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Associations of Race and Ethnicity with Patient-Reported Outcomes and Health Care Utilization among Older Adults Initiating a New Episode of Care for Back Pain

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Abstract

Study Design—Secondary analysis of the Back Pain Outcomes using Longitudinal Data (BOLD) cohort study.

Objective—To characterize associations of self-reported race/ethnicity with back pain (BP) patient-reported outcomes (PROs) and health care utilization among older adults with a new episode of care for BP.

Summary of Background Data—No prior longitudinal studies have characterized associations between multiple race/ethnicity groups, and BP-related PROs and health care utilization in the US.

Methods—This study included 5,117 participants 65 years from three US health care systems. The primary BP-related PROs were BP intensity and back-related functional limitations over 24 months. Health care utilization measures included common diagnostic tests and treatments related to BP (spine imaging, spine-related relative value units (RVUs), and total RVUs) over 24 months. Analyses were adjusted for multiple potential confounders including sociodemographics, clinical characteristics, and study site.

Results—Baseline BP ratings were significantly higher for Blacks vs. Whites (5.8 vs. 5.0; $p < 0.001$). Participants in all race/ethnicity groups showed statistically significant, but modest improvements in BP over 24 months. Blacks and Hispanics did not have statistically significant improvement in BP-related functional limitations over time unlike Whites, Asians, and non-Hispanics; however, the magnitude of differences in improvement between groups was small. Blacks had less spine-related health care utilization over 24 months than Whites (spine-related RVU ratio of means 0.66, 95% confidence interval [CI] 0.51–0.86). Hispanics had less spine-related health care utilization than non-Hispanics (spine-related RVU ratio of means 0.60; 95% CI 0.40–0.90).

Conclusions—Blacks and Hispanics had slightly less improvement in BP-related functional limitations over time and less spine-related health care utilization as compared to Whites and non-Hispanics, respectively. Residual confounding may explain some of the association between race/ethnicity and health outcomes. Further studies are needed to understand the factors underlying these differences and which differences reflect disparities.

Keywords

older adults; race; ethnicity; low back pain; functional limitation; disability; utilization; disparity; Black; Asian; Hispanic

INTRODUCTION

Back pain (BP) is a leading cause of disability worldwide¹ and results in an economic burden exceeding \$100 billion annually in the United States (US).^{2,3} Prior studies have reported that Blacks in the US receive less diagnostic workup and treatment for BP compared to Whites^{4,5} despite reporting greater pain intensity and functional limitations.^{4,6–8} Few studies have evaluated back-related outcomes comparing other races or ethnicities; however, two reports suggest a similar pattern of less treatment despite greater reported BP intensity among Hispanics compared to non-Hispanics.^{5,9} Differences in back-related outcomes and health care utilization associated with race and ethnicity may be explained by patient-, provider-, and/or system-level factors.¹⁰ An accurate understanding of how the typical course and management of BP vary for different racial and ethnic groups in the US is a necessary step toward identifying possible disparities in medical care. The importance of this goal is highlighted by current projections of US demographics which indicate that by 2050, >50% of the US population will be non-White or Hispanic.^{11–13}

We used data from the Back pain Outcomes using Longitudinal Data (BOLD) cohort to examine associations of self-reported race and ethnicity with back-related outcomes and health care utilization for older adults with new episodes of primary care for BP. Given that

race and ethnicity are different social constructs that may be distinct or overlap we refer to them jointly here as 'race/ethnicity'.¹⁴ The primary aim of this study was to examine longitudinal associations between race/ethnicity and patient-reported outcomes over 2-year follow-up after adjustment for potential confounders. The secondary aim was to examine associations between race/ethnicity and health care utilization.

METHODS

Definitions

Differences in back-related PROs or health care utilization between race/ethnicity groups may exist for various reasons. The term "disparity" in health services and policy research often pertains specifically to differences between groups that might signal injustice or inequity.¹⁴ The Healthy People 2020 Initiative written by the US Office of Disease Prevention and Health Promotion considers a "disparity" to be a difference between groups that is closely linked with social, economic, and/or environmental disadvantage.¹⁵ In this article, we apply the term "difference" to compare race/ethnicity groups without inferences as to underlying causes and use the term "disparities" for the more specific instance where differences are thought to be explained by socioeconomic and/or environmental disadvantage.

Study Design and Participant Sample

The BOLD cohort has been described previously.¹⁶ In brief, 5,239 participants 65 years who presented for a new ('index') primary care or emergency department visit for BP were enrolled between 2010 and 2013. Participants had no back-related visits within the six months prior to the index visit, and received care from one of three US health care systems: Henry Ford Health System, Kaiser Permanente Northern California, and Harvard Vanguard Medical Associates. For the current study, we excluded participants without available electronic medical record (EMR) data during the study period or who had unknown clinic locations for their index visit. The institutional review boards at the University of Washington and all sites approved the BOLD study methods and all participants provided informed consent.

