD, PhD

Context: Physicians often encounter patients with functional pain disorders such as irritable bowel syndrome (IBS), fibromyalgia (FM), and their co-occurrence. Although these diseases are diagnosed exclusively by patients' report of symptoms, there are few comparative studies about patients' perceptions of these diseases.

Objective: To compare perceptions of these conditions among 4 groups—3 clinical groups of older women with IBS, FM, or both disorders (IBS plus FM) and 1 similarly aged control group of women with no IBS or FM—using their responses to survey questions about stressful life events, general physical and mental health, and general medical, pain, and psychiatric comorbidities.

Method: Using data from the Biopsychosocial Religion and Health Study survey, responses from women were compared regarding a number of variables. To compare stress-related and physical-mental health profiles across the 4 groups, 1-way analyses of variance and χ^2 tests (with Tukey-Kramer and Tukey post hoc tests, respectively) were used, with α set to .05.

Results: The present study comprised 3811 women. Participants in the control group, the IBS group, the FM group, and the IBS plus FM group numbered 3213 (84.3%), 366 (9.6%), 161 (4.2%), and 71 (1.9%), respectively, with a mean (standard deviation) age of 62.4 (13.6), 64.9 (13.7), 63.2 (10.8), and 61.1 (10.9) years, respectively. In general, participants in the control group reported fewer lifetime traumatic and major life stressors, better physical and mental health, and fewer comorbidities than respondents in the 3 clinical groups, and these differences were both statistically significant and substantial. Respondents with IBS reported fewer traumatic and major life stressors and better health (ratings and comorbidity data) than respondents with FM or respondents with IBS plus FM. Overall, respondents with both diseases reported the worst stressors and physical-mental health profiles and reported more diagnosed medical, pain, and psychiatric comorbidities.

Conclusion: The results revealed statistically significant, relatively large differences in perceptions of quality of life measures and health profiles among the respondents in the control group and the 3 clinical groups.

J Am Osteopath Assoc. 2012;112(11):726-735

Physicians routinely encounter patients with functional pain disorders, which often present complex treatment challenges. Two common and frequently studied functional pain disorders are irritable bowel syndrome (IBS) and fibromyalgia (FM).[1-3] Although formal diagnostic criteria have been published, both syndromes lack objective findings and, generally, the diagnosis is made on the basis of patient's self-reported symptoms.[4,5] Irritable bowel syndrome is characterized by chronic abdominal pain with altered bowel function,[4] whereas FM is a disease of chronic widespread pain and pain in at least 11 of 18 predetermined tender points.[5] In some studies,[6-8] patients with IBS and patients with FM reportedly have similar psychosocial, medical, and psychiatric profiles, and in several community and clinical studies,[9-12] a substantial number of patients have comorbid IBS and FM. Both diseases occur in approximately one-third of patients[2] when either IBS or FM is

From the departments of psychiatry, pediatrics, and medicine (Drs Przekop, Haviland, Zhao, Morton and Fraser), the School of Public Health (Mr Oda and Dr Fraser), and the School of Behavioral Health (Dr Morton) at Loma Linda University in California; the Betty Ford Center in Rancho Mirage, California (Dr Przekop); and the Western University College of Osteopathic Medicine of the Pacific in Pomona, California (Dr Przekop). Drs Haviland, Morton, and Fraser were co-investigators of the Biopsychosocial Religion and Health Study.

Financial Disclosure: Funding for this study was from the National Institute on Aging and from the National Cancer Institute for the parent study.

Address correspondence to Peter Przekop, DO, PhD, 2195 Club Center Dr, Suite A, San Bernardino, CA 92408-4162.

E-mail: pprzekop@llu.edu

Submitted May 8, 2012; revision received August 8, 2012; Accepted August 30, 2012.

the primary diagnosis.[13] Given the striking prevalence of comorbidity and similarities among individuals with these diseases, many investigators have hypothesized shared pathologic charactertistics[3-14] but with only partial success[15-19] at generating a unified explanation.

One study[20] reported patients with comorbid IBS and FM who scored lower on several indices (global feeling of wellness, sleep, anxiety, number of tender points, sense of coherence, concerns about illness and severity) than patients with IBS only and patients in a control group.[20] Similarly, patients with comorbid IBS and FM report lower health-related quality of life scores and more tender points than patients with IBS or FM and control group.[13-21] These results suggest that patients with both IBS and FM are more ill with a diminished quality of life than patients with either disease alone or control patients.

In many studies,[22-25] researchers have demonstrated the co-occurrence of IBS, FM, and psychiatric illnesses, which has generally been associated with more severe symptoms and less favorable outcomes. Moreover, traumatic events are associated with both increased prevalence and worse outcomes of IBS and FM; however, to our knowledge, no common interpretation has emerged.[26-29]

In previous research,[20-29] patients with IBS have been compared with patients with comorbid IBS and FM, but these comparisons never have included patients with FM only; nor did past studies evaluate more comprehensive indices, such as perceived general medical, pain, and psychiatric comorbidities. Such comparison might reveal a progressively worsening disease burden among these groups. In the present study, we include 3 clinical groups and compare self-reported perceptions of respondents' medical and mental health. The use of self-reported information may reveal differences in how patients understand these diseases and in how they perceive their disease burden. These individual perceptions may yield insight into a possible underlying process that contributes to disease progression and ultimately may contribute to more effective treatments for patients with these diseases. Specifically, we compared 4 groups of women drawn from the same population—controls (no IBS or FM), those with IBS only, FM only, and both IBS and FM—on the following self-reported measures: physical health and symptoms; mental health assessments; medical-pain-psychiatric comorbidities; and traumatic and major life stressor experiences. We hypothesized that respondents with neither disorder would report better perceived physical and mental health and fewer perceived stressful events than respondents in the 3 clinical groups. We further predicted that, with the exception of gastrointestinal symptoms, self-reported health scores and stress profile scores would worsen, respectively, from IBS to FM to respondents with both disorders.

