Widespread Pain and Fibromyalgia in a Biracial Cohort of Young Women

STUART A. GANSKY and OCTAVIA PLESH

ABSTRACT. ***Objective.*** To assess the distribution of widespread pain, tenderpoints (TP), and fibromyalgia (FM) in young African American (AA) and Caucasian (C) women.

Methods. A community population of 1334 young (21-26 yrs old) women (684 AA and 650 C) was surveyed and classified for body pain spread [chronic widespread pain (CWP), axial regional chronic pain (RCP), nonaxial RCP, or no pain]. Of these women, 553 were examined for TP based on American College of Rheumatology criteria.

Results. Overall, 5.6% reported CWP, while 22% reported axial RCP, and 16% reported nonaxial RCP. From the CWP group, 57% were confirmed as FM cases. C women had significantly more TP and greater TP pain score than AA women ($p \leq 0.005$). Overall FM prevalence was 2.4% (95% confidence interval: 1.7–3.5%), with 3.0% in AA and 2.0% in C women. Increase in body pain and tenderness was significantly associated with decreased subjective socioeconomic status (SSS), worse self-reported health, greater impact of premenstrual symptoms on activities, and greater depressive symptoms. The effect of depressive symptoms on pain differed by race.

Conclusions. Widespread pain and tenderness is highly prevalent in these young women. Racial differences seem to exist; C women had significantly increased tenderness while AA women had more widespread pain. The association of depressive symptoms and pain was stronger in AA women. Racial differences emerged relatively early in these young women. (First Release Jan 31 2007; J Rheumatol 2007;34:810–7)

Key Indexing Terms:
FIBROMYALGIA PALPATION COHORT STUDIES EPIDEMIOLOGY
HEALTH DISPARITIES SUBJECTIVE SOCIOECONOMIC STATUS

The American College of Rheumatology (ACR) classification criteria for fibromyalgia (FM) require: (1) chronic widespread pain (CWP) for at least 3 months and (2) pain upon palpation of at least 11 of 18 specified tenderpoints (TP)[1]. Reports show that approximately 20% of people with CWP meet the ACR TP criterion for FM classification, with those remaining being encompassed under the term CWP (see reviews[2,3]). Since publication of the ACR criteria, FM studies from Western Europe and North America mostly reported about Caucasian (C) populations[2-5]. These studies reported about 10% of general Western populations with CWP and 1-4% with FM[2], increasing with age up to 50-70 and decreasing thereafter (perhaps due to selective survival). However, younger population studies are lacking[2,3].

From Preventive and Restorative Dental Sciences, Center for Health and Community, University of California, San Francisco, San Francisco, California, USA.

Supported by grant US DHHS NIH/NIDCR R01-DE13487.

S.A. Gansky, MS, DrPH, Associate Professor, Preventive and Restorative Dental Sciences, Center for Health and Community, Center to Address Disparities in Children's Oral Health; O. Plesh, MD, DDS, MS, MS, Professor, Preventive and Restorative Dental Sciences, University of California, San Francisco.

Address reprint requests to: Dr. S.A. Gansky, University of California, San Francisco, 3333 California St, San Francisco, CA 94143-1361, USA. E-mail: stuart.gansky@ucsf.edu

Accepted for publication November 15, 2006.

CWP varies as a function of pain intensity and duration (recurrent or persistent) and number of body sites (regional or generalized)[2]. FM's generalized tenderness is considered a marker of pain severity and distress, with FM presenting one end of the spectrum of the musculoskeletal pain continuum[6]. Distress is operationalized in this context as a combination of somatization with depression and/or anxiety[2]. More TP is not only associated with more body pain sites and distress, but also strongly influenced by sex[7]. Women reportedly experience CWP only 1.5 times more than men, but experience tenderness 11 times more than men[2,3]. However, sex's role is not presently understood. Most population-based studies on CWP and FM and their associated factors comprised European and North American C. Age, sex, distress, and other pains common to this age group (such as dysmenorrhea) relate to these pains[2-8].

However, in non-C populations, little is known about the epidemiology of body pain and tenderness and characteristics associated with their progression such as socioeconomic, psychological, and other health-related factors[2]. Our previous studies on temporomandibular disorders (TMD), a regional chronic pain disorder often associated with FM, showed that young C women had significantly greater prevalences of TMD-type pain, as well as signs and symptoms, compared to African Americans (AA) above and beyond socioeconomic status (SES)[9]. Since sex, age, and race may significantly relate to CWP and FM progression, studies controlling for some of

these while investigating the others are needed. Further, to better understand the pathogenesis and natural history of CWP and FM, studies should include the entire spectrum of individuals from pain-free to localized regional to widespread chronic pain, with and without generalized tenderness. Therefore, our purpose was to investigate the prevalence of regional chronic pain (RCP) with non-axial and axial involvement, CWP, and tenderness; estimate the prevalence of FM; and assess their relationship to race, SES, self-reported health, depressive symptoms, and premenstrual pain and associated premenstrual symptoms in an established cohort of young C and AA women.

