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Prevalence and pharmaceutical treatment of plantar fasciitis in United States adults

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Abstract

This study provides prevalence estimates of plantar fasciitis in United States (U.S.) adults, as well as the types and frequencies of pharmaceutical treatment specifically for this pain. Data are from the 2013 National Health and Wellness Survey, a large (n=75,000) internet panel survey designed to approximate the adult U.S. population. Strengths of associations are determined using multivariable logistic regression. It was estimated that 0.85% (95% CI: 0.77 – 0.92) of the sample reported diagnosed plantar fasciitis with pain in the last month. Higher prevalence of plantar fasciitis was seen in females (1.19%) [referent] versus males (0.47%), in those aged 45–64 (1.33%) versus those aged 18–44 (0.53%) [referent], and in the obese (1.48%) versus those with a body mass less than 25 (0.29%) [referent]. Prescription medications for pain were used by 41.04% of plantar fasciitis respondents, but only 6.31% attributed this use specifically to plantar fasciitis pain. NSAIDs (4.01%) and opioids (2.21%) were the most prevalent prescription drugs used specifically for plantar fasciitis pain. Almost 70% of individuals with plantar fasciitis used over-the-counter (OTC) analgesics for general pain management, with OTC NSAIDs being used by 49.47% and acetaminophen by 26.93% of respondents. Individuals diagnosed by medical specialists had twice the odds of using prescription drugs as those diagnosed by other providers (OR= 2.12; 95% CI: 1.01–4.46). Non-Hispanic blacks were more likely to use prescription pain medications specifically for plantar fasciitis pain than Non-Hispanic whites (OR = 3.02; 95% CI: 1.05–8.70). These findings will help inform healthcare providers and policy makers whether the current use of pharmaceutical treatments for plantar fasciitis reflect evidence-based treatment guidelines.

Keywords

Prevalence; pain severity; pain treatment; primary care; specialists

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INTRODUCTION

Plantar fasciitis is a progressive degenerative disorder of the plantar fascia of the foot (18). It has been associated with heel pain, falls, poor quality of life, and disability (2, 7, 15, 17, 25, 27). Specifically, individuals with plantar fasciitis report difficulties in running-related activities and, to a lesser extent, walking-related activities (27). Individuals with plantar fasciitis most often report pain at the inferior part of the heel that is worse first thing in the morning or after extended intervals of inactivity (21, 34). Tong and Furia (36) estimated that in 2007, $284 million was spent on medical treatments for plantar fasciitis in the United States (U.S.).

Most epidemiological investigations of plantar fasciitis in the U.S. had been in relatively small samples of clinical populations (e.g., 17, 25–27) or in specific demographic groups such as the elderly (2, 7, 10), runners (20, 31, 33), factory workers (40) or the active military (30). Given the differences in survey design and study populations, it is not surprising that there is wide variability in plantar fasciitis prevalence as cited in these studies (2.7%-17.5%). We are only aware of one nationally representative assessment of plantar fasciitis in the U.S. Using data from the 1995–2000 National Ambulatory Medical Care Survey (NAMCS), Riddle and colleagues (28) found that out of approximately 855 million patient visits made to doctors' offices each year in the U.S., only 1,005,000 visits per year (0.12% of all visits) were associated with a diagnosis of plantar fasciitis. This rate is close to that found in a regional study of patient visits in southwestern Australia (23), where 0.19% of medical encounters were associated with the management of plantar fasciitis.

U.S. studies that considered plantar fasciitis prevalence across demographic subgroups found associations between plantar fasciitis and increasing age (11, 23, 25, 27, 28), higher body mass index (BMI) (15, 25–28, 38), and being female (7, 10, 11, 25, 28, 34, 40). Other key demographic characteristics such as education attainment, health insurance status and region of the country have not been studied. Only two studies in the U.S. (17, 25) looked at the severity of pain associated with plantar fasciitis, and none examined other characteristics, such as the frequency of pain or pain-related interference. The few studies (17, 25, 28) assessing medication use for plantar fasciitis were limited to use of NSAIDS (range: 39.05% to 55.5% of individuals with plantar fasciitis). None looked at predictors of medication use. A more complete understanding of plantar fasciitis epidemiology will aid in identifying individuals at risk for developing plantar fasciitis.

To address gaps in the epidemiology of plantar fasciitis, we had several goals: 1) to describe the prevalence of plantar fasciitis in U.S. adults overall, and by age, body mass index, ethnicity/race, education attainment, health insurance status, region, and sex; 2) to describe the types and prevalence of prescription and over-the-counter (OTC) drugs used to manage plantar fasciitis pain; 3) to explore associations between participant characteristics and use of prescription drugs for plantar fasciitis pain; and 4) to assess whether use of prescription pain drugs varies by who diagnosed the plantar fasciitis. This last goal is guided by recent literature showing that patients seeing medical specialists are more likely to be prescribed opioids for pain management (16, 19, 29, 39) and to be associated with opioid-related fatalities (24) than patients seeing other types of medical providers. Understanding what

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drives medication use, both patient and provider characteristics, as well as the types of medication used, will help inform healthcare providers and policy makers if the current use of pharmaceutical treatments for plantar fasciitis reflect evidence-based treatment guidelines (6, 21, 34, 35).

METHODS

The study data were taken from the 2013 National Health and Wellness Survey (NHWS) (Kantar Health, New York, NY, USA), a self-administered, Internet-based questionnaire completed by a large (N=75,000) sample identified through a web-based consumer panel (Lightspeed GMI, Warren, New Jersey, USA) and its affiliates. This is an opt-in panel, in which panelists choose to participate in surveys. The NHWS was reviewed and approved by an independent institutional review board (Essex IRB, Lebanon, NJ). All respondents in the NHWS provided online written consent to participate prior to data collection.