Patient-Reported Race and Ethnicity

The US Office of Management and Budget (OMB) uses the 1997 *Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity* to define race and ethnicity categories for official data collection.¹⁷ These revised standards include five race categories (American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, and White) and two ethnicity categories (Hispanic or Latino and non-Hispanic or non-Latino).^{18,19} This classification scheme provides standard categories for self-identification, collection, and description of racial and ethnic data.¹⁸ In this study, individuals could report none, one, or more than one race/ethnicity group. Race and ethnicity were ascertained in two separate questions and thus were not mutually exclusive categories.

Patient-Reported Outcomes (PROs)

PROs were collected via phone interview or mailed questionnaires at baseline and at 3, 6, 12, and 24 months later. The baseline assessment occurred within 3 weeks of a participant's index visit for BP. The primary PROs were BP intensity and back-related functional limitations. Participants used a 0 to 10 numerical rating scale (NRS) to rate their average BP intensity during the past 7 days. We also examined proportions with ≥30% improvement in BP ratings at 24 months.²⁰ A modified version of the Roland-Morris Disability Questionnaire (RMDQ) was used to measure functional limitations related to back and leg pain (sciatica) and is described elsewhere.²¹ We also examined proportions with ≥30% improvement in RMDQ scores at 24 months.^{22,23} A secondary outcome was BP resolution at 24-month follow-up defined as ≥30 days with no BP. BP resolution questions were added after study enrollment began and were obtained in a subset of participants (n=1943).²⁴

Health Care Utilization Outcomes

Health care utilization measures including diagnostic imaging and common treatments used for BP were obtained from the EMR. EMR data were collected from 12 months before the index visit through 24 months after the index visit or until a participant withdrew or died. EMR data included Current Procedural Terminology 4 (CPT) codes and International Classification of Diseases Clinical Modification (ICD-9-CM) codes. We used CPT and ICD-9-CM codes to identify health care utilization potentially related to BP including lumbar spine imaging (radiographs, computed tomography [CT], magnetic resonance imaging [MRI]), physical therapy (PT) visits, opioid prescriptions written, psychotherapy visits, and spine surgeries for each participant from the index visit through 24 months after the index visit. Opioid prescriptions, PT, and psychotherapy visits were not specifically linked to BP and may have reflected some treatment for other conditions. Since guidelines recommend a selective approach to obtaining imaging for BP²⁵, we also examined the subcategories of spine radiographs ('x-rays') or MRI/CT ordered 'early' (<6 weeks from the date of the index visit). We mapped each CPT code to its calendar year-specific relative value unit (RVU), a metric which reflects the relative amount of work attributed to each encounter used by the Centers for Medicare and Medicaid Services and most other payers.^{26–28} For each individual, we determined cumulative health care utilization by summing RVUs (total RVUs and "spine-specific RVUs") accumulated from the date of the index visit through 24 months after the index visit using methods described elsewhere.^{29–31}

Covariates

Covariates were chosen for this analysis based on conceptual importance as possible confounders. Sociodemographic covariates included patient-reported age, sex, marital status, educational attainment, employment status, and ongoing litigation related to current pain. Administrative/EMR data based on study-site included private/commercial health insurance or Medicaid coverage and location of the index visit (primary care vs. emergency department vs. other). All participants were Medicare-eligible due to age. We used US census data to define tertiles of mean *per capita* income for the cities in which the index visits took place because more specific location data (address or zip code) were not available.³² Participants reported their duration of BP at baseline and confidence in BP

recovery rated on a 0 to 10 scale where ‘0’ reflected ‘not at all confident’ and ‘10’ reflected ‘extremely confident’. Depressive and anxiety symptoms were assessed with the Patient Health Questionnaire-2 (PHQ-2) and Generalized Anxiety Disorder scale-2 (GAD-2).^{33,34} ICD-9-CM codes over 12 months prior to the index visit were used to generate the Quan comorbidity index.³⁵ Participants reported whether they smoked currently, had quit within the past year, or never smoked. For each participant, we summed all RVUs accumulated in the 12 months prior to the index visit as a reflection of baseline overall health care utilization.