MATERIALS AND METHODS

Population. An established cohort of 1334 young women 22-26 years old, about half AA and about half C, participated in this study. They were recruited to participate in the longitudinal National Heart Lung and Blood Institute Growth and Health Study (NGHS) cohort of 9- to 10-year-olds in 2 centers: University of California at Berkeley (UCB) and University of Cincinnati/Cincinnati Children's Hospital Research Foundation (CHRF). Detailed information regarding the cohort, including reliability and validity of the measures, was published[10].

UCB recruited participants from public and parochial schools in the Richmond Unified School District of west Contra Costa County, California, encompassing cities and towns (Richmond, San Pablo, Pinole, El Sobrante, Hercules, El Cerrito, and Kensington) of varied size, density, ethnicity, sociodemographics, economics, and lifestyle. CHRF recruited participants from public and parochial schools in the greater Cincinnati area that were selected to be racially and socioeconomically representative of Hamilton County, Ohio (including inner city, urban, and suburban areas). Since 1987, this cohort has provided annual or biannual information via examinations and questionnaires regarding medical history, demographics, and psychosocial measures. Therefore, based on the initial selection criteria and high retention, this cohort represents young women in the San Francisco Bay Area and the greater Cincinnati area reasonably well.

Data collection. Data collection consisted of telephone interviews and clinical examinations at both centers. Interviewers and examiners were trained and calibrated for other ongoing studies on multiple occasions. In a 3 nation reliability assessment of pain on palpation, the UCB and CHRF examiners had the best reliability as well as the best validity when compared to the gold standard examiner with all intraclass correlations > 0.70. The ACR criteria broadly defined CWP (from body mannequins) as pain in axial and at least contralateral body quadrants. As a screening procedure, we used the specific, reliable, and validated London Fibromyalgia Epidemiology Study Screening Questionnaire[11], which included axial pain and pain on both right and left sides and both above and below the waist. Subjects not meeting these criteria were classified as having RCP, with or without axial involvement. Subjects reporting axial pain along with distributed pain (both right and left sides as well as both above and below the waist) fulfilled ACR criterion for CWP. Subjects who did not meet these criteria on all 4 quadrants but had 1-3 affected quadrants and axial pain were labeled as having axial RCP. Subjects were also classified as non-axial RCP or no pain, as appropriate. One trained examiner at each center performed TP palpation. By design, the whole CWP group and a subset of the other groups based on questionnaire classification were invited for examinations. For logistical and ethical (consent) reasons, percentages actually examined were: 77% of CWP, 61% of RCP, 34% of nonaxial pain, and 32% of no pain groups. The examiner, blinded to the subject body pain classification, palpated each of 18 points in a predetermined order as specified by ACR criteria. Pressure was applied with the thumb with increasing pressure at a rate of 1 kg per second, up to 4 kg. For each point, the subject was asked to report her pain at the point of palpation on a 0-10 scale. Mean scores for each TP were calculated as specified by a standardized manual[12]. Also scores were summed for a total TP palpation pain intensity score.

SES of these young women was measured using a 10 rung ladder subjective SES score (SSS)[13,14] as well as family income from the inception of the cohort and parental education. Participants' self-rated health was assessed on a 5-point scale (excellent to poor), but dichotomized as fair or poor health for analysis as in many national health surveys. Depressive symptoms (negative affect) and somatization scales (with and without pain) were determined as 3 categories (normal, moderate, severe) from the validated 32-item revised symptom checklist[15]. Menstrual pain/discomfort was assessed with a 4-point item (none, mild, moderate, severe). Interference/impact in normal activities from conditions (crying spells, avoiding people, decreased appetite, food craving/increased appetite, irritability, depression, fatigue, difficulty sleeping, sleeping too much, losing temper, mood swings) the week before menstruation (premenstrual symptoms) were assessed using 4-point items (none, slight, moderate, severe).