Quota sampling from the consumer panel was stratified by age, sex, and race to select a pool of potential participants for the NHWS that would closely match the demographic proportions of the U.S. A total of 1,183,287 e-mail invitations were sent to panel members. Of these, 110,038 panel members responded to the invitation, with 9,025 (8.3%) refusing informed consent. The demographic characteristics of non-responders are not available. Based on recommendations from the American Association for Public Opinion Research (AAPOR)(1), a “response rate” for this panel survey cannot be calculated, as this measure is reserved for probability samples; instead, based on AAPOR recommendations, we calculated; 1) the “eligibility rate” as “the number of sampled panel members who completed the screening [91,267] and were found eligible [82,736],” which equaled 90.6%; and 2) the “break off rate” as “the proportion of survey questionnaires that were begun [82,736] but never completed [7,736],” which equaled 9.4%, for a final sample of 75,000. The demographic characteristics of the NHWS sample are compared to data from the U.S. Census Bureau American Community Survey (ACS) (37) in Table 1.

Study definition of plantar fasciitis

Survey participants were asked if they had any pain within the past year. Individuals who responded that they had pain in the last year were queried if they had one or more diagnoses for their pain and to select the specific diagnoses from a list of 28 choices including plantar fasciitis. Individuals were also asked if they had pain within the past month and to select the specific types of pain from a list of 28 choices including plantar fasciitis pain. We combined these three questions to define our study sample as individuals with both a diagnosis of plantar fasciitis and plantar fasciitis pain within the past month (henceforth referred to as PF). This definition was applied when calculating PF prevalence for the entire sample and for demographic subgroups.

Use of prescription and over-the-counter (OTC) medications for pain management

The NHWS collected information on the potential use of 61 prescription drugs specifically to manage PF based on two questions:

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1. "Earlier, you indicated that you currently take a prescription medication for your pain. Please indicate which of the following prescription medications you currently use to treat your pain. *Please select all that apply."*
2. **"**You indicated you use the following prescription medications. Which type of pain do you primarily treat with each prescription medication."

The 61 prescription medications queried we grouped as follows:

1. anti-convulsants (gabapentin, pregabalin);
2. anti-depressants (tricyclic: amitriptyline);
3. muscle relaxants (carisoprodol, cyclobenzaprine, methocarbamol);
4. nonsteroidal anti-inflammatory drugs (NSAIDS: e.g., celecoxib, diclofenac, ibuprofen, ketorolac tromethamine, meloxicam, nabumetone, naproxen);
5. opioids (e.g., codeine, fentanyl, hydromorphone, morphine, oxycodone, oxymorphone, tramadol);
6. serotonin and norepinephrine reuptake inhibitors (SNRIs: duloxetine, milnacipran).
7. combinations of acetaminophen with opioids.

Information on the use of three OTC analgesics was also obtained: NSAIDS, acetaminophen, and aspirin. Unlike for prescription drugs, in the NHWS, individuals were asked if they used OTC products to treat any pain, not a specifically type of pain (e.g., PF).

The NHWS also collected information on the use of herbal products and other non-vitamin, non-mineral supplements to treat any pain. As with OTC analgesics, data on the use of these products to treat specific types of pain (e.g., PF) was not collected. Products in this group encompassed a wide range of supplements including, but not limited to, boswellia, chondroitin, curcumin, feverfew, glucosamine, Methylsulfonylmethane (MSM), turmeric, and white willow bark. Given the relatively low use of these products, only category-level data are reported.

Who diagnosed PF

Participants who reported a diagnosis for plantar fasciitis were asked who diagnosed the condition. Participants had to choose a single provider from a list of six provider types: 1) Primary care physician or general practitioner or internist; 2) Orthopedist; 3) Nurse practitioner or physician assistant; 4) Rheumatologist; 5) Pain management specialist; or 6) Other. Data from this question were recoded into two categories: 1) Medical specialist (Orthopedist, Rheumatologist, Pain management specialist) or 2) Non-specialist (Primary care physician or general practitioner or internist, Nurse practitioner or physician assistant, Other) [reference].

Covariates

As covariates, we examined three classes of variables that have previously been shown to be associated with pain prevalence and/or treatment (12) as outlined below.

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Demographic characteristics—

1. Age: 18–44 [reference category]; 45–64; and 65 or more;
2. Ethnicity and race: Non-Hispanic whites [reference category]; Non-Hispanic blacks; Hispanic whites; and Other;
3. Health insurance status: no health insurance; private health insurance [reference category]; and public health insurance;
4. Highest Education attainment: less than college graduate; and college graduate [reference category]);
5. Region of country: Northeast; Midwest, West, and South; [reference category];
6. Sex: male; female [reference category]

Pain characteristics—

1. Severity of PF pain in the last month: “How severe is your plantar fasciitis pain?”: Less than severe [reference category]; and severe;
2. Global pain frequency: “How frequently do you have problems with pain?”: daily pain; and not daily pain [reference category];
3. Global pain interference: “During past 4 weeks, how much did pain interfere with normal work?”: a little bit at most [reference category]; and moderate or more;
4. Years since plantar fasciitis diagnosed: 0 to 2 years [reference category]; 3 or more years; and don’t remember.

Other health status characteristics—

1. Any pain diagnosis other than PF: No [reference category]; and yes;
2. Body mass index (BMI): less than 25; 25 to less than 30; 30 or more;
3. Reported having diagnosed depression in the past 12 months: no [reference category]; and yes;
4. Reported having diagnosed diabetes in the past 12 months: no [reference category]; and yes;
5. Reported having diagnosed insomnia or other sleep difficulties in the past 12 months: no [reference category]; and yes;
6. Global health status: “In general, would you say your health is: ”poor to fair; and good to excellent [reference category].
7. Limitations climbing stairs: “Does your health now limit you in these activities: a) climbing one flight of stairs; b) climbing several flights of stairs:” Yes to either; No to both [reference category].