Statistical Analysis

We used descriptive statistics to examine participant baseline characteristics according to race/ethnicity groups. We used linear regression to compare baseline pain intensity and RMDQ scores *between* race/ethnicity groups. We used a longitudinal generalized estimating equation (GEE) approach for regression models³⁶ to examine changes over time *within* each race/ethnicity group and to compare changes over time *between* race/ethnicity groups (characterized by race/ethnicity $\times$ time interactions). We used an analogous approach to examine associations between race/ethnicity and other back-related outcomes over 24 months using logistic regression for binary outcomes (BP resolution and health care utilization categories) and GEE with a log link and gamma distribution for RVU outcomes. All models were adjusted for baseline values of the outcome, study site, and the covariates described above and accounted for non-response using inverse probability weighting.³⁷ Race analyses were performed separately from ethnicity analyses to provide parallel evaluations. Analyses of race were restricted to comparisons between Whites, Blacks, and Asians, excluding race groups where the sample size was insufficient to permit reliable statistical inferences (Native American/Alaskan Natives and Hawaiian/Pacific Islanders) or where race designations did not permit interpretable comparisons (‘other’, ‘unknown’, or multiple races). Whites were considered the reference group for between-race statistical comparisons, and non-Hispanics were the reference group for between-ethnicity comparisons, since these represented the largest groups in our study. Two-sided P-values < 0.05 were considered statistically significant. Analyses were performed using Stata IC, version 14 (Stata Corp., College Station, TX).

RESULTS

Patient-reported Outcomes

A participant flow diagram is presented in Figure 1. Baseline characteristics of the cohort (n=5117) are presented in Table 1. The majority of participants were female (65%). There were other differences in baseline characteristics including, but not limited to, educational attainment (8% of Blacks completed graduate school vs. 19% of Whites), *per capita* income of the city where the index visit occurred (65% of Blacks in the lowest income tertile vs. 24% of Whites), and clinical location of index visit (13% Blacks in emergency department/urgent care vs. 3% Whites). Race/ethnicity groups were concentrated at certain sites; for example, 61% of Blacks were from the Detroit area and 64% of Whites, 84% of Asians, and 89% of Hispanics were from Northern California.

Figure 2 and Table S1 (supplemental digital content) present adjusted means for BP intensity ratings (NRS) stratified by race and ethnicity. Adjusted baseline BP ratings were significantly higher for Blacks vs. Whites (mean 5.8 vs. 5.0; $p<0.001$), but not for Hispanics vs. non-Hispanics (5.3 vs. 5.2; $p=0.29$). There were statistically significant improvements over time in adjusted BP ratings *within* all race/ethnicity groups (all p -values <0.001). There were no significant differences in improvements in BP ratings *between* groups over time comparing Blacks vs. Whites (mean NRS improvement between baseline and 24 months 1.4 vs. 1.5; $p=0.20$), Asians vs. Whites (mean NRS improvement 1.8 vs. 1.5; $p=0.12$), or Hispanics vs. non-Hispanics (mean NRS improvement 1.4 vs. 1.5; $p=0.06$).

Figure 3 and Table S2 (supplemental digital content) present adjusted RMDQ means stratified by race and ethnicity. Adjusted baseline RMDQ scores were not significantly different for Blacks vs. Whites (mean 10.6 vs. 9.7; $p=0.06$) or Hispanics vs. non-Hispanics (10.2 vs. 10.0; $p=0.86$). Adjusted RMDQ scores indicated no significant functional improvement over time *within* race/ethnicity groups for Blacks (mean RMDQ improvement 0.6 points; $p=0.10$) or Hispanics (0.5; $p=0.12$), but there was statistically significant functional improvement over time for Whites (1.3; $p<0.001$), Asians (1.9; $p=0.001$), and non-Hispanics (1.2; $p<0.001$). Blacks had significantly less functional improvement over time as compared to Whites (adjusted mean RMDQ improvement between baseline and 24 months 0.6 vs. 1.3; $p=0.03$), but differences in functional improvement between other race/ethnicity groups were not statistically significant.

The proportion of individuals with 30% improvement in BP intensity at 24 months was 47.3% for Whites, 35.5% for Blacks, 54.6% for Asians, 45.9% for non-Hispanics, and 43.5% for Hispanics. The adjusted odds of 30% improvement in BP intensity at 24 months was significantly lower in Blacks vs. Whites (odds ratio [OR] 0.76, 95% confidence interval [CI] 0.60–0.96, $p=0.02$), but there were no statistically significant differences for Asians compared to Whites, or Hispanics compared to non-Hispanics (Table 2). The proportion of individuals with 30% improvement in back-related functional limitations at 24 months was 39.3% for Whites, 28.5% for Blacks, 46.7% for Asians, 38.0% for non-Hispanics, and 31.7% for Hispanics. The adjusted odds of 30% improvement in back-related functional limitations at 24 months was significantly lower in Blacks vs. Whites (odds ratio [OR] 0.72, 95% confidence interval [CI] 0.56–0.92, $p=0.008$), but there were no statistically significant differences for Asians compared to Whites, or Hispanics compared to non-Hispanics (Table 2). The proportion of individuals with BP resolution at 24 months was 26.6% for Whites, 16.1% for Blacks, 42.4% for Asians, 25.7% for non-Hispanics, and 23.3% for Hispanics. The adjusted odds of BP resolution at 24 months (Table 2) were significantly lower in Blacks (OR 0.70, 95% CI 0.52–0.94, $p=0.02$) and higher in Asians (OR 2.38, 95% CI 1.60–3.52, $p<0.001$) compared to Whites, but were similar between Hispanics and non-Hispanics.