Data analysis. Proportions, means, and odds ratios (OR) or risk ratios were calculated with their 95% confidence intervals (CI). Chi-square tests, logistic regression models, cumulative ordered logit regression models, and generalized logit regression models were used to simultaneously compare factors, such as race and center, related to categorical responses (e.g., body pain spread) adjusting for potential confounders, such as SSS. For pairwise comparisons, stepdown Bonferroni (i.e., Bonferroni-Holm) p values (p*) were used[16]; contrasts were used for race, center, and race × center differences. Effect modification for race differences was assessed with interactions in regression models. Collinearity and model fit were also assessed. Box plots showing quartiles [25th, 50th (median), and 75th percentiles] along with 95% CI for the median illustrated patterns for number of TP.

RESULTS

Demographic and health characteristics. Percentages and means of SES, depressive symptoms, somatization with and without pain, and menstrual pain and interference of premenstrual symptoms with activities by center and race are in Table 1. C had significantly higher SES (parental income and education). SSS, however, did not differ racially, although Californians had higher parental education and SSS than Ohioans. Overall, about half the cohort had moderate or severe depressive symptoms. Additionally, C had significantly higher mean impact of premenstrual symptoms on daily life versus AA for the following symptoms: depression (0.9 to 0.6); fatigue (1.1 to 0.8); crying spells (0.8 to 0.4); food craving/increased appetite (1.2 to 1.1); irritability (1.5 to 1.3); and mood swings (1.4 to 1.2; all p* ≤ 0.011). C had significantly decreased appetite versus AA (0.3 to 0.4; p* < 0.001).

Self-reported body pain spread. Overall, 56% of the young women reported no history of pain in the prior 3 months, while 16% reported nonaxial RCP, 22% reported axial RCP, and 5.6% reported axial CWP. Body pain distribution (Table 2) differed significantly by race adjusting for center (3 df chi-square p = 0.020); C had significantly more RCP than AA [Bonferroni-Holm (BH) multiplicity corrected pairwise tests, p* = 0.033]. However, further analyses revealed a race × center interaction (p = 0.041), with the racial difference in RCP confined to UCB (Table 2). Further, for both centers, slightly more AA were classified as having CWP than C, but not to a statistically significant level (center-adjusted chi-square raw p = 0.082; BH p* = 0.227).

Table 1. Cohort characteristics by center and race (n = 1334) – %/mean.

Characteristic	Northern California (UCB)		Ohio (CHRF)		BH, p* Values	
	AA (n = 361)	C (n = 376)	AA (n = 323)	C (n = 274)	Race	Center
Socioeconomic Status (SES)						
Parental income: $20K+	44	81	37	77	< 0.001	0.105
Parental education: HS Grad+	75	81	54	73	< 0.001	< 0.001
Subjective SES score (SSS)	5.7	5.8	5.2	5.6	0.622	0.013
Depressive symptoms						
Moderate or severe	49	53	55	52	1.000	1.000
Somatization with pain						
Moderate or severe	40	45	41	43	1.000	1.000
Somatization without pain						
Moderate or severe	33	37	32	33	1.000	1.000
Menstrual pain/discomfort	1.4	1.6	1.5	1.5	1.000	1.000
Premenstrual symptom impact						
Depression	0.5	0.8	0.6	0.9	< 0.001	0.622
Fatigue	0.8	1.1	0.8	1.1	< 0.001	1.000
Sleep Difficulty	0.4	0.4	0.5	0.5	1.000	1.000

BH: Bonferroni-Holm stepdown test p values denote p* values. UCB: University of California – Berkeley; CHRF: Cincinnati Children's Hospital Research Foundation; 20K+: ≥ $20,000; HS Grad+: ≥ high school graduate/graduate equivalent degree (GED); AA: African American; C: Caucasian.

Table 2. Self-reported body pain by race (N = 1334) – 3 d.f. chi-square test p = 0.020 for the cross-tabulation. (%)

Body Pain Spread	Northern California (UCB)		Ohio (CHRF)		BH, p* Values
	AA (n = 361)	C (n = 376)	AA (n = 323)	C (n = 274)	Race
None	60	51	57	56	0.227
Non-axial	15	16	18	17	0.766
Regional chronic pain	19	29	20	20	0.033
Chronic widespread pain	6	4	7	5	0.227

AA: African American; C: Caucasian. BH: Bonferroni-Holm stepdown test p values denote p* values. UCB: University of California – Berkeley; CHRF: Cincinnati Children's Hospital Research Foundation; 3 df chi-square test, p = 0.020 for the cross-tabulation, center-adjusted.