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8. Walking limitations: “Does your health now limit you in these activities: a) walking more than a mile; b) walking several hundred yards; c) walking one hundred yards.” No to all [reference category]; Yes to any.

Statistical Analyses

We used the sampling weights supplied by Kantar Health to calculate weighted percentage, and 95% confidence intervals (95% CI).

The demographic characteristics of the NHWS were compared to the demographic characteristics of the U.S. Census Bureau American Community Survey by assessing the absolute standardized differences (ASD) in covariate prevalence (age, Hispanic identify, race, region, sex) (42). A concern when comparing two such large surveys, with a combined sample size of more than 2 million individuals, is the real possibility that trivial differences in prevalence (e.g., 0.1%) can be statistically significant. Unlike chi-square tests and other statistical tests of hypothesis, ASD is not influenced by sample size. An ASD of less than 0.1 was chosen a priori as an indication of good covariate balance between groups.

The chi-square test was used to identify statistically significant bivariate relationships between variables. The Z-test was used to compare PF prevalence between medical specialists versus non-specialists (reference). The Cochran-Armitage test for trend was used to assess the relationship between the dependent variable and PF pain severity. Alpha was set at 0.05 with all tests 2-sided. No adjustment was made for multiple comparison.

Multivariable logistic regression was used to assess the relationship between use of prescription drugs specifically for PF (yes, no) and the independent variable (diagnosed by a medical specialist; yes, no) after controlling for covariates in the regression model. Given the importance to control for core demographic characteristics when assessing pain-related outcomes (12), age, ethnicity/race, health insurance status, highest education, region and sex were included in the regression model. All other covariates associated with the dependent variable at the 0.05 level in chi-square analysis were included in the regression model. Odds ratio and 95% CI were calculated. For the logistic regression model, there was no evidence of collinearity in inspections of tolerance values, condition indices, and variance inflation factors, suggesting properly specified heteroskedastic models. All estimates were generated using SAS (version 9.4, SAS Institute Inc., Cary, NC).

Post Hoc analysis

During the analyses, we found that Non-Hispanic blacks were more likely to use prescription pain medications specifically for plantar fasciitis than were Non-Hispanic whites. Since this was an unexpected finding based on the published literature (22), in a series of post hoc bivariate analysis, we examined the data in more detail. We wanted to assess whether the severity and impact of plantar fasciitis differed between Non-Hispanic blacks and whites. Specifically, we used contingency tables and chi square analyses to compared group differences in: 1) PF pain severity; 2) pain-related interference; 3) limitations in walking; and 4) limitations in climbing stairs.

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RESULTS

Comparison of the NHWS to the ACS

Covariate prevalence and absolute standard difference values comparing the NHWS to the ACS are presented in table 1. Based on ASD values, there is generally excellent balance (i.e., ASD below 0.1) in the demographic distributions of the two surveys for both unweighted prevalence and weighted prevalence with Hispanic identity being the exception. While the prevalence of reporting a Hispanic identify was balanced for the weighted percentages between surveys, it was unbalanced for the raw data, with an absolute standard difference of 0.122; in this case, participants in the NHWS were less likely to report being Hispanic than in the ACS.

Population prevalence

Of the 75,000 participants aged 18 years or older that participated in the NHWS, 848 (1.10%, 95% CI: 1.16–1.34) reported a diagnosis of plantar fasciitis in the last year. Of these 848 individuals, more than three-quarters (n = 650: 76.99%, 95% CI 73.83–80.14) reported having plantar fasciitis pain in the month. Thus, in the sample population, the overall prevalence of diagnosed plantar fasciitis with current pain (PF) was 0.85% (Table 2). The prevalence of PF was lowest in persons aged 18–44 (0.53%) and highest in persons aged 45–64 (1.33%) (Table 2). Females (1.19%) were 2.5 times more likely to report PF than males (0.47%). By ethnicity and race, Hispanic whites had the highest prevalence of PF (0.95%) followed closely by Non-Hispanic whites (0.93%). Both these groups had significantly higher PF prevalence than was seen in Non-Hispanic blacks (0.54%; p-value versus Non-Hispanic whites < 0.001; p-value versus Hispanic whites = 0.0434). Concerning education, no difference in PF prevalence was seen in college graduates (0.89%) versus those who hadn't graduated college (0.83). Persons on public health insurance had significantly higher PF prevalence (1.13%) than those without health insurance (0.62%; $p < 0.001$) or private health insurance (0.86%; $p = 0.016$). Although small differences in PF prevalence were noted across geographic regions, none of these differences were statistically different from each other. BMI was strongly associated with PF. Those with a BMI of 30 or more (1.48%) were 5-times more likely to have PF than those with a BMI less than 25 (0.29%).

Characteristics of PF pain

Of the 650 individuals with PF, one quarter (25.93%, 22.18–29.69) reported having severe PF pain, 45.45% (51.17–49.74) reported moderate pain and 28.61% (24.88–32.35) had mild PF pain. Most individuals with PF reported pain every day (61.98%; 57.77–66.19). More than one-half of Individuals with PF reported that their pain interfered with normal work activities at least moderately (53.95%, 49.71–58.20), with almost a third reporting severe (quite a bit or extreme) pain-related interference (30.36, 26.49–34.22).