Health Care Utilization

The proportion in each group receiving various treatments and diagnostic studies is shown in Table 3. In adjusted analyses (Table 3), Blacks were not significantly different from Whites with respect to receiving PT, psychotherapy, or opioid prescriptions over 24 months, but they were significantly less likely to receive early (<6 weeks from index visit) spine radiographs

(OR 0.67, 95% CI 0.53–0.84) or spine MRI (OR 0.71, 95% CI 0.55–0.93) at any time. Conversely, Blacks were *more* likely to receive spine CT at any time compared to Whites (OR 1.62, 95% CI 1.06–2.45). *Post hoc* analyses indicated that the greater odds of receiving a spine CT for Blacks was driven almost entirely by the Henry Ford site where most Black participants were recruited and where CT utilization was higher than at other sites (data not shown).

Unadjusted characteristics of RVUs over 24 months are presented in supplemental digital content Table S3. Adjusted mean spine-related RVUs for Blacks were one-third fewer than those for Whites over 24-month follow-up (ratio of means 0.66, 95% CI 0.51–0.86)(Table 3). In absolute terms, adjusted mean spine-related RVUs were 14.0 for Blacks and 21.2 for Whites (Table S4, supplemental digital content). *Post hoc* analysis indicated that this difference in spine-related RVUs was driven by fewer ‘late’ RVUs in months 6–24 following the index visit (ratio of means 0.44, 95% CI 0.28–0.68) suggesting relatively less spine-related health care utilization due to ongoing treatment in Blacks as compared to Whites (data not shown). Although Hispanics were comparable to non-Hispanics with respect to specific diagnostic imaging use and non-surgical/surgical treatments, adjusted mean total RVUs for Hispanics were fewer than those for non-Hispanics over 24-month follow-up (ratio of means 0.77, 95% CI 0.64–0.92), as were spine-specific RVUs (ratio of means 0.60, 95% CI 0.40–0.90)(Table 3). In absolute terms, adjusted mean total RVUs were 87.0 for Hispanics and 113.5 for non-Hispanics and adjusted mean spine-related RVUs were 12.4 for Hispanics and 20.6 for non-Hispanics (Table S4, supplemental digital content). There were no material differences with respect to ‘late’ RVUs (data not shown).

DISCUSSION

This study of older adults with BP recruited from three US health care systems found that Blacks had a small but statistically significant greater baseline BP intensity (adjusted mean NRS 0.8). All race/ethnicity groups demonstrated only modest within-group improvements in BP intensity over 24 months and there were no statistically significant differences between race/ethnicity groups in NRS improvement over time. Blacks and Hispanics did not have statistically significant within-group improvements in back-related functional limitations over time in contrast to Whites, Asians, and non-Hispanics; however, the magnitude of differences in improvement between groups was quite small (e.g., the difference between Whites and Blacks in adjusted mean RMDQ improvement over 24 months was 0.6 points on the 0–24 scale). Despite these small differences in adjusted mean scores, Blacks had about three-quarters the odds of Whites of attaining 30% improvement in BP intensity or functional limitations, or BP resolution at 24 months.

To our knowledge, this study is the first to compare longitudinal changes in back-related PROs and health care utilization between multiple race/ethnicity groups in the US. Our finding of greater baseline BP intensity and slightly less back-related functional improvement in Blacks compared to Whites is generally consistent with results from clinical studies of BP^{6–9,38} and experimental pain studies.³⁹ The reasons for differences in BP reporting between Blacks and Whites are unclear. One explanation for such differences is confounding due to psychological, socioeconomic, or cultural factors.^{40–42} Although our

study adjusted for a range of possible confounders, these are expected to have provided limited adjustment for several key factors such as pain beliefs/attitudes, social roles and experiences, socioeconomic status, and other factors related to pain and the reporting of pain. Residual confounding may explain the small differences between Blacks and Whites observed in back-related PROs. Another explanation for these differences could be actual biological differences through mechanisms of endogenous pain modulation^{43,44}, endocrine factors^{43,45}, and genetic factors.^{39,46,47}