Methods

Data Source

Data were drawn from the Biopsychosocial Religion and Health Study (BRHS).[30] From 2006 through 2007, BRHS investigators randomly sampled 20,000 of 96,194 individuals who participated in the Adventist Health Study 2 (AHS-2, 2002-2007)[31]; of these 20,000 individuals, 10,988 (54.9%) returned completed BRHS questionnaires. The AHS-2 evaluated data about cancer risk, diet, and lifestyle among Seventh-Day Adventist (SDA) church members living in the United States and Canada. The BRHS investigators, however, limited their sample to only members living in the United States. Participants in the BRHS were recruited from 1000 predominantly black and 3500 predominantly nonblack (largely white, but some Asian and Latino) churches and through SDA newspapers and television programs. The BRHS was a 410-question survey of adverse experiences in child and adulthood, religious engagement, and physical and mental health outcomes among SDA church members. We deemed 73 of the survey questions relevant for our analyses in the present study, including biographic-demographic, physical-mental health, stress, and medical history items. Both the AHS-2 and BRHS study protocols were approved with an expedited review by the Loma Linda University Institutional Review Board. Respondents consented by returning the questionnaire.

Sample Selection

Inclusion criteria for our study sample included women who identified themselves as white and who answered the survey questions regarding IBS and FM diagnoses. The numbers of men and nonwhite women with FM were too small and thus precluded meaningful analyses. Women were selected for the control group if they answered no to the IBS and the FM questions (ie,"Mark the bubbles below to show which conditions/diseases you have ever had diagnosed by a physician."). Women were assigned to the IBS group if they answered yes to the IBS question and no to the FM question. Women were assigned to the FM group if they answered yes to the FM question and no to the IBS question. Women were assigned to the IBS plus FM group if they answered yes to both the FM and the IBS questions.

Measures

Rationale

We evaluated a number of variables from the BRHS questionnaire. The selected variables were neither entirely independent nor redundant. We chose to be overinclusive, however, to facilitate comparisons among clinical data (eg, continuous measure of depression severity and a clinical diagnosis of depression in one's lifetime). Listed first are

the continuous physical-mental health variables, followed by the categorical (in all instances, yes/no) variables.

Physical Health—To measure physical health, we used body mass index (BMI); interpretive score ranges were obese (>30), overweight (25-29.9), and normal (18.5-24.9). We also used the Short Form-12, version 2 (SF-12v2) physical health composite[32] for an overall assessment of physical health. Scores ranged from 0 (lowest health level) to 100 (highest health level).

Body pain was measured by means of respondents' answers to the SF-12v2 question "During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?"[32] Ratings were on a 5-point scale, ranging from 1 (not at all) to 5 (extremely).

Physical Symptoms—Physical symptom frequency in the past month[33] was assessed by means of questions about how frequently respondents experienced headache, indigestion, constipation/diarrhea, and incontinence (ie, problem controlling urine or bowel movements). Each was rated on a 5-point scale: 1 (never), 2 (once), 3 (2-3 times), 4 (4-5 times), and 5 (>5 times) in the past month.

Sleep Quality—Sleep quality was assessed on the basis of averaged ratings of 3 items: trouble falling asleep, waking in the middle of the night with difficulty going back to sleep, and waking up very early with difficulty going back to sleep. Items were rated on a 4-point scale, from 1 (almost every day) to 4 (rarely or never). Lower scores indicated poor sleep quality and higher scores indicated good sleep quality. Total scores were expressed as mean (standard deviation [SD]) of available items (1 missing item was allowed).

Mental Health—We used the SF-12v2 mental health composite score[32] to assess overall mental health. Scores ranged from 0 (lowest mental health level) to 100 (highest level). For depressive symptom severity, we used the 11-item Center for Epidemiological Studies-Depression Scale (CES-D). Items are rated on a 3-point scale: 0, none/rarely; 1, occasionally or a moderate amount; and 2, most/all of the time. Scores were reported as the mean (SD) of completed items (2 missing items were allowed). Total scores were transformed to full 20-item CES-D equivalent scores[34]; scores greater than or equal to 16 may reflect clinical depression (a cut-point for screening, not diagnostic, purposes).

To assess neuroticism, we used the 8-item Big Five Inventory Neuroticism Scale.[35] This scale assessed psychological functioning in the past month. Items were rated on a 7-point scale (modified from the original 5-point scale), ranging from "not true" (1) to "very true"(7). Total score was expressed as mean (SD) of completed items (1 missing item was allowed).

Medical-Pain-Psychiatric Diagnoses: Comorbidities—Medical, pain, and psychiatric diagnoses were binary variables (yes=1, no=0) from responses to a section that began with, "Mark the bubbles below to show which conditions/diseases you have ever had diagnosed by a physician." The medical diagnoses included angina pectoris, asthma, type 2 diabetes mellitus, hypertension, hypothyroidism, and sleep apnea. The pain diagnoses were degenerative arthritis, degenerative disk disease, sciatica/arthritic back, and rheumatoid arthritis. The psychiatric diagnosis was depression.

Trauma and Major Life Stressors—Trauma and major life stress items were adapted from the Trauma Assessment in Adults scale and Ryff and colleagues' child abuse scales.[36-38] Respondents were asked about "different types of stressful or difficult life events." We classified the items as either traumatic experiences or major life stressors. The traumatic experiences are those that likely involved death threats, witnessing another person's death, threats of serious injury, or threats to physical integrity that elicited intense reactions, such as fear, helplessness, or horror.[39-41] We then grouped the items by trauma type:

- Life-threatening (4 questions regarding war, "really bad" accident [thoughts of death or severe injury], natural disaster, or witnessing someone seriously injured or killed)
- Emotional abuse or neglect (2 questions about "mother/woman who raised you" or "father/man who raised you" insulting, swearing at, or ignoring when respondents were between ages 5 and 15 years)
- Physical assault or abuse (2 assault questions, actual and threatened in participant's lifetime; 4 abuse questions from when respondents were between ages 5 and 15 years, mother or father pushing, slapping, throwing objects, kicking, biting, striking with an object)
- Sexual assault/abuse (3 questions regarding actual and threatened events in one's lifetime)

The major life stressors (single yes/no items) were serious illness (eg, cancer, leukemia, AIDS, multiple sclerosis), abortion (for self or intimate partner), miscarriage (for self or intimate partner), divorce or separation, homelessness, and death of a child. For each of these 5 trauma and stressor variables, respondents were scored 0 points in the category if all responses were "no/never" and were scored 1 point if they answered "yes" to any of the questions in the category.