Forty percent of those with PF (40.46%: 35.76–45.16) reported being diagnosed within the last year. Fifty-one percent (50.91%: 46.14–55.67) were diagnosed at least 3 years previously, and one-third had received their diagnosis at least 5 years previously (33.0%: 28.55–37.49). Years since diagnosis was related to the prevalence of severe PF pain ($p = 0.042$): 22.96% (18.35–27.56) of individuals diagnosed within the last 2 years reported

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severe PF pain, compared to 30.88% (24.58–37.18) of those diagnosed at least 3 years previously. However, years since diagnosis was unrelated to the frequency of PF pain in the previous month (p = 0.905); 62.17% (56.65–67.69) of individuals diagnosed within the past 2 years reported daily PF pain compared to 61.66% (55.22–68.09) of those diagnosed 3 or more years ago.

Pain severity and pain interference also varied by age, race, education and health insurance status but not by sex, region or BMI (table 2). Age was inversely related to the prevalence of severe PF pain: As age increased, the prevalence of severe plantar fasciitis pain decreased from 33.49% (26.02–40.96) in those 18–44 years of age to only 19.86% (10.88–28.85; p=0.22) in those 65 or older. However, the prevalence of at least moderate pain-related interference increased with age: 44.05% (36.43–51.67) in those aged 18–44 to versus 69.41% (59.48–79.93; p <0.001) in those 65 or older. While Non-Hispanic blacks were more likely to have pain related interference than Non-Hispanic whites (71.31% [59.43–83.19] vs. 51.64% [47.02–56.26]; p< 0.001), no difference was seen in the prevalence of severe plantar fasciitis pain. No differences were seen between Hispanic and Non-Hispanic whites in either the prevalence of severe pain or pain-related interference. Individuals with less than a college education were more likely to have pain-related interference than those with a college education (41.7% [35.42–47.98] vs. 59.13% [53.80–64.46] p < 0.001). Those with public health insurance were more likely to have pain-related interference than those with private insurance (74.27 [66.72–81.83] vs 45.36 [39.86–50.87]; p< 0.001). Despite having relatively low plantar fasciitis prevalence, those without health insurance had higher rates of severe plantar fasciitis pain than those with private health insurance (34.86% [23.98–45.98] vs. 22.58% [18.08–27.07]; p = 0.041).

Health Status

Individuals with PF were more likely to have comorbid conditions than those without PF (Table 3). Specifically, individuals with PF were more likely to have pain associated with diagnosed: 1) back problems (44.74% vs. 10.18%); 2) headaches and migraines (23.53% vs. 4.45%); 3) joint problems (48.25% vs. 11.04%); 4) neuropathic pain (12.45% vs. 2.48%); 5) pelvic pain (25.13% vs. 3.50%); and 6) tendonitis, sprains or strains (19.00% vs. 2.03%). Individuals with PF were also more likely to have diagnosed depression (39.33% vs. 15.66%), diagnosed diabetes (19.80 vs 10.28), and diagnosed sleep disorders (58.5% vs. 28.97%). Mirroring the significant association of PF with other debilitating health conditions, individuals with PF were more likely to report having poor/fair health compared to those without PF (33.85% vs. 17.9%).

Who diagnosed Plantar fasciitis

Of the 650 persons reporting PF, substantially more (74.31%, 95% CI: 70.95–78.41; p<0.001) were diagnosed by a medical non-specialist (referent), than by a medical specialist (25.69%, 95% CI: 22.33–29.05. Individuals diagnosed by a medical specialist tended to have more severe disease (severe PF pain , moderate or more pain-related interference with work), have had the PF longer (three or more years since diagnosis), have poorer health status (poor-fair global health status, diagnosed depression, diagnosed sleep disorders) and more functional limitations (any limitation walking and any limitation using stairs) than

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those diagnosed by non-specialists (Table 4). Despite differences in health status according to who diagnosed PF, no differences were seen in the prevalence of diagnosed pain other than PF (Table 4) or the prevalence of back problems, headaches and migraines, joint problems, neuropathic pain, or tendonitis, sprains and strains (data not shown).

Medication use by individuals with plantar fasciitis pain

Table 5 lists the prescription medications and OTC used by those with PF. While 41.04% of individuals with PF were using at least one prescription drug for pain management, only 6.31% said they used the drug specifically to manage their PF pain. Similarly, while about one-quarter of individuals with PF pain used opioids (27.97%) and prescription NSAIDS (23.73%) for any pain, far fewer used these medications specifically to treat their PF pain. No individuals were identified who used anticonvulsants, muscle relaxants or amitriptyline specifically for their PF. More than two-thirds of individuals with PF were using OTC products for pain management (69.88%). The most prevalent OTC products used were NSAIDs (49.48%) followed by acetaminophen (26.93%). Only 1.37% used herbal products or other non-vitamin, non-mineral dietary supplements.

Participant characteristics associated with medication use

Individuals diagnosed by a medical specialist were twice as likely to use a prescription drug for their PF pain than someone diagnosed by a non-specialist (Table 6: 10.31% vs. 4.89%; p= 0.029). Besides who diagnosed PF, only one other characteristic, PF pain severity, was associated with the use of prescription drugs specifically for PF pain in bivariate analyses. It was found that individuals with severe PF pain were more likely to use prescription drugs for the PF pain than those with less severe pain (11.05% vs. 4.65%; p= 0.009). These associations were explored further in multivariable logistic regression analyses (Table 7) that controlled for age, ethnicity/race, health insurance status, highest education, region and sex. Individuals diagnosed by a medical specialist had twice the odds (OR: 2.12; 95% CI 1.01–4.46) of using a prescription medicine specifically for PF as did individuals diagnosed by a non-specialist. However, after controlling for other variables in the regression model, PF pain severity was no longer statistically associated with prescription drug use specifically for PF pain (OR: 2.12; 95% CI: 0.99–4.51). The logistic regression analysis also revealed that Non-Hispanic blacks had 3-times the odds (OR: 3.02; 95% CI: 1.05–8.70) of using prescription drugs specifically for PF as Non-Hispanic whites. This is consistent with the bivariate analysis, with Non-Hispanic blacks having a significantly higher use of prescription drugs than Non-Hispanic whites: 12.41% versus 4.70% (p=0.0128), respectively.