Differences in the diagnosis and management of various pain conditions according to race/ethnicity have been reported previously with Whites generally being prescribed higher doses of opioids for pain,^{48–55} having earlier and more comprehensive diagnostic workup,^{5,51} and receiving earlier surgical intervention compared to Blacks.^{56–58} Our findings in the specific context of BP are similar. In this study, Blacks were less likely to receive early spine X-rays or MRI of the spine at any time compared to Whites. Interestingly, Blacks were more likely to receive spine CT at any time. This finding was driven primarily by data from one study site where spine CT orders for back pain were common in the emergency department (ED) and may have been due to Blacks receiving a higher proportion of overall care services through the ED at that site. Blacks had less total healthcare utilization over 24 months and specifically had fewer spine-related RVUs than Whites. Given that Blacks also had fewer spine-related RVUs later in follow-up (6–24 months), when utilization was less likely due to initial diagnostic work-up, such differences in RVUs appear not to be explained by diagnostic imaging utilization alone. The magnitude of difference in RVUs between Blacks and Whites (7.2 RVUs) is of possible clinical relevance when considering RVU amounts for a lumbar spine radiograph (0.22) and a transforaminal lumbar epidural injection (1.9) as of January 1st, 2017 (Table 4). Our study found no statistically significant differences in opioid prescriptions for Blacks vs. Whites. This contrasts with some studies in other contexts^{54,55} which have found less opioid prescribing for Blacks. A novel finding of our study is the magnitude of difference in RVUs between Hispanics and non-Hispanics which is also of possible clinical relevance, demonstrating a difference of 26.4 total RVUs and 8.2 spine-related RVUs. Since these differences were not explained by our analysis of those receiving diagnostic imaging or specific treatments, possible explanations include other spine-related diagnostics/treatments we did not evaluate or differences in *volume* of services provided which our analyses did not address.

Unlike many other health conditions, less treatment and diagnostic workup is often considered better-quality care for new episodes of BP in the absence of historical or clinical red-flags.⁵⁹ Therefore, less spine-related health care utilization for Blacks and Hispanics could paradoxically represent better BP care. It is unclear whether these *differences* in PROs and health care utilization by race/ethnicity constitute actual *disparities* per se (explained by socioeconomic and/or environmental disadvantage) since our analytic approach did not isolate mediation through individual covariates linked with disadvantage and several potentially important confounders linked with disadvantage were not measured. In theory, the observed differences in health care utilization by race/ethnicity may have explanations unrelated to disadvantage such as culturally-motivated patient preferences. Nevertheless, given the historical legacy of health care disparities affecting ethnic minorities in the United States,⁶⁰ it is important to consider whether utilization differences in our study may reflect

inequity in the provision of care. Our work demonstrates several important differences in back-related outcomes associated with race/ethnicity in a large US sample, even after adjustment for specific patient-level characteristics and some system-level factors. Future work in the specific context of BP is needed to further examine these differences by race/ethnicity, to account for more provider-level and system-level factors to clarify drivers underlying the differences observed in this study, and to identify which factors reflect disparities that are modifiable.

Strengths of the current study include the longitudinal design and large sample size drawn from different regions in the US. Nevertheless, further studies are needed to confirm whether our findings hold true for other regions of the country. A limitation of our study is the general classification of race/ethnicity using the OMB definitions. For example, the novel finding that US Asians had a greater likelihood of BP resolution, but otherwise similar trajectories of BP and functional improvements as compared to Whites raises questions. The categorization of ‘Asian’ participants in this study combines individuals originating from disparate regions of the Middle East, East Asia, and South Asia, possibly obscuring important differences between individuals from different regions. This concern applies to all race/ethnicity designations examined in this article. To address this issue, future studies using self-report to examine differences in race/ethnicity, in samples with large subgroups of various races/ethnicities, may benefit from creating further subdivisions within the OMB classifications or potentially moving beyond self-reporting entirely by accounting for specific genetic markers.⁶¹

CONCLUSIONS

Identifying differences in back-related outcomes associated with race/ethnicity is a necessary step toward improving health outcomes in the US and creating an equitable health care system. These findings warrant replication in other regions of the country and further critical examination to determine how racial/ethnic health disparities where present for patients with BP may be mitigated.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1. Flowchart of study participants*

*missing follow-up data accounted for using non-response weighting

Figure 2. Back pain intensity over time by race and ethnicity*

A: Multivariate-adjusted mean scores for back pain intensity by race.