Data Analysis

For continuous data, we used 1-way analysis of variance (4 groups: control, IBS, FM, and IBS plus FM). Residual plots were inspected visually to check any deviation from analysis of variance (ANOVA) assumptions. For categorical data, we used 2 (yes/no) × 4 (participant group) χ^2 tests (one 3 × 4 for education, however). When the overall tests were statistically significant, we conducted either Tukey-Kramer tests (for continuous variables) or Tukey post hoc tests for proportions (for categorical variables) controlling the family-wise error rate.[42] We used SAS software (version 9.2; SAS Institute, Cary, North Carolina) for all tests of statistical significance, with α set at .05. Because available data were used for the various statistical tests, sample numbers vary across comparisons.

Results

Sample Sizes and Participants' Ages

There were 3811 respondents who met the study criteria. Women in the control group, the IBS group, the FM group, and the IBS plus FM group numbered 3213 (84.3%), 366 (9.6%), 161 (4.2%), and 71 (1.9%), respectively, with a mean (SD) age of 62.4 (13.6), 64.9 (13.7), 63.2 (10.8), and 61.1 (10.9) years, respectively.

Age and Education Comparisons

Age comparisons are shown as mean (SD) in *Table 1*. The overall ANOVA was statistically significant ($P<.05$), but the only statistically significant pairwise difference was that women in the control group on average were 2.5 years younger than those in the IBS group (Tukey-Kramer post hoc test, $P<.05$). Sample numbers and percentages for the education (high school or less, some college, college graduate or higher) comparisons also are shown in *Table 1*. The overall 3 × 4 χ^2 test was statistically significant ($P<.05$). The only statistically significant post hoc differences, however, were between women in the control group and the FM group (Tukey post hoc tests for proportions, $P<.05$); the proportion of college graduates was higher in the control group. On the basis of these results, we re-ran the comparisons adjusting for age and education; there were no material differences, and thus we present the unadjusted analyses.

General

We predicted that reports of comorbidities would increase from control participants to IBS to FM to IBS plus FM participants. *Table 2* reveals this pattern in the group comparisons on medical and pain diagnoses and CES-D (depressive symptom) scores. Details about the statistically significant ($P<.05$) pairwise differences are given in the next 4 sections.

Control and Clinical Group Comparisons

Table 3 shows the sample numbers and means (SDs) for the continuous physical health and symptoms, sleep quality, and mental health measures. All overall 1-way ANOVA tests were statistically significant. With 2 exceptions, women in the control group reported better physical and mental health, less pain, fewer physical symptoms, and better sleep quality, as determined by post hoc pairwise tests. Differences in mean BMI between the control group (26.4) and the IBS group (27.0) and mean (SD) incontinence scores

Table 1.
Age and Education of Women in the Control Group and Women With Irritable Bowel Syndrome, Fibromyalgia, or Both Disorders (N=3811)[a]

Variable	Control (n=3213)	IBS (n=366)	FM (n=161)	IBS+FM (n=71)
Age[b]				
No. (%)	3163 (98.4)	360 (98.4)	158 (98.1)	69 (97.2)
Mean (SD), years	62.4 (13.6)	64.9 (13.7)	63.2 (10.8)	61.1 (10.9)
Education Level, No. (%)[c]				
High school or less	627 (19.6)	71 (19.6)	35 (21.7)	14 (20.0)
Some college[d]	1325 (41.4)	165 (45.6)	85 (52.8)	35 (50.0)
College graduate or higher[d]	1247 (39.0)	126 (34.8)	41 (25.5)	21 (30.0)

[a] The number of respondents varies because of missing responses.

[b] Overall 1-way analysis of variance was statistically significant, $P<.05$; control and IBS differences were statistically significant, $P<.05$, using Tukey-Kramer post hoc tests.

[c] Overall 3×4 χ^2 test was statistically significant $P<.05$.

[d] Control and FM differences were statistically significant, $P<.05$, using Tukey post hoc tests.

Abbreviations: FM, fibromyalgia; IBS, irritable bowel syndrome; SD, standard deviation.

between the control group and the FM group (1.7 [1.3] for both groups) were not statistically significant. The mean physical health composite score for women aged 55 to 64 years in the normative sample was 46.28. The mean mental health composite score for the same population in the normative sample was 50.14.

Table 2 displays sample numbers and percentages for the medical, pain, and psychiatric diagnoses and trauma/stressor variables (all categorical or yes/no). All overall χ^2 tests were statistically significant. With the exception of type 2 diabetes mellitus and rheumatoid arthritis, the control group showed statistically significant lower rates of general medical, pain, and psychiatric diagnoses than the IBS group. The percentage point differences were substantial, particularly between the control group and the IBS plus FM group. The widest percentage point differences were recorded for hypothyroidism (16.1% [control] and 52.2% [IBS plus FM]) and sleep apnea (3.8% [control] and 24.6% [IBS plus FM]).

Compared with the FM group, the control group reported lower rates of physical, sexual, and emotional trauma and lower major life stressor rates than those in the FM group (range, 10.2%-15.7%). Except in the category of type 2 diabetes mellitus, the control group reported lower rates of general medical, pain, and psychiatric diagnoses than the FM group.

Comparisons across all variables between the control and FM groups and the control and IBS plus FM groups were similar, with 2 exceptions. We observed no statistically significant differences between the control and IBS plus FM groups for variables in the emotional abuse/neglect category and for rheumatoid arthritis rates. There were no statistically significant differences between the control and IBS groups for the trauma/major life stressor variables.