DISCUSSION

Using data from a large internet-based survey, we identified 650 individuals with PF (0.85% of all adults surveyed). Of these 650 individuals, 261 (41%) were using a prescription drug to manage their pain, but only 38 individuals (6.3%) were using these pain medicines specifically for the PF pain. For these 38 individuals, those diagnosed by a medical specialist had twice the odds of using prescription pain medications versus those diagnosed by non-specialists. These data are consistent with the literature, with medical specialist being more

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likely to prescribe opioids for pain than other providers (16, 19, 29, 39). We expanded on this literature by: 1) examining prescription drug use specifically to manage a single painful condition, PF; 2) showing this difference in prescription medication use persists independent of the pain associated with the specific condition of interest; and 3) controlling for a larger array of demographic characteristics than previously considered including region and education. However, limiting our analysis to any prescription pain medication may have masked prescribing differences for specific drug categories. For instance, Breuer et al., (5) found that primary care physicians were more likely to prescribe NSAIDs, while pain specialists were more likely to prescribe opioids to patients with chronic pain.

We found that Non-Hispanic blacks were substantially more likely to use pain medicine for their PF than were Non-Hispanic whites, even after controlling for other key demographic characteristics, pain severity and who diagnosed PF. The reasons for this high use of prescription pain drugs for PF pain was not clear given a rich literature showing that blacks are often undermedicated for their pain (22). While pain severity can be a driver of prescription medication use (12), in the present study there was no statistical difference in the prevalence of severe PF pain between Non-Hispanic blacks and whites - 27.85% vs. 23.08%, respectively ($p = 0.456$) – However, we did find that Non-Hispanic blacks are more likely to suffer from at least moderate pain-related interference than Non-Hispanic whites (71.31% vs 51.64%, respectively; p= 003). The increased pain-related interference seen in Non-Hispanic blacks may partly account for their higher rates of walking limitations than seen in Non-Hispanic whites (74.58% vs. 61.2%, respectively; p= 0.035), as well as limitations using stairs (79.08% vs. 64.45%, respectively; $p = 0.026$). The increased likelihood of limitations and pain-related interference seen in Non-Hispanic blacks may be driving higher use of prescription pain medications than seen in Non-Hispanic whites.

The prevalence of drug use in the present study is less than that found in clinical PF populations. For instance, Klein et al., (17) found that 8.8% of patients being seen by orthopedic surgeons at a university hospital were using opioids for their PF versus 2.2% in the current study. This higher use of medications probably reflects more severe disease seen in clinical populations than in the general population. As evidence, those with severe PF pain in the present study were twice as likely to use any prescription pain medications than those with less severe disease. However, even the low use of opioids for PF seen in the present study is still worrisome given: 1) the potential harms associated with opioid use (8); and 2) that practice guidelines and clinical reviews do not recommend opioids to manage PF (6, 21, 34, 35).

Several previous surveys have identified the use of NSAIDs among individuals with plantar fasciitis (17, 25, 28, 41), with rates of use varying from 39.0% (25) to 55.5% (17) of patients. We found that 49.48% used OTC NSAIDs and 23.73% used prescription NSAIDs, with 11.49% (8.70–14.28) using both. Despite this high use of NSAIDs across multiple surveys, as well as inclusion into at least one clinical practice guideline (34), we are aware of only two randomized clinical trials testing the efficacy of oral NSAIDs in PF pain, both of which failed to find NSAIDS efficacious (3,9). These limited clinical trial data question the high prevalence of NSAIDs use, especially given evidence suggesting that inflammatory

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processes do not contribute to PF pathology (18), and the potential harm associated with long-term use of NSAIDs (32).

It is possible that the high level of co-morbid pain seen in this study - 84% of individuals with PF reported having at least one other diagnosed painful condition - may impact the prevalence of drug use specifically to treat PF. It may be that treatment for the first diagnosed pain condition influences treatment choices for subsequently diagnosed condition(s). For example, of the 153 individuals with both PF and diagnosed, current idiopathic low back pain (LBP), 70 (43%) reported having their LBP diagnosed first, 42 (24%) reported having PF diagnosed first, with the remainder (33%) having LBP and PF diagnosed in the same year. The impact of diagnosis order in individuals with multiple sources of pain is a research question to be addressed in future analyses.

Both the present study and Riddle et al., (28) saw substantially lower PF prevalence than that seen in smaller studies of specific demographic groups, such as factory workers or runners. While some of these discrepancies may result from differences in the study designs (e.g. self-reported PF versus clinical evaluation), a more likely explanation is that prolonged standing, as might be done by factory workers (40), along with frequent running are strongly associated with plantar fasciitis (20, 31, 33). However, despite these differences in overall PF prevalence, there are several common observations between the present analyses and previous studies: 1) age appears associated with PF (11, 13, 17, 23, 25, 27, 28); 2) females are more likely to have PF than males (7, 10, 11, 23, 25, 27, 30, 33, 40); 3) higher BMI is associated with PF (13–15, 25–27, 38); 4) PF is associated with reduced health-related quality of life (15); 5) PF is associated with limitations in physical activities involving the lower extremities, such as walking, running or climbing stairs (15, 25, 27); and 6) primary care physicians more likely to diagnose PF than other providers (28). The consistency of these findings suggests factors that could aid in identifying individuals at risk for developing plantar fasciitis, as well areas where preventative and treatment strategies might be focused.