Tenderness upon palpation. ACR TP clinical examination was performed on 553 women. Based on screening body pain status, different percentages of women were invited for examinations yielding 224 women with no body pain, 73 with non-axial RCP, 180 with axial RCP, and 58 with CWP. Those examined did not differ significantly from those not examined, stratifying on body pain status, in any measures (race, center, race × center, household income, parental education, or SSS) (OR from 0.9 to 1.1 and Mantel-Haenszel p values ≥ 0.248).

The number of TP by body pain spread and race as shown in box plots significantly increased with increasing spread of body pain (p < 0.001, Figure 1). The reference line showing the 11/18 TP threshold and the labeled percentage of examined women meeting the criterion demonstrated that many RCP cases exceed the cutoff; even some women who reported no pain at screening exceed the cutoff (Figure 1). Overall, about one-third of women had ≥ 11/18 TP. Tenderness was more generalized extending beyond the specific ACR TP to the control points. Similar to the number of TP, the overall percentage of women with ≥ 11/18 increases with body pain: 22% for none, 29% for nonaxial RCP, 41% for axial RCP, and 57% for CWP (p = 0.001). Overall, regardless of body pain spread, C had a significantly greater percentage with ≥ 11/18 TP (39%) than AA (27%) (p ≤ 0.005 adjusting for center, SSS, and body pain spread), as well as a significantly greater number of TP (p < 0.001 adjusting for center, SSS, and body pain spread). Overall, total TP palpation pain intensity score by body pain spread and race was quite similar to the number of TP. The overall FM prevalence was 2.4% (exact 95% CI: 1.7–3.5%); prevalence was 3.0% (exact 95% CI: 1.8–4.5%) in AA and 2.0% (exact 95% CI: 1.0–3.4%) in C.

TP anatomic location. Since almost half the RCP group with axial involvement also had ≥ 11 TP, the distribution of 18 TP and 3 control points of this group was compared to the FM group (CWP with ≥ 11/18 TP) and the non-FM CWP group

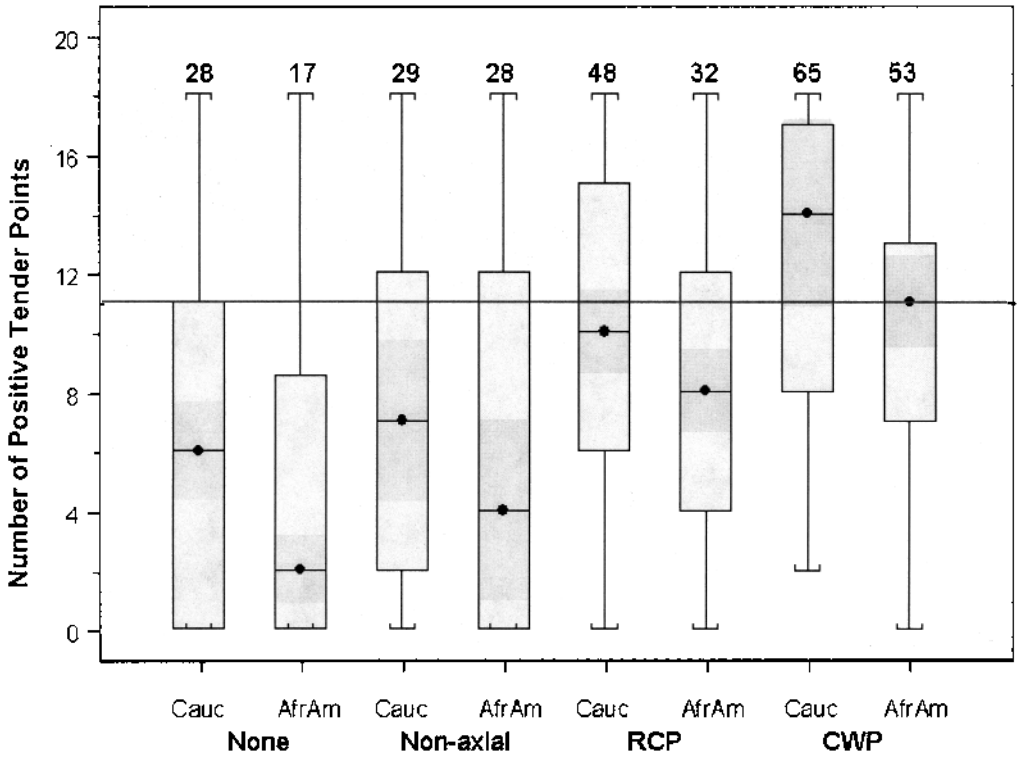

Figure 1. Tenderpoint distribution by body pain spread and race. Midlines and dots are medians. Shaded areas are 95% CI for medians. Rectangular areas are interquartile ranges (25th–75th percentiles = middle 50% of distribution). Brackets are 10th and 90th percentiles; horizontal reference line indicates ACR criterion of 11/18 positive TP and numbers above the upper brackets are percentages who had ≥ 11/18 positive TP.