Table 2.
Diagnoses and Trauma/Stressors of Women in the Control Group and Women With Irritable Bowel Syndrome, Fibromyalgia, or Both Disorders (N=3811)[a]

	Control (n=3213)		IBS (n=366)		FM (n=161)		IBS+FM (n=71)	
Survey Questions	**n**	**Mean (SD)**	**n**	**Mean (SD)**	**n**	**Mean (SD)**	**n**	**Mean (SD)**
Medical Diagnoses								
Angina pectoris[b-d]	58	3194 (1.8)	22	361 (6.1)	13	161 (8.1)	8	68 (11.8)
Asthma[b-d]	279	3191 (8.7)	72	365 (19.7)	35	158 (22.2)	20	70 (28.6)
Type 2 diabetes mellitus	236	3203 (7.4)	44	365 (12.1)	19	161 (11.8)	9	70 (12.9)
Hypertension[b-d]	868	3181 (27.3)	147	362 (40.6)	60	159 (37.7)	32	70 (45.7)
Hypothyroidism[b-d,f,g]	505	3146 (16.1)	85	358 (23.7)	48	156 (30.8)	35	67 (52.2)
Sleep apnea[b-d,f]	122	3179 (3.8)	31	356 (8.7)	25	161 (15.5)	17	69 (24.6)
Pain Diagnoses								
Degenerative arthritis[b-d,f]	684	3177 (21.5)	143	358 (39.9)	80	159 (50.3)	42	70 (60.0)
Degenerative disk[b-f]	394	3172 (12.4)	81	361 (22.4)	64	158 (40.5)	27	69 (39.1)
Sciatica/arthritic back[b-f]	485	3182 (15.2)	111	363 (30.6)	70	160 (43.8)	37	68 (54.4)
Rheumatoid arthritis[c]	180	3179 (5.7)	42	360 (11.7)	20	161 (12.4)	8	70 (11.4)
Psychiatric Diagnosis								
Depression[b-g]	490	3176 (15.4)	101	356 (28.4)	65	159 (40.9)	45	70 (64.3)
Trauma/Stressors								
Trauma, life threatening	1562	3200 (48.8)	193	360 (53.6)	100	161 (62.1)	44	70 (62.9)
Trauma, physical[c,d]	1154	3212 (35.9)	156	365 (42.7)	83	161 (51.6)	38	71 (53.5)
Trauma, sexual[c,d]	996	3181 (31.3)	133	355 (37.5)	71	158 (44.9)	36	70 (51.4)
Trauma, emotional/neglect[c]	1049	3200 (32.8)	139	361 (38.5)	74	160 (46.3)	28	71 (39.4)
Major life stressors[c,d]	1911	3197 (59.8)	235	361 (65.1)	112	160 (70.0)	53	70 (75.7)

[a] All differences statistically significant, $P<.05$, 2×4 χ^2 test. The number of respondents vary because of missing responses.

[b] Statistically significant for control and IBS, $P<.05$, using Tukey post hoc test.

[c] Statistically significant for control and FM, $P<.05$, using Tukey post hoc test.

[d] Statistically significant for control and IBS+FM, $P<.05$, using Tukey post hoc test.

[e] Statistically significant for IBS and FM, $P<.05$, using Tukey post hoc test.

[f] Statistically significant for IBS and IBS+FM, $P<.05$, using Tukey post hoc test.

[g] Statistically significant for FM and IBS+FM, $P<.05$, using Tukey post hoc test.

Abbreviations: FM, fibromyalgia; IBS, irritable bowel syndrome

IBS and FM Group Comparisons

Regarding physical health and symptoms, sleep quality, and mental health (*Table 3*), the IBS group reported lower BMI, better physical health, and lower pain scores than the FM group. There were no statistically significant differences between the IBS and FM groups in headache score, sleep score, or the 3 mental health scores. As predicted, the IBS group compared with the FM group reported more symptoms of the following conditions, expressed as mean (SD): indigestion (2.9 [1.4] vs 2.5 [1.4]), constipation/diarrhea (2.9 [1.5] vs 2.0 [1.3]), and incontinence (2.4 [1.6] vs 1.7 [1.3]).

Percentages for diagnoses and trauma/stressors in *Table 2* were similar between the IBS and the FM groups. There were, however, 3 statistically significant differences: lower rates of diagnosed degenerative disk disease (22.4% vs 40.5%), sciatica/arthritis back (30.6% vs 43.8%), and depression (28.4% vs 40.9%) among women with IBS than those with FM.

IBS and IBS Plus FM Group Comparisons

Pairwise comparisons between IBS and IBS plus FM groups (*Table 3*) were statistically significant, with the exception of the incontinence and sleep quality categories. Respondents in the IBS plus FM group generally reported worse physical and mental health, more pain, and more physical symptoms than those in the IBS group. In *Table 2*, the IBS plus FM group reported higher rates of hypothyroidism, sleep apnea, degenerative arthritis, degenerative disk disease, sciatica/arthritis back, and depression diagnoses than those with IBS only. In general, the differences were substantial but not as large as between the control group and the IBS plus FM group.

Table 3.
Physical Health and Symptoms, Sleep Quality, and Mental Health Scores of Women in the Control Group and Women With Irritable Bowel Syndrome, Fibromyalgia, or Both Disorders (N=3811)[a]

	Control (n=3213)		IBS (n=366)		FM (n=161)		IBS+FM (n=71)	
Variable	**n**	**Mean (SD)**	**n**	**Mean (SD)**	**n**	**Mean (SD)**	**n**	**Mean (SD)**
Physical Health								
SF-12 physical health[b-f]	2950	48.6 (11.0)	330	43.5 (12.4)	145	37.1 (12.8)	65	34.9 (13.1)
SF-12 body pain[b-f]	3187	1.9 (1.1)	357	2.4 (1.2)	159	3.2 (1.3)	71	3.3 (1.2)
Body mass index[c-f]	3203	26.4 (6.3)	362	27.0 (6.4)	159	29.0 (7.5)	71	29.8 (9.1)
Physical Symptoms								
Headaches[b-d,f,g]	3190	2.3 (1.3)	361	2.8 (1.3)	160	2.8 (1.4)	71	3.3 (1.4)
Indigestion[b-g]	3179	2.0 (1.2)	355	2.9 (1.4)	161	2.5 (1.4)	67	3.5 (1.4)
Constipation/diarrhea[b-g]	3157	1.8 (1.1)	354	2.9 (1.5)	161	2.0 (1.3)	69	3.5 (1.5)
Incontinence[b,d,e,g]	3161	1.7 (1.3)	358	2.4 (1.6)	157	1.7 (1.3)	71	2.5 (1.6)
Sleep								
Sleep quality[b-d]	3187	3.3 (0.7)	358	3.0 (0.8)	159	3.0 (0.8)	71	2 .9 (0.8)
Mental Health[b-d,f,g]								
SF-12 mental health	2950	52.5 (8.9)	330	50.0 (9.4)	145	50.3 (11.5)	65	46.7 (10.4)
Depressive symptoms	3196	9.1 (8.5)	364	12.8 (9.9)	161	14.4 (10.1)	71	18.7 (10.5)
Neuroticism	3190	24.0 (8.9)	363	27.2 (9.0)	161	26.1 (9.3)	71	30.8 (9.6)