The current analysis has several limitations beyond those already mentioned: 1) The NHWS is a cross-sectional survey and cannot be used to establish causality; 2) A diagnosis of current plantar fasciitis pain is measured in this study by self-report, as are interactions with healthcare providers and use of prescription drugs. It also must be considered that when participants report the use of a specific prescription drug for a specific type of pain, they may be reporting on the reason they currently use the drug, not necessarily the reason they were initially prescribed the drug; 3) Because the NHWS limited questions about prescription drug use to 61 specific drugs or combinations, we may be underestimating actual use of prescription drugs to manage plantar fasciitis pain. However, given that the list of 61 includes the most well-known pain medications, any underestimation is probably small; 4) The NHWS did not collect many participant characteristics that have previously been shown associated with PF pain, including type and amount of physical activity, shoe wear, and type of occupation. Inclusion of these variables in the analysis may have identified populations with substantially higher rates of PF and prescription pain medications then seen in the present analysis; and 5) The NHWS is a convenience internet sample, albeit a very large one, which limits the generalizability of our findings. In this regard, the lower than expected unweighted prevalence of individuals self-reporting as Hispanic (versus the Census

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Bureau American Community Survey) may limit comparisons of this demographic group to results derived from national probability samples, especially if the under-recruitment resulted from some type of systematic bias (e.g., lack of internet access. Nevertheless, the distribution of the NHWS by age, race, region and sex are comparable to ACS (Table 1). Also comforting is that: 1) our observed PF prevalence is consistent with that for PF healthcare visits by the general U.S. adult population (28); and 2) the prevalence generated from the NHWS for many other diagnosed disease or conditions (i.e., arthritis, asthma, cancer, diabetes, heart disease, hypertension, insomnia and stroke) are consistent with the prevalence calculated using the Centers for Disease Control and Prevention's National Health Interview Survey (4).

In conclusion, most of our current knowledge regarding PF epidemiology is based on clinical samples or specific cohorts (e.g., runners, factory workers, etc.) rather than a wide swath of U.S. adults. Therefore, the current study, involving a large sample of U.S. adults, provides additional insights into an often-disabling disorder, as well as the pharmaceutical treatments being used for its management despite limited, if any, clinical trial data supporting their use. What is still unknown is the extent to which non-pharmacologic interventions identified in practice guideline (6, 21, 35, 36) are used by individuals with PF in the general population.

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Highlights

- Plantar fasciitis pain prevalence is presented for U.S. adults by demographic group
- Most individuals with plantar fasciitis report a least moderate daily pain.
- Disease severity was associated with pharmaceutical therapy
- Blacks and individuals diagnosed by medical specialists had more severe disease
- These two groups were also more likely to receive pharmaceutical therapy

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PERSPECTIVE

The current study provides additional insights into the pain and disability associated with plantar fasciitis, as well as the pharmaceutical treatments being used for its management. Both prescription and OTC medications are used to manage plantar fasciitis symptoms despite limited, if any, clinical trial data supporting their use.

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Table 1

The Demographic Characteristics of the 2013 NHWS Sample Compared With Data From the 2011 to 2013 U.S. Census Bureau ACS

		2013 NHWS				2011–2013 ACS				
		Raw N	Raw Percent (Column)*	Weighted Percent (Column)*	SE	Raw Percent (Column)*	Weighted Percent (Column)*	SE	ASD of Unweighted Percent	ASD of Weighted Percent
Age	18 to 44	32,159	42.9	47.3	.2	41.6	46.5	.02	.026	.016
	45 to 64	26,341	35.1	35.1	.16	38.1	35.3	.02	.026	.004
	≥65	16,500	22.0	17.7	.2	20.3	18.2	.02	.042	.013
Hispanic	No	68,395	91.7	85.4	.19	88.0	85.3	.01	.122	.003
	Yes	6,192	8.3	14.6	.19	12.0	14.7	.01	.122	.002
Race	White	57,916	77.5	75.0	.19	78.4	75.7	.02	.022	.015
	Black or African American	8,871	11.9	12.3	.15	10.6	12.1	.01	.04	.007
	Other	7,913	10.6	11.9	.15	11.0	12.3	.01	.013	.012
Region	Northeast	13,203	17.6	17.6	.16	18.2	18.2	.01	.016	.016
	Midwest	18,056	24.1	24.1	.19	21.8	21.4	.01	.055	.064
	West	16,040	21.4	21.4	.19	23.2	23.2	.01	.043	.043
	South	27,701	36.9	36.9	.21	37.0	37.2	.01	.002	.006
Sex	Male	36,289	48.4	48.1	.21	48.1	48.6	.02	.006	.01
	Female	38,711	51.6	51.9	.21	51.9	51.4	.02	.006	.01

Abbreviation: SE, standard error.

*Values may not add to 100% because of rounding error or missing data.

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Table 2

One Month Prevalence of Diagnosed, Current Plantar Fasciitis Pain According to Demographic Characteristics