(< 11/18 TP) (Table 3). As expected, in general, all TP and control points were significantly more likely to be tender in the FM group than the other 2 groups. Similarities in the distribution of the most commonly positive TP were found among FM and RCP with ≥ 11/18 TP (i.e., right and left occipital and second rib). The most common TP were also the most painful. However, for the CWP non-FM group (< 11/18 TP) the most common TP differed (i.e., right and left low cer-

Table 3. Anatomic distribution of tenderpoints (9 bilateral plus 3 unilateral controls): % positive and mean pain score (0–10).

Location	FM (CWP ≥ 11/18 TP) (N = 33)				RCP ≥ 11/18 TP (N = 73)				CWP < 11/18 TP (N = 25)			
	% Positive		Pain Score		% Positive		Pain Score		% Positive		Pain Score	
	R	L	R	L	R	L	R	L	R	L	R	L
Occipital	97	97	5.3	4.7	96	89	4.8	4.8	28†‡	32†‡	1.1†‡	1.3†‡
Low cervical	85	88	3.7	4.1	89	93	3.8	4.3	40†‡	40†‡	1.6‡	2.1‡
Trapezius	88	82	5.0	4.2	88	93	4.3	4.5	40†‡	52‡	1.2†‡	1.9‡
Supraspinatus	82	85	3.2	3.6	74	77	2.6	2.9	36†	24†‡	1.6	1.0†
2nd rib	97	94	4.9	4.9	96	96	4.9	5.0	36†‡	44†‡	1.4†‡	1.8†‡
Lateral epicondyle	76	76	3.4	3.3	77	82	3.5	3.5	28†‡	8†‡	1.0‡	0.3†‡
Gluteal	58	55	2.3	2.5	55	62	2.2	2.4	16‡	16‡	0.6	0.6
Trochanter	64	64	3.0	2.8	73	66	2.9	2.7	16[1,2]	32	0.6†‡	1.4
Knee	70	76	3.6	3.9	84	88	4.2	4.3	20†‡	20†‡	0.8†‡	0.8†‡
Midforehead	36		0.7		37		1.1		4		0.1	
Dorsum forearm	30		0.8		37		1.2		8		0.2	
Thumbnail	21		0.6		37		1.1		0†		0.0	

† CWP < 11/18 vs FM (CWP ≥ 11/18), bootstrap stepdown, p* ≤ 0.05; ‡ CWP < 11/18 vs RCP ≥ 11/18, bootstrap stepdown, p* ≤ 0.05. CWP: chronic widespread pain; FM: fibromyalgia; RCP: regional chronic pain.

vical and trapezius). Although the number of TP between RCP and CWP women with ≥ 11/18 TP would be expected to be similar due to dichotomizing at the ACR criterion (11 TP), the total palpation TP intensity scores were also strikingly similar. There were no racial differences regarding TP distribution. Moreover, no lateral asymmetry in TP distribution was noted and this pattern was not mediated by race, center, or race × center interaction effects.

Factors related to body pain spread and tenderness. Both body pain spread and tenderness increased as SSS decreased and other measures increased (Figure 2). For body pain spread, the other 8 premenstrual symptoms (listed in the Methods but not shown in Figure 2) were all related, while for tenderness, only mood swings and sleeping too much were related. Furthermore, racial differences across some of these gradients were evident. SSS was significantly higher in C at each body pain spread category (Mantel-Haenszel p = 0.031) but not at each tenderness category; fair/poor self-rated health was significantly higher in AA across pain spread and tenderness categories (both Mantel-Haenszel, p < 0.009); and the impact of both premenstrual mood symptoms (crying spells, depression, irritability, mood swings, and fatigue, but not sleep or menstrual pain) were higher in C across pain spread and tenderness categories (all Mantel-Haenszel, p < 0.01).

The relationship between moderate or severe depressive symptoms and body pain spread differed by race (homogeneity interaction test suggestive of statistical significance, p = 0.06). More C with RCP (69%) had moderate or severe depressive symptoms than AA (59%), but fewer C with CWP (79%) had moderate or severe depressive symptoms than AA (93%).