B: Multivariate-adjusted mean scores for back pain intensity by ethnicity.

NRS: numerical rating scale

*Means are adjusted for all covariates listed in Table 1. Numeric values of adjusted means and 95% confidence intervals are provided as digital supplemental content (Table S1)

Figure 3. Back-related functional limitations over time by race and ethnicity*

A: Multivariate-adjusted mean scores for Roland-Morris Disability Questionnaire by race.

B: Multivariate-adjusted mean scores for Roland-Morris Disability Questionnaire by ethnicity.

RMDQ: Roland-Morris Disability Questionnaire

*Means are adjusted for all covariates listed in Table 1. Numeric values of adjusted means and 95% confidence intervals are provided as digital supplemental content (Table S2)

Table 1

Baseline characteristics by race and ethnicity (unadjusted) *

Characteristic	White ^a (n = 3746)	Black ^a (n = 781)	Asian ^a (n = 195)	non-Hispanic ^a (n = 4791)	Hispanic ^a (n = 302)
Sociodemographics					
Age (years)	74.1 (7.0)	73.1 (6.5)	73.6 (6.8)	73.9 (6.9)	72.9 (6.0)
Female sex	2397 (64)	561 (72)	106 (54)	3093 (65)	202 (67)
Education					
Less than high school	147 (4)	114 (15)	5 (3)	268 (6)	37 (12)
High school graduate/GED/voc/tech	943 (25)	303 (39)	34 (17)	1299 (27)	119 (39)
Some college	888 (24)	217 (28)	39 (20)	1154 (24)	93 (31)
Four-year college graduate	1056 (28)	85 (11)	66 (34)	1224 (26)	24 (8)
Professional/graduate degree	708 (19)	61 (8)	50 (26)	839 (18)	27 (9)
Marital					
Married/living with partner	2421 (65)	331 (42)	135 (69)	2930 (61)	164 (54)
Separated/divorced	379 (10)	138 (18)	13 (7)	537 (11)	52 (17)
Single, never married	169 (5)	57 (7)	11 (6)	239 (5)	12 (4)
Widowed	770 (21)	254 (33)	36 (18)	1076 (22)	73 (24)
Work					
Full-time/part-time	445 (12)	70 (9)	15 (8)	536 (11)	35 (12)
Retired (not due to ill health)	3047 (81)	639 (82)	166 (85)	3904 (81)	244 (81)
Retired/disabled (due to health)	77 (2)	45 (6)	7 (4)	135 (3)	7 (2)
Other	165 (4)	25 (3)	7 (4)	201 (4)	15 (5)
Ongoing litigation related to current pain	15 (0.4)	7 (0.9)	2 (1.0)	28 (0.6)	2 (0.7)
Health insurance^b					
Any private insurance	2498 (67)	579 (74)	131 (67)	3266 (68)	177 (59)
Any Medicaid	70 (1.9)	88 (11.3)	9 (4.6)	172 (3.6)	5 (1.7)
Study site^c					
Northern California	2413 (64)	225 (29)	171 (88)	2853 (60)	269 (89)

Characteristic	White ^a (n = 3746)	Black ^a (n = 781)	Asian ^a (n = 195)	non-Hispanic ^a (n = 4791)	Hispanic ^a (n = 302)
Detroit, Michigan metropolitan area	414 (11)	474 (61)	16 (8)	913 (19)	20 (7)
Boston, Massachusetts metropolitan area	919 (25)	82 (10)	8 (4)	1025 (21)	13 (4)
Per capita income of city where index visit occurred^d					
Lowest income tertile	907 (24)	510 (65)	55 (28)	1487 (31)	114 (38)
Medium income tertile	1504 (40)	189 (24)	61 (31)	1795 (37)	110 (36)
High income tertile	1335 (36)	82 (10)	79 (41)	1509 (31)	78 (26)
Index visit clinical location					
ED or urgent care visit	95 (3)	103 (13)	4 (2)	204 (4)	9 (3)
Primary care	3651 (97)	678 (87)	191 (98)	4587 (96)	293 (97)
Back Pain Characteristics and Comorbidities					
Duration of back pain					
< 1 month	1262 (34)	224 (29)	78 (40)	1582 (33)	115 (38)
1–3 months	752 (20)	121 (15)	48 (25)	937 (20)	51 (17)
3–6 months	268 (7)	37 (5)	13 (7)	318 (7)	16 (5)
6–12 months	209 (6)	70 (9)	10 (5)	286 (6)	21 (7)
1–5 years	511 (14)	148 (19)	26 (13)	706 (15)	51 (17)
>5 years	740 (20)	181 (23)	20 (10)	958 (20)	48 (16)
Back pain intensity ratings (0–10)^e	4.8 (2.7)	6.2 (2.8)	4.9 (2.7)	5.0 (2.8)	5.4 (2.8)
Back-related functional limitations (RMDQ; 0–24)^f	8.9 (6.3)	12.1 (6.4)	9.7 (6.2)	9.5 (6.4)	10.7 (6.1)
Confidence in back pain recovery (0–10)^g	5.4 (3.7)	5.3 (3.7)	6.7 (3.3)	5.4 (3.7)	6.0 (3.6)
Quan comorbidity index^h	0.8 (1.4)	1.2 (1.7)	0.8 (1.5)	0.9 (1.4)	0.8 (1.4)
PHQ-2 scoreⁱ	0.6 (1.2)	0.8 (1.3)	0.6 (1.3)	0.7 (1.2)	0.9 (1.3)
GAD-2 score^j	0.8 (1.4)	1.0 (1.6)	1.2 (1.7)	0.9 (1.5)	1.3 (1.5)
Current smoking	197 (5)	78 (10)	7 (4)	295 (6)	16 (5)
Health care utilization (in 12 months prior to index visit)					
Total Relative Value Units	15.8 (7.2, 35.6)	20.8 (8.4, 45.4)	11.1 (4.7, 31.2)	16.2 (7.3, 37.1)	17.0 (8.0, 36.9)
Any opioid prescription ^k	526 (14)	98 (13)	25 (13)	666 (14)	51 (17)