		Sample N	Plantar Fasciitis,* n (Weighted Row %, 95% CI)	Sample N	Severe Plantar Fasciitis Pain,† n (Weighted Row %, 95% CI)	Plantar Fasciitis With Moderate or More Pain-Related Interference,‡ n (Weighted Row %, 95% CI)
	Total Sample	75,000	650 (.85, .77–.92)	650	160 (25.93, 22.19–29.68)	343 (53.95, 49.72–58.19)
Age	18–44¶	32,159	188 (.53, .44–.6)	188	57 (33.49, 26.02–40.96)	84 (44.05–36.43–51.67)
	45–64	26,341	333 (1.33, 1.18–1.48)	333	80 (23.72, 18.94–28.50)	180 (54.69, 49.10–60.28)
	65 +	16,500	129 (.76, .58–.94)	129	23 (19.86, 10.88–28.85)	79 (69.41, 59.48–79.93)
BMI	<25¶	25,528	78 (.29, .22–.36)	78	12 (17.78, 7.68–27.28)	39 (52.39, 40.35–64.43)
	25 to <30	28,852	190 (.81, .69–.94)	190	47 (25.75, 18.82–32.69)	97 (52.37, 44.63–60.09)
	≥30	23,692	362 (1.48, 1.31–1.65)	362	92 (26.70, 21.64–31.76)	194 (54.55, 48.79–60.32)
Education	< College graduate	43,677	388 (.83, .74–.92)	388	103 (27.40, 22.59–32.22)	233 (59.13, 53.80–64.46)
	College graduate¶	31,323	262 (.89, .78–1.0)	262	57 (22.45, 17.11–27.79)	110 (41.7, 35.42–47.98)
Ethnicity and Race	Non-Hispanic White¶	53,967	502 (.93, .84–1.02)	502	111 (23.08, 19.16–27.00)	254 (51.64, 47.02–56.26)
	Non-Hispanic black	8,515	59 (.54, .39–.68)	59	17 (27.85, 15.93–36.77)	40 (71.31, 59.43–83.19)
	Hispanic, white	3,724	35 (.95, .58–1.32)	35	12 (32.43, 15.02–49.84)	18 (59.88, 41.61–78.16)
	Other	8,794	54 (.64, .45–.83)	54	20 (38.56, 24.21–52.91)	31 (52.25, 37.43–67.08)
Health Insurance	None	13,045	85 (.62, .48–.76)	85	30 (34.86, 23.98–45.98)	47 (54.24, 42.83–65.64)
	Public	14,015	156 (1.13, .93–1.33)	156	40 (29.15, 21.04–37.27)	112 (74.27, 66.72–81.83)
	Private¶	46,010	400 (.86, .77–.96)	400	88 (22.58, 18.08–27.07)	178 (45.36, 39.86–50.87)
Region	Northeast	13,203	109 (.78, .62–.93)	109	29 (28.77, 19.35–38.18)	57 (53.63, 43.54–63.72)
	Midwest	18,056	187 (.98, .83–1.13)	187	40 (23.23, 16.71–29.76)	101 (54.77, 47.19–62.35)
	West	16,040	143 (.90, .74–1.060	143	42 (32.06, 23.36–40.77)	75 (53.33, 44.24–62.42)
	South¶	27,701	211 (.76,.64–.88)	211	49 (22.44, 16.34–28.55)	110 (53.86, 46.22–61.55)
Sex	Male	36,289	188 (.47, .39–.56)	188	51 (28.76, 21.09–36.44)	96 (55.30, 46.71–63.90)
	Female¶	38,711	462 (1.19, 1.08–1.31)	462	109 (24.89, 20.61–29.17)	247 (53.45, 48.61–58.30)

*Defined as a diagnosis of plantar fasciitis and PF.

†On the basis of the question: “How severe is your plantar fasciitis pain?”

‡On the basis of the question: “During past 4 weeks, how much did pain interfere with normal work?”

[¶] Referent group

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Table 3

Plantar Fasciitis Pain: Selected Comorbidities and Global Health Status

	Those With Plantar Fasciitis* (N = 650), n (Weighted Column %, 95% CI)	Those Without Plantar fasciitis (N = 74,350), n (Weighted Column %, 95% CI)	P
Any limitations walking	401 (63.37, 59.35–67.4)	27,472 (38.24, 37.83–38.65)	<.001
Any limitations climbing stairs	428 (66.38, 62.42–70.34)	29,215 (40.22, 39.81–40.63)	<.001
Any type of diagnosed pain besides plantar fasciitis	541 (84.20, 81.17–87.24)	18,433 (24.41, 24.05–24.76)	<.001
Diagnosed back problems	284 (44.73, 40.46–49.00)	7,618 (10.18, 9.93–10.43)	<.001
Diagnosed diabetes	132 (19.80, 16.44–23.15)	8,229 (10.28, 10.02–10.53)	<.001
Diagnosed depression	242 (39.33, 35.17–43.5)	11,214 (15.66, 15.37–15.96)	<.001
Diagnosed headaches and migraines	153 (23.53, 20.02–27.05)	3,186 (4.45, 4.28–4.62)	<.001
Diagnosed joint problems	314 (48.25, 43.99–52.52)	8,616 (11.04, 10.78–11.30)	<.001
Diagnosed neuropathic pain	83 (12.45, 9.67–15.22)	1,956 (2.48, 2.35–2.60)	<.001
Diagnosed pelvic pain	162 (25.13, 21.28–28.97)	2,645 (3.50, 3.36–3.65)	<.001
Poor/fair global health status	213 (33.85, 29.81–37.88)	12,250 (17.0, 16.68–17.31)	<.001
Diagnosed sleep disorders	366 (58.5, 54.33–62.66)	20,724 (28.97, 28.59–29.34)	<.001
Diagnosed tendonitis, sprains, strains	125 (19.0, 15.76–22.26)	1,442 (2.03, 1.83–2.05)	<.001

*Defined as a diagnosis of plantar fasciitis and PF.