[a] All overall 1-way analysis of variance tests were statistically significant, $P<.05$. Scales for tests were as follows: SF-12 physical health, 0 (lowest level of health) to 100 (highest level of health); SF-12 body pain, 1 (pain did not interfere with work) to 5 (pain interfered extremely with work); physical symptoms, 1 (never experienced symptom during the month) to 5 (experienced symptom >5 times per month); sleep, average of 3 items (trouble falling asleep, waking in the middle of the night with difficulty falling asleep, waking up early with difficulty going back to sleep) on 4-point scale (1=almost every day; 4=rarely or never); SF-12 mental health, 0 (lowest level of mental health) to 100 (highest level of mental health); depressive symptoms, 11 items rated on a 3-point scale transformed to full 20-item CES-D scale where scores ⩾16 may reflect clinical depression; neuroticism, mean (SD) of 8 psychological function items rated on a 7-point (1=not true, 7=very true) scale, modified from the original 5-point scale. The number of respondents vary because of missing responses.

[b] Statistically significant for control and IBS, $P<.05$, using Tukey-Kramer post hoc test.

[c] Statistically significant for control and FM, $P<.05$, using Tukey-Kramer post hoc test.

[d] Statistically significant for control and IBS+FM, $P<.05$, using Tukey-Kramer post hoc test.

[e] Statistically significant for IBS and FM, $P<.05$, using Tukey-Kramer post hoc test.

[f] Statistically significant for IBS and IBS+FM, $P<.05$, using Tukey-Kramer post hoc test.

[g] Statistically significant for FM and IBS+FM, $P<.05$, using Tukey-Kramer post hoc test.

Abbreviations: CES-D, Center for Epidemiological Studies-Depression scale; FM, fibromyalgia; IBS, irritable bowel syndrome; SD, standard deviation; SF-12, Short Form-12.

FM and IBS Plus FM Group Comparisons

There were no statistically significant between-group differences on the physical health or sleep measures (*Table 3*). Women in the FM plus IBS group, however, reported more physical symptoms (ie, headaches, indigestion, constipation/diarrhea, and incontinence) and worse mental health scores than the FM group. Statistically significant differences were found between the IBS plus FM group and the FM group for hypothyroidism (52.2 vs 30.8) and depression (64.3 vs 40.9) (*Table 2*).

Comment

Group Differences

The differences in self-reported physical and mental health problems, comorbidities, and stressors between women in the control and clinical groups were substantial. Moreover, there was an increase in self-reported disease burden for women with FM, who reported more illness and more comorbidities than women with IBS (with the exception of gastrointestinal symptoms). Moreover, women with both disorders self-reported more overall disease burden than women in the IBS or FM groups.

Two previous clinical studies[20,21] reported less severe illness for patients with IBS as measured by health-related quality of life scores and number of tender points than for patients with IBS plus FM but more severe illness than for those in a control group. In another clinical study,[13] patients with IBS plus FM were less severely ill as measured by number and severity of symptoms than patients with IBS or FM or those in the control group. Overall, our respondents' self-reports parallel these findings. Variation within groups in disease burden is common for patients with IBS and FM. Patients with IBS, for example, are heterogeneous in disease manifestations. As reported by 3 studies,[12,13,21] some patients meet diagnostic criteria for IBS but are able to cope adequately and do not have to seek medical care, whereas others are less able to cope, are more ill, and seek medical care. Patients with FM also experience a wide range of pain, stiffness, distress, and restrictions, as reported by other studies.[43,44] Our data demonstrated substantial differences in overall perceived disease burden.

In the present study, respondents in each clinical group perceived themselves as more ill than the control group and disease burden perceptions worsened progressively from IBS to FM to IBS plus FM. Future studies may investigate how this apparent perceived disease burden may contribute to a patient's overall health status.

Shared Pathologic Characteristics

Taken together, our results suggest that the differences in perceived disease burden may contribute to the differences in self-reported health seen in these groups. Previous studies[45,47,48] have suggested that alterations of central nervous system function and hyperactivity of hypothalamic-pituitary-axis function may play critical pathophysiologic roles in IBS, FM, and chronic pain and that these effects may be additive and affect cognition.[45,47] Investigators recently demonstrated that patients with FM or FM plus IBS show deficits in the ability to change sensitivity and disengage from a pain stimulus,[48] suggesting that these diseases affect cognition, perception, and attention. This relationship between disease and pain perception may explain why functional pain syndromes respond to cognitive therapies.[49,50] Despite an interesting, growing, and somewhat consistent body of evidence, we are far from a unified theory that explains the underlying pathologic characteristics of functional disorders. Our data do not speak directly to this critical gap. Future studies may address shared underlying expressions of these disease states and the role that cognitions and perceptions may play in their progression.

Incontinence, Sleep, and BMI

Respondents with IBS reported worse incontinence than respondents in the FM group and in the control group. This is not surprising because IBS patients have a 5-fold increased incidence of incontinence related to diarrhea.[51] All disease groups reported worse perceived sleep quality compared with the control group. This result is similar to evidence from another study,[52] which demonstrated that sleep abnormalities have a negative effect on disease burden and progression. Obesity has been shown to affect disease progression and functional restrictions,[53] and the present study confirmed this finding in the data for the FM and IBS plus FM groups.