Depressive symptom score had a strong effect on tenderness in AA but not C. The effect of depressive symptoms on tenderness (≥ 11/18 TP) adjusting for body pain spread was moderated by race: AAs' risk ratio was 2.84 (p < 0.001), but Cs' risk ratio was 1.26 (p = 0.199). Thus, a race by depression interaction was evident for tenderness. Somatization with and without pain (moderate or severe) increased with body pain and tenderness in each race.

Since body pain spread, tenderness, and factors associated with them differed by race and center, multivariable models helped clarify these complex relationships while adjusting for other factors (e.g., potential confounders). The relationships between factors and body pain spread were not the same for each kind of pain, violating the main assumption of ordinal logistic (cumulative logit) regression models (i.e., proportional odds), so generalized logit models were fitted with the results shown in Table 4. Since impacts of premenstrual symp-

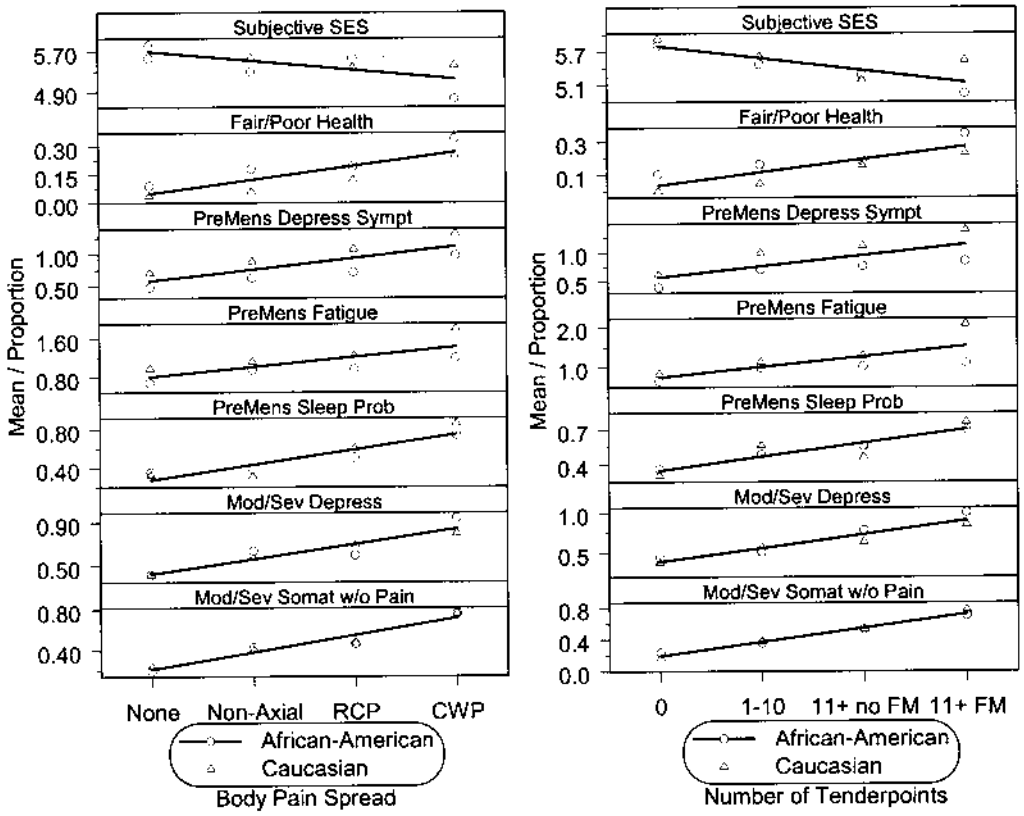

Figure 2. Characteristics by race and pain manifestation: body pain spread (n = 1334) and number TP (n = 553). Means for ordinal measures [subjective SES score (SSS); premenstrual symptom impacts) and proportions for dichotomous ones (fair/poor self-rated health; moderate/severe depression; somatization without pain) by race and pain classification group. Left side shows body pain spread (none, nonaxial RCP, axial RCP, CWP). Right side shows number of TP (0, 1-10, 11-18 not CWP, FM).

Table 4. Factors related to body pain spread and tenderpoints.