SD = standard deviation; IQR = interquartile range

* Values presented include means (standard deviations) or medians (interquartile range; bottom quartile, top quartile) for continuous variables, and numbers (%) for categorical variables. All percentages represent a proportion within each respective race or ethnicity group.

^a Individuals could choose none, one, or more than one race/ethnicity group. Analysis was restricted to participants who self-reported only one race group, or one ethnicity group.

^b Data on primary and secondary insurance carriers were grouped into the two non-mutually exclusive categories of 'any private insurance' or 'any Medicaid'.

^c Northern California site is Kaiser Permanente health system; Detroit site is Henry Ford health system; Boston site is Harvard Vanguard health system.

^d Per capita income data obtained from www.census.gov/quickfacts, accessed 8/1/2015. All values are per capita income in 2013 dollars(2009–2013).

^e Numerical rating scale; higher scores represent more pain.

^f Roland-Morris Disability Questionnaire (RMDQ); higher scores represent greater functional limitations.

^g Expectation that back and/or leg pain would be completely gone or much better 3 months; rated on a 0 to 10 scale; 0 = 'not at all confident' and 10 = 'extremely confident'.

^h ICD-9-CM codes over the 12 months prior to the index visit were used to generate the Quan comorbidity index.

ⁱ PHQ-2 (Patient Health Questionnaire-2); higher scores represent greater depressive symptoms.

^j GAD-2 (Generalized Anxiety Disorder-2); higher scores represent greater anxiety symptoms.

^k Number of participants who had at least one opioid prescription written during the 12 months prior to the index visit.

Table 2

Improvement in back pain or back-related functional limitations at 24 months

Race/Ethnicity ^b	30% improvement in back pain			30% improvement in back-related functional limitations			Participant-reported complete resolution of back pain ^a		
	n (%) [*]	aOR(95% CI)	p-value	n (%) [*]	aOR (95% CI)	p-value	n (%) [*]	aOR (95% CI)	p-value
White (n=2935)	1387 (47.3)	reference	NA	1154 (39.3)	reference	NA	769 (26.6)	reference	NA
Black (n=593)	210 (35.5)	0.76 (0.60–0.96)	0.02	169 (28.5)	0.72 (0.56–0.92)	0.008	95 (16.1)	0.70 (0.52–0.94)	0.02
Asian (n=152)	83 (54.6)	1.11 (0.77–1.58)	0.58	71 (46.7)	1.11 (0.77–1.59)	0.57	61 (42.4)	2.38 (1.60–3.52)	<0.001
non-Hispanic (n=3724)	1708 (45.9)	reference	NA	1414 (38.0)	reference	NA	942 (25.7)	reference	NA
Hispanic (n=230)	100 (43.5)	0.83 (0.57–1.23)	0.36	73 (31.7)	0.82 (0.55–1.22)	0.33	52 (23.3)	0.97 (0.63–1.51)	0.90

All odds ratios and p-values are adjusted for the variables presented in Table 1.

aOR=adjusted odds ratio, CI=confidence interval

^{*} Values represent numbers and proportions of participants within each race or ethnicity group who achieved the given level of improvement.^a Participant-reported complete resolution of back pain defined as 30 days with no pain.^b Participants completing RMDQ at 24 months.