Pain-Related Interference

The general burden of perceived pain interference reported by respondents with IBS plus FM was more severe than for the respondents in the control group or the respondents with IBS. The patterns for perceived pain interference, for example, increased progressively from control group to IBS to FM to IBS plus FM groups, and correspondingly, perceived physical health progressively declined from control respondents to IBS to FM to IBS plus FM group. Increases in perceived pain may be explained by an increase in response or sensitivity to pain (ie, excitatory input), a lack of central regulation of pain (ie, inhibitory control), and by the altered perception of pain (ie, hyperalgesia, allodynia).[54,55] The effect of pain is seen in the progressive differences across groups, an effect that manifests as the perceived restriction that pain exerts on an individual.

Depressive Symptoms and Neuroticism

Average self-reported depressive symptoms and neuroticism scores for all clinical groups were statistically signif-

icantly higher than scores for the control group, and the IBS plus FM group reported higher scores than the IBS and the FM groups. In other studies,[22-25,52] researchers also have linked depression and anxiety (neuroticism in the present study) with disease burden and progression, and our results follow this same pattern.

Pain-Related Diagnoses

In general, pain-related diagnoses—whether typically made by means of objective findings (eg, osteoarthritis, degenerative disk disease, sciatica/arthritic back) or, as with IBS and FM, dependent on self-reported criteria (eg, headaches)—also increased progressively across groups. The only exception was rheumatoid arthritis, with a slightly increased rate seen in the FM group. An increase in headaches was expected, but we did not expect to find an increase in self-reported nonfunctional pain disorders that paralleled the frequency and severity of self-reported functional pain-related disorders. There is no obvious explanation for the finding or for any common causal relationship, and, although we are cautious in our interpretation, we view this finding as interesting and worthy of further study. Subsequent investigations may reveal that patients with functional pain disorders attend to physical and psychological symptoms in a progressive manner. This may reveal a common underlying pathology, which increases across groups in the present study.

Medical Diagnoses

A consistent increased frequency in the self-reported medical diagnoses of hypothyroidism, hypertension, asthma, angina pectoris, and sleep apnea was seen across all 4 groups. Although these diagnoses are self-reported, there is a consistent pattern to our findings. Respondents with IBS plus FM report more functional, psychiatric, pain-related, and general medical diagnoses than the other groups, and higher scores were reported by the control group, followed by the IBS, FM, and IBS plus FM groups. Such consistency makes it difficult to argue that functional disorders are simply psychiatric or somatic complaints. These findings underscore the need to search for an underlying process.

Trauma and Major Life Stressors

Adverse life experiences can have dramatic effects on disease occurrence and progression, as demonstrated in previous studies of IBS and FM.[56,57] In all of the trauma/stressor categories evaluated in the present study, there was a consistent increase in self-reported events from the control group to IBS to FM to IBS plus FM groups. The largest statistically significant differences were between the control and FM groups and the control and IBS plus FM groups. Self-reported physical and sexual trauma and major life stressors were significantly increased in the FM and FM plus IBS groups compared with the control group, whereas significantly more emotional trauma and neglect were reported by the FM group compared with the control group. Further studies might examine these associations and investigate the complex relationship between environmental, cognitive, and genetic factors, an effort that with time may lead to a unified explanation of functional disorders.

Study Strengths

The present study's relatively large community sample included a sufficient number of women with self-reported disorders, which allowed for meaningful cross-group statistical comparisons. The BRHS survey contained very detailed information about demographics, health-related factors, and traumatic and stress-related events. Moreover, much of the information was derived from standardized physical and mental health questionnaires commonly used in research and clinical practice, and particularly in published studies of trauma and FM.[28,53]

Study Limitations

The present study has several limitations. First, this cross-sectional study is limited to 1 point in the participants' lives, and we cannot say whether there is variation across groups in the causes and consequences of pain. Moreover, the present study is a secondary data analysis and, thus, we depended on available data. Second, the response rate to the BRHS survey was slightly higher than 50%. The response rate from older white women, however—the group from which the present samples were drawn—was more than 60%. Third, we limited our analyses to white women affiliated with 1 Protestant denomination (Seventh-Day Adventist), and this may have introduced a systematic reporting bias and limited generalizability. Fourth, our IBS and FM criteria were self-reported, physician-given diagnoses, and although we primarily were interested in participants' perceptions, we have no corroborating data from treating physicians or medical records. Fifth, although our trauma and stressor categories were based on a defensible and conventional classification scheme, it is imperfect because we do not have data on individual reactions. Thus, we cannot be certain that participants with "yes" responses to the emotional abuse/neglect questions, for example, in fact reported a "traumatic" event or that serious illness (as defined in the present study) is best thought of as a major life stressor and not a traumatic experience.[41] Finally, although we had type I error protection within the various statistical tests (ie, post hoc tests), we did not have this same protection across the ANOVA and χ^2 tests that preceded them. Despite this, however, we are confident in our findings.

Conclusion

The present study revealed perceived differences in present and past stressors, pain restrictions, and mental and physical health between women in the control group and women in the 3 clinical groups. Our 3 clinical groups reported substantial, statistically significant, and worsening perceptions of their disease burden. Our data reveal differences in the way each group perceives disease burden, and these perceptions appear to diverge from the traditional medical pathology. As future research data accumulate, this view may inform more accurate decisions about effective management strategies and approaches[50] when offering care to these often difficult-to-treat patients, and osteopathic techniques should be included in treatment planning.

References

1. Sperber AD, Drossman DA. Review article: the functional abdominal pain syndrome. *Aliment Pharmacol Ther.* 2011;33(5):514-524.

2. Sperber AD, Dekel R. Irritable bowel syndrome and co-morbid gastrointestinal and extra-gastrointestinal functional syndromes. *J Neurogastroenterol Motil.* 2010;16(2):113-119.

3. Weir PT, Harlan GA, Nkoy FL, et al. The incidence of fibromyalgia and its associated comorbidities: a population-based retrospective cohort study based on International Classification of Diseases, 9th Revision codes. *J Clin Rheumatol.* 2006;12(3):124-128.