Factor	Body Pain Spread* (n = 1334)			ACR Tenderpoint Criterion† (n = 553)		
	df	Chi-square	p Value	df	Chi-square	p Value
Body pain spread	—	—	—	3	19.5	0.001
Subjective socioeconomic score	3	1.82	0.610	1	2.53	0.112
Depressive symptom score	6	68.3	< 0.001	2	12.9	0.002
Center	3	3.46	0.326	1	0.10	0.750
Race	3	4.69	0.196	1	8.93	0.003
Race × depression	6	11.6	0.071	2	10.5	0.005
Prementrual interference — fatigue	3	9.07	0.028	1	1.43	0.232

* Generalized logit model. † Logit model.

toms (e.g., depression, fatigue, and sleep problems) were highly intercorrelated, only one at a time was used, and the best fitting model was retained.

Results showed depression score was a significant mediator and moderator. In predicting body pain spread with the generalized logit model adjusting for center and race, depressive symptom score, which was highly significant, mediated the SSS effect. Premenstrual fatigue was related to increased body pain. Depression by race was suggestive of significance despite the fact that interaction effects often have low power; depressive symptoms were related to RCP in C and CWP in AA.

In predicting ≥ 11/18 TP with logistic regression adjusting for center, race, and body pain spread, again depression was a highly significant mediator of the SSS effect. Since, by design, participants were selected for examinations based on self-reports, body pain spread was used as an adjustment variable. Race and depression by race remained significant when adjusting for these other factors including body pain spread.

Therefore, depressive symptom score was far and away the biggest predictor of body pain spread and tenderness serving as a mediating effect; moreover, the depression score moderated the race effect on body pain spread and tenderness.

DISCUSSION

To our knowledge, this is the first study reporting FM in young C and AA women from US communities. Our main findings show that body pain (RCP, CWP) and tenderness (including FM) prevalences were higher than expected for women this young and that racial differences may exist regarding both pain and tenderness. Further, socioeconomic factors, health, and depression appear to impact body pain and tenderness differently in the 2 races. These findings have research and clinical relevance, as they may relate to the natural history of CWP and FM and the impact these chronic pains may have in the lives of different racial/ethnic groups.

Unexpectedly, our study found higher prevalences of RCP, CWP, and FM compared to previous population based studies, which reported the prevalence of CWP as 10-11%[4,17] and like FM, to increase with age, up to 70[18,19] years old, perhaps due to selective survival. Tenderness (sensitivity to pressure), FM's other main feature, was also unexpectedly higher (41%) in these young women. Previous reports showed that about 20-22% of CWP subjects fulfilled the ≥ 11/18 TP criterion for FM[3,20], compared to our results of 57%. Therefore, the FM prevalence in young (22 to 26-year-old) women was also significantly higher than expected: 2.4% compared to < 1% (the lower bound of the 2-sided 95% CI for our results was 1.7%). Epidemiological studies reported that FM affects 1-4% of North Americans[4,5]; a steady increase in prevalence with age from < 1% in 18- to 30-year-olds to 8-9% in 55 to 64-year-olds was also reported in a population study[4]. Most North American general population studies have been conducted on relatively homogeneous populations[5,21]. These studies illustrated that FM is more common in C (2-7%) than Pima Indians (nonexistent)[22]. Less is known about community-dwelling adults of other racial/ethnic backgrounds.

Our prior report on this biracial cohort found a significantly higher prevalence of TMD in C compared to AA[23]. TMD are a more localized type of RCP with lower (10%) prevalence than general RCP. RCP, which comprised a larger body area, showed racial differences similar to TMD. However, this racial difference was demonstrated mainly for the California and not the Ohio center, while TMD differed racially in both centers. These results may be from true racial differences or methodological discrepancies. In our study, standardized questionnaires were similar to previous studies[11]. More AA reported CWP in both centers suggesting both races interpreted questions similarly. Therefore, the race × center interaction for RCP probably is unrelated to differential understanding reflecting true race × center differences. Epidemiologic regional differences regarding body pain in general[2] and in this specific NGHS cohort[24] have been reported. Such regional effects have been interpreted as differences in local culture and climate[25]. Tenderness showed a different racial profile compared to body pain spread: AA reported more widespread pain, while C had significantly more tenderness (TP count and pain intensity). Interestingly, the effect of premenstrual symptoms was also significantly higher in C. Perhaps, different expression and interpretation of pain and symptoms account for these racial differences[25].

The extent of body pain and tenderness was related along a gradient to the level of SSS, self-rated health, impact of premenstrual symptoms, depression, and somatization, confirming previous reports on the association of these factors with body pain and tenderness. However, our results showed that these factors relate to pain differently in the 2 races. As most FM studies were conducted in adult C populations, little is known about these factors in young populations of other racial/ethnic backgrounds[2,3].