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Table 4

Health Characteristics of Those With Diagnosed, Current Plantar Fasciitis Pain According to Who Provided Diagnosis

	Medical Specialist* (N = 167), n (Weighted Column %, 95% CI)	Nonspecialist†,‡ (N = 483), n (Weighted Column %, 95% CI)	P
Any limitation using stairs	124 (72.86, 65.42–80.29)	304 (64.07, 59.40–68.75)	.049
Any type of diagnosed pain besides plantar fasciitis	137 (82.39, 75.96–88.81)	404 (84.85, 81.44–88.27)	.564
Any walking limitation	118 (72.07, 64.90–79.23)	283 (60.27, 55.48–65.06)	.007
Daily pain	112 (68.66, 61.11–76.21)	290 (59.59, 54.61–64.58)	.049
Diagnosed depression	76 (51.43, 44.28–59.68)	166 (35.02, 30.33–39.70)	.001
Diagnosed sleep disorders	106 (65.85, 58.10–73.60)	260 (55.87, 50.95–60.80)	.033
Moderate or more pain-related interference	102 (62.37, 54.48–70.27)	241 (50.95, 45.96–55.94)	.016
Poor/fair global health status	71 (44.05, 35.79–52.31)	142 (30.20, 25.66–34.75)	.004
Severe plantar fasciitis pain	55 (34.76, 26.73–42.80)	105 (22.78, 18.65–26.92)	.009
Three or more years since diagnosis	82 (47.26, 39.02–55.50)	173 (34.12, 29.56–38.68)	.006

*Orthopedist, rheumatologist, or pain management specialist.

†Primary care physician or general practitioner or internist, nurse practitioner, or physician assistant, other.

‡Referent group.

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Table 5

Use of Prescription Medications and OTC Products by Those With Diagnosed, Current Plantar Fasciitis Pain

	Prevalence in Those With Diagnosed Plantar Fasciitis* (N = 650)	
	Drug Used for Any Type of Painn (Weighted Column %, 95% CI)	**Drug Used Specifically for Plantar Fasciitis Painn (Weighted Column %, 95% CI)**
Any prescription drug	261 (41.04, 36.78–45.3)	38 (6.31, 4.21–8.42)
Opioid use	172 (27.97, 23.93–32.0)	14 (2.21, .93–3.48)
Prescription NSAIDs	138 (23.73, 19.77–27.69)	23 (4.01, 2.3–5.72)
Anticonvulsants	55 (7.88, 5.75–10.01)	0
SNRI	15 (1.94, .95–2.94)	0
Muscle relaxants	62 (9.94, 7.51–12.48)	0
Amitriptyline	9 (1.47, .49–2.46)	0
Any OTC	466 (69.88, 65.77–73.98)	Data not collected
Any OTC analgesic	441 (66.39, 62.22–70.56)	Data not collected
OTC acetaminophen	175 (26.93, 23.19–30.67)	Data not collected
OTC NSAIDs	329 (49.48, 45.23–53.73)	Data not collected
OTC aspirin	69 (9.45, 2.25–7.19)	Data not collected
Multiple products (2 or more of aspirin, acetaminophen, NSAIDs)	127 (26.87, 22.56–31.18)	Data not collected
OTC herbal products	10 (1.37, 1.59–2.23)	Data not collected

Abbreviation: SNRI, serotonin and norepinephrine reuptake inhibitor.

*Defined as a diagnosis of plantar fasciitis and PF.

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Table 6

Use of Prescription Drugs for Plantar Fasciitis Pain According to Selected Participant Characteristics

		Use of Any Prescription Drug Specifically for Plantar Fasciitis* (N = 38), n (Weighted Row %, 95% CI)	χ^2 P
Who diagnosed plantar fasciitis pain?	Medical specialist	14 (10.31, 4.68–15.93)	.029
	Not medical specialist†	24 (4.89, 2.89–6.89)	
Covariate			
Age	18 to 44†	13 (8.46, 3.85–13.07)	.175
	45 to 64	22 (6.27, 4.56–9.08)	
	≥65	3 (2.55, 0–5.51)	
Any limitation using stairs	No†	16 (7.87, 3.91–11.83)	.300
	Yes	22 (5.52, 3.06–7.98)	
Any type of diagnosed pain besides plantar fasciitis	No†	9 (9.25, 2.86–15.64)	.239
	Yes	29 (5.76, 3.56–7.96)	
Any walking limitation	No†	13 (5.45, 2.38–8.53)	.531
	Yes	25 (6.81, 3.99–9.62)	
BMI	<25†	6 (6.86, 1.34–12.39)	.293
	25 to <30	12 (7.69, 3.07–12.31)	
	≥30	17 (4.96, 2.51–7.41)	
	Missing	3 (14.8, 0–30.71)	
Diagnosed depression	No†	21 (5.51, 3.08–7.95)	.359
	Yes	17 (7.54, 3.72–11.36)	
Diagnosed sleep disorders	No†	15 (6.12, 2.94–930)	.882
	Yes	23 (6.45, 3.63–9.26)	
Ethnicity and race	Non-Hispanic white†	21 (4.70, 2.67–6.73)	.063
	Non-Hispanic black	7 (12.41, 3.30–21.51)	
	Hispanic, white	4 (6.93, 0–14.47)	
	Other	6 (12.73, 2.07–23.39)	
Global Health Status	Poor to fair	12 (6.53, 2.6–10.46)	.887
	Good to excellent†	26 (6.20, 3.72–8.67)	
Health insurance	None	6 (8.31, 1.43–15.18)	.418
	Public	6 (3.95, .80–7.10)	
	Private†	26 (6.74, 4.03–9.45)	
Highest level of education	< College graduate	23 (6.41, 3.70–9.12)	.871
	College graduate†	15 (6.07, 3.01–9.13)	
Pain frequency	Less than daily pain†	17 (6.76, 346–10.07)	.737
	Daily pain	21 (6.03, 3.30–8.770)	
Pain interference with work	Little at most†	13 (4.45, 1.94–6.96)	.103
	Moderate or more	25 (7.90, 4.64–11.16)	

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		Use of Any Prescription Drug Specifically for Plantar Fasciitis* (N = 38), n (Weighted Row %, 95% CI)