4. Longstreth GF, Thompson WG, Chey WD, Houghton LA, Mearin F, Spiller RC. Functional bowel disorders [published correction appears in *Gastroenterology.* 2006;131:688]. *Gastroenterology.* 2006;130(5):1480-1491.

5. Wolfe F, Smythe HA, Yunus MB, et al. The American College of Rheumatology 1990 criteria for the classification of fibromyalgia—report of the multicenter criteria committee. *Arthritis Rheum.* 1990;33(2):160-172.

6. Veale D, Kavanagh G, Fielding JF, Fitzgerald O. Primary fibromyalgia and the irritable bowel syndrome: different expressions of a common pathogenetic process. *Br J Rheumatol.* 1991;30(3):220-222.

7. Gruber AJ, Hudson JI, Pope HG Jr. The management of treatment-resistant depression in disorders on the interface of psychiatry and medicine—fibromyalgia, chronic fatigue syndrome, migraine, irritable bowel syndrome, atypical facial pain, and premenstrual dysphoric disorder. *Psychiatr Clin North Am.* 1996;19(2):351-369.

8. Hudson JI, Goldenberg DL, Pope HG Jr, Keck PE Jr, Schlesinger L. Comorbidity of fibromyalgia with medical and psychiatric disorders. *Am J Med.* 1992;92(4):363-367.

9. Cremonini F, Talley NJ. Irritable bowel syndrome: epidemiology, natural history, health care seeking and emerging risk factors. *Gastroenterol Clin North Am.* 2005;34(2):189-204.

10. Saito YA, Schoenfield P, Locke GR III. The epidemiology of irritable bowel syndrome in North American: a systematic review. *Am J Gastroenterol.* 2002;97(8):1910-1915.

11. Hungin APS, Whorwell PJ, Tack J, Mearin F. The prevalence, patterns and impact of irritable bowel syndrome: an international survey of 40,000 subjects. *Aliment Pharmacol Ther.* 2003;17(5):643-650.

12. Wolfe F, Ross K, Anderson J, Russell IJ, Hebert L. The prevalence and characteristics of fibromyalgia in the general population. *Arthritis Rheum.* 1995;38(1):19-28.

13. Sperber AD, Atzmon Y, Neumann L, et al. Fibromyalgia in the irritable bowel syndrome: studies of prevalence and clinical implications. *Am J Gastroenterol.* 1999;94(12):3541-3546.

14. Fink P, Schröder A. One single diagnosis, bodily distress syndrome, succeeded to capture 10 diagnostic categories of functional somatic syndromes and somatoform disorders. *J Psychosom Res.* 2010;68(5):415-426.

15. Williams DA, Clauw DJ. Understanding fibromyalgia: lessons from the broader pain research community. *J Pain.* 2009;10(8):777-791.

16. Moshiree B, Price DD, Robinson ME, Gaible R, Verne GN. Thermal and visceral hypersensitivity in irritable bowel syndrome patients with and without fibromyalgia. *Clin J Pain.* 2007;23(4):323-330.

17. Tak LM, Cleare AJ, Ormal J, et al. Meta-analysis and meta-regression of hypothalamic-pituitary-adrenal axis activity in functional somatic disorders. *Biol Psychol.* 2011;87(2):183-194.

18. Vandvik PO, Wilhelmsen I, Ihlebaek C, Farup PG. Comorbidity of irritable bowel syndrome in general practice: a striking feature with clinical implications. *Aliment Pharmacol Ther.* 2004;20(10):1195-1203.

19. Markowitz M, Harris W, Ricci JF, et al. Comorbid conditions in patients with irritable bowel syndrome: data from a national IBS awareness registry. *Gastroenterology.* 2001;120(5 suppl 1):A231.

20. Sperber AD, Carmel S, Atzmon Y, et al. Use of the functional bowel disorder severity index (FBDSI) in a study of patients with the irritable bowel syndrome and fibromyalgia. *Am J Gastroenterol.* 2000;95(4):995-998.

21. Sperber AD, Carmel S, Atzmon Y, et al. The sense of coherence index and the irritable bowel syndrome: a cross-sectional comparison among irritable bowel syndrome patients with and without coexisting fibromyalgia, irritable bowel nonpatients, and controls. *Scand J Gastroenterol.* 1999;34(3):259-263.

22. Kato K, Sullivan PF, Evengård B, Pedersen NL. Chronic widespread pain and its comorbidities: a population-based study. *Arch Intern Med.* 2006;166(15):1649-1654.

23. Cole JA, Rothman KJ, Cabral HJ, Zhang Y, Farraye FA. Migraine, fibromyalgia, and depression among people with IBS: a prevalence study. *BMC Gastroenterol.* 2006;6:26.

24. Almansa C, Rey E, Sánchez RG, Sánchez AA, Díaz-Rubio M. Prevalence of functional gastrointestinal disorders in patients with fibromyalgia and the role of psychological distress. Clin Gastroenterol Hepatol. 2009;7(4):438-445.

25. Whitehead WE, Palsson OS, Levy RR, Feld AD, Turner M, Von KM. Comorbidity in irritable bowel syndrome. *Am J Gastroenterol.* 2007;102(12):2767-2776.

26. Drossman DA, Leserman J, Nachman G, et al. Sexual and physical abuse in women with functional or organic gastrointestinal disorders. *Ann Intern Med.* 1990;113(11):828-833.

27. Koloski NA, Talley NJ, Boyce PM. A history of abuse in community subjects with irritable bowel syndrome and functional dyspepsia: the role of other psychosocial variables. *Digestion.* 2005;72(2-3):86-96.

28. Haviland MG, Morton KR, Oda K, Fraser GE. Traumatic experiences, major life stressors, and self-reporting a physician-given fibromyalgia diagnosis. *Psychiatry Res.* 2010;177(3):335-341.

29. Perona M, Benasayag R, Perelló A, et al. Prevalence of functional gastrointestinal disorders in women who report domestic violence to the police. *Clin Gastroenterol Hepatol.* 2005;3(5):436-441.