Lower SES (education and income), disability, immigrant status, and lower employment status (e.g., manual labor) have been associated with FM and CWP[2]. In our study of young women, the only SES measure related to pain (spread and tenderness) was SSS, which asks individuals to rank themselves relative to others in society. Despite racial differences in objective SES, at this age women of both races perceived themselves by SSS as similar socioeconomically, but perhaps different geographically (Table 1). However, the relationship of SSS to pain differs racially: AA with CWP or FM had significantly lower SSS than C (Figure 2). SSS relates to negative affect[13], so distress (depressive symptoms) influenced SSS, which influenced pain; i.e., negative affect was a mediator between SES and pain. SES can be a potential risk factor for developing chronic pain or can be a consequence of pain, leading to less ability for full educational attainment/employment, resulting in lower SES. Our results showing no relationship between objective SES and pain challenge the notion of SES as a risk factor, at least in young women. Thus, for this young age group, it may be more appropriate to use SSS.

Body pain spread increased with worse general health in a gradient[26], which was more pronounced in AA in our study (Figure 2). Thus, chronic body pain may impact young AA women's general health more than C women's. A recent review of racial/ethnic pain disparities, mostly on clinic populations, showed chronic pain is more likely to be under-treated in minorities than in C[27]. A retrospective analysis of a multidisciplinary pain center for chronic pain management found AA under 50 years old with chronic pain reported "considerable diminution" in overall physical and emotional health compared to C[28]. Our results corroborated their findings and also showed this racial disparity occurred in non-care-seeking individuals, emerging relatively early in their lives. Therefore, plans to eliminate racial health disparities should include earlier chronic pain management programs for minorities.

Premenstrual fatigue, mood, and sleep were reported to increase during menses and menopause in patients with FM, perhaps relating to hormonal fluctuations[29-31]. After adjusting for other factors, the strongest association with a premenstrual symptom impact was for pain spread with fatigue. This was not surprising as fatigue constitutes the other main symptom of FM.

Somatization and depressive symptoms demonstrated a gradient with increased body pain and tenderness (Figure 2). FM has been called a "sedimentation rate" for distress[32], where distress was operationalized as a combination of somatization with depression. Remarkably, we found a higher percentage of women with FM (94%) reported moderate to severe depressive symptoms compared to previous studies (26-71%)[33]. This large difference may be due to methodological discrepancies (e.g., a younger cohort and a different depression instrument). Previous studies showed higher depression prevalence in younger women than older women[34,35]. Moreover, our instrument (revised symptom checklist) measures distress level rather than clinical depression[15]. Even women with severe depressive symptom scores may not be clinically depressed. However, brain imaging research suggested mood changes below the pathological level (i.e., clinical diagnosis) can modify or increase pain[33]. Furthermore, our overall prevalences of depressive symptoms were similar to those collected 2 years earlier in this NGHS cohort with the Community Epidemiologic Study–Depression instrument[34,35].

Importantly, depressive symptoms related to pain differently for the 2 races: worse chronic pain (CWP and FM) was associated with more distress (e.g., psychological health) in AA than C. Our cross-sectional study could not determine the temporality of this relationship; however, the association is considered to be bidirectional: psychological distress can both precede and follow chronic pain[36-38], somewhat mitigating that limitation.

Psychological distress is also considered to predict persistence of FM[36] and RCP[39]. The few prospective population pain studies examining the persistence of pain and the transition from RCP to CWP and FM found 33–74% CWP persistence, increasing with age[40,41]. Further, RCP with axial involvement (i.e., cervical or thoracic spine, lower back, and chest involvement) generally persists[41]. Persistence of CWP and RCP were associated with higher TP count, distress level, and other health problems – strongest for RCP with axial involvement[17,18]. Similarities between RCP (axial involvement) with high tenderness and FM were also noted in the distribution pattern of most common TP. The FM group appeared more similar to the RCP with high tenderness group than the CWP with low tenderness group; occipital and 2nd rib TP were similarly high in the high tenderness groups but not the CWP with low tenderness group (Table 3). A similar TP distribution was reported in a previous community study[42].

In conclusion, our results demonstrate body pain spread, tenderness and depressive symptoms are high in this community population of young women, with tenderness being more common than body pain. These unexpectedly high percentages in this young population should be of great concern. Furthermore, racial differences seem to exist regarding tenderness, with C presenting higher tenderness compared to AA who reported more body pain spread. Higher body pain (CWP and FM) was more strongly related to physical and psychological health (i.e., self-reported health and depressive symptoms) in AA women compared to C women. This racial difference may have important clinical significance in planning to reduce health disparities by targeting earlier chronic pain management in AA women.

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