Table 3

Associations between race/ethnicity and health care utilization over 24 months

Health care resource	White (n=3746)		Black ^a (n=781)		Asian ^a (n=195)		non-Hispanic (n=4791)		Hispanic ^b (n=302)	
	n (%)	aOR (95% CI) ^d	n (%)	aOR (95% CI) ^d	n (%)	aOR (95% CI) ^d	n (%)	aOR (95% CI) ^d	n (%)	aOR (95% CI) ^d
Diagnostic Spine Imaging										
Early spine radiographs ^c	929 (24.8)	182 (23.3)	0.67 (0.53–0.84)	55 (28.2)	0.98 (0.69–1.38)	1177 (24.6)	78 (25.8)	0.94 (0.65–1.36)		
Early spine MRI/CT ^c	355 (9.5)	84 (10.8)	0.87 (0.65–1.17)	16 (8.2)	0.69 (0.40–1.21)	462 (9.6)	25 (8.3)	0.65 (0.34–1.21)		
Any spine radiographs	1329 (35.5)	277 (35.5)	0.83 (0.68–1.02)	77 (39.5)	0.95 (0.69–1.29)	1701 (35.5)	117 (38.7)	0.94 (0.68–1.30)		
Any spine CT	76 (2.0)	66 (8.5)	1.62 (1.06–2.45)	4 (2.1)	0.88 (0.27–2.88)	148 (3.1)	2 (0.7)	0.46 (0.12–1.75)		
Any spine MRI	742 (19.8)	104 (13.3)	0.71 (0.55–0.93)	38 (19.5)	0.82 (0.56–1.21)	899 (18.8)	62 (20.5)	0.91 (0.60–1.37)		
Non-Surgical Care										
Any PT	1486 (39.7)	266 (34.1)	1.18 (0.96–1.45)	86 (44.1)	0.78 (0.57–1.07)	1869 (39.0)	130 (43.1)	0.91 (0.65–1.26)		
Any psychotherapy	157 (4.2)	21 (2.7)	0.77 (0.44–1.32)	7 (3.6)	0.54 (0.23–1.28)	193 (4.0)	14 (4.6)	0.78 (0.43–1.42)		
Any opioid prescription	746 (19.9)	88 (11.3)	0.78 (0.58–1.04)	40 (20.5)	0.72 (0.50–1.05)	900 (18.8)	63 (20.9)	0.68 (0.45–1.01)		
Surgical care										
Any fusion	45 (1.2)	6 (0.8)	0.60 (0.25–1.45)	3 (1.5)	1.21 (0.35–4.21)	56 (1.2)	2 (0.7)	0.88 (0.22–3.58)		
Any non-fusion	79 (2.1)	10 (1.3)	0.55 (0.26–1.14)	6 (3.1)	1.28 (0.55–2.95)	98 (2.1)	5 (1.7)	0.77 (0.25–2.37)		
RVUs(ratio of means)										
Total RVUs	NA	NA	0.91 (0.82–1.02)	NA	0.77 (0.62–0.96)	NA	NA	0.77 (0.64–0.92)		
Spine-specific RVUs	NA	NA	0.66 (0.51–0.86)	NA	0.92 (0.55–1.54)	NA	NA	0.60 (0.40–0.90)		

All odds ratios are adjusted for the variables presented in Table 1.

aOR=adjusted odds ratio, CI=confidence interval, MRI=magnetic resonance imaging, CT=computed tomography, PT = physical therapy, RVU=Relative Value Unit, NA=not applicable

* Values represent numbers and proportions of participants within each race or ethnicity group who received a specified health care resource.

^a Whites are the reference group.

^b non-Hispanics are the reference group.

^c 'Early' imaging was obtained before 6 weeks post-index visit.

^d Values represent odds (95% confidence interval) of having received a specified health care resource compared to the reference race/ethnicity group.

Table 4Work RVUs for selected healthcare resources^a

CPT code	Health care resource	Associated Work RVUs ^b
72100	Lumbosacral spine (X-ray) 2 or 3 view	0.22
97163	PT evaluation (complex)	1.2
72148	MRI lumbar spine without contrast	1.48
64483	Transforaminal lumbar injection with guidance	1.9
90837	Psychotherapy (60 min)	3.0

CPT=Current Procedural Terminology, RVU=Relative Value Unit, PT=physical therapy, MRI=Magnetic Resonance Imaging

^aResources shown are examples commonly used in the diagnosis and treatment of back pain.^bWork RVUs according to the 2017 CMS update.