30. Lee JW, Morton KR, Walters J, et al. Cohort profile: the biopsychosocial religion and health study (BRHS). *Int J Epidemiol.* 2009;38(6):1470-1478.

31. Butler TL, Fraser GE, Beeson WL, et al. Cohort profile: the Adventist Health Study-2 (AHS-2). *Int J Epidemiol.* 2008;37(2):260-265.

32. Ware JE Jr, Kosinski M, Dewey JE. *How to Score Version 2 of the SF-12® Health Survey.* Lincoln, RI: QualityMetric, Inc; 2002.

33. Pudrovska T, Schieman S, Pearlin LI, Nguyen K. The sense of mastery as a mediator in the association between economic hardship and health in late life. *J Aging Health.* 2005;17(5):634-660.

34. Kohout FJ, Berkman LF, Evans DA., Cornoni-Huntley J. Two shorter forms of the CES-D depression symptoms index. *J Aging Health.* 1993;5(2):179-193.

35. John OP, Srivastava S. The big five trait taxonomy: history, measurement, and theoretical perspectives. In: Pervin LA, John OP, eds. *Handbook of Personality: Theory and Research.* 2nd ed. New York, NY: The Guilford Press; 2001:102-138.

36. Ryff CD, Singer BH, Palmersheim KA. Social inequalities in health and well-being: the role of relational and religious protective factors. In: Brim OG, Ryff CD, Kessler RC, eds. In: *How Healthy Are We? A National Study of Well-Being at Midlife.* Chicago, IL: University of Chicago Press; 2004:90-123.

37. Cusack KJ, Frueh BC, Brady KT. Trauma history screening in a community mental health center. *Psychiatr Serv.* 2004;55(2):157-162.

38. McHugo GJ, Caspi Y, Kammerer N, et al. The assessment of trauma history in women with co-occurring substance abuse and mental disorders and a history of interpersonal violence. *J Behav Health Serv Res.* 2005;32(2):113-127.

39. Lazarus RS, Folkman S. *Stress, Appraisal, and Coping.* New York, NY: Springer Publishing Co; 1984.

40. Shalev AY. Stress versus traumatic stress: from acute homeostatic reactions to chronic psychopathology. In: van der Kolk BA, McFarlane AC, Weisaeth L, eds. *Traumatic Stress: the Effects of Overwhelming Experience on Mind, Body, and Society*. New York, NY: The Guilford Press; 1996:77-101.

41. *Diagnostic and Statistical Manual of Mental Disorders.* Text rev, 4th ed. Washington, DC: American Psychiatric Association; 2000.

42. Elliot AC, Reisch JS. Implementing a multiple comparison test for proportions in a 2×c crosstabulation in SAS. Paper presented at: 31st Annual SAS Users Group International (SUGI) Conference; March 26-29, 2006; San Francisco, CA. Paper 204-31. http://www2.sas.com/proceedings/sugi31/204-31.pdf. Accessed August 22, 2012.

43. De Souza JB, Goffaux P, Julien N, Potvin S, Charest J, Marchand S. Fibromyalgia subgroups: profiling distinct subgroups using the fibromyalgia impact questionnaire—a preliminary study. *Rheumatol Int.* 2009;29(5):509-515.

44. Giesecke T, Williams DA, Harris RE, et al. Subgrouping of fibromyalgia patients on the basis of pressure-pain thresholds and psychological factors. *Arthritis Rheum.* 2003;48(10):2916-2922.

45. Gracely RH, Geisser ME, Giesecke T, et al. Pain catastrophizing and neural responses to pain among persons with fibromyalgia. *Brain.* 2004;127(pt 4):835-843.

46. Kwan CL, Diamant NE, Pope G, Mikula K, Mikulis DJ, Davis KD. Abnormal forebrain activity in functional bowel disorder patients with chronic pain. *Neurology.* 2005;65(8):1268-1277.

47. Corrigan FM, Fisher JJ, Nutt DJ. Autonomic dysregulation and the Window of Tolerance model of the effect of complex emotional trauma. *J Psychopharmacol.* 2010;25(1):17-25.

48. Becker S, Kleinböhl D, Baus D, Hölzl R. Operant learning of perceptual sensitization and habituation is impaired in fibromyalgia patients with and without irritable bowel syndrome. *Pain.* 2011;152(6):1408-1417.

49. Kroenke K, Swindle R. Cognitive-behavioral therapy for somatization and symptom syndromes: a critical review of controlled clinical trials. *Psychother Psychosom.* 2000;69(4):205-215.

50. Przekop P, Przekop A, Haviland MG, Riggs M. Neurocognitive enhancement for the treatment of chronic pain. *J Bodywork Movement Ther.* 2010;14(4):334-335.

51. Drossman DA, Sandler RS, Broom CM, McKee DC. Urgency and fecal soiling in people with bowel dysfunction. *Dig Dis Sci.* 1986;31(11):1221-1225.

52. Okifuji A, Donaldson GW, Barck L, Fine PG. Relationship between fibromyalgia and obesity in pain, function, mood, and sleep. *J Pain.* 2010;11(12):1329-1337.

53. Przekop P, Haviland MG, Morton KR, Oda K, Fraser GE. Correlates of perceived pain-related restrictions among women with fibromyalgia. *Pain Med.* 2010;11(11):1698-1706.

54. Crofford LJ. Violence, stress, and somatic syndromes. *Trauma Violence Abuse.* 2007;8(3):299-313.

55. Baraniuk JN, Whalen G, Cunningham J, Clauw DJ. Cerebrospinal fluid levels of opioid peptides in fibromyalgia and chronic lower back pain. *BMC Musculoskeletal Disorders.* 2004;5:48.

56. Roy-Byrne PP, Davidson KW, Kessler RC. Anxiety disorders and comorbid medical illness. *Gen Hosp Psychiatry.* 2008;30(3):208-225.

57. Bradley RG, Binder EB, Epstein MP, Tang Y. Influence of childhood abuse on adult depression: moderation by the corticotropin-releasing hormone receptor gene. *Arch Gen Psychiatry.* 2008;65(2):190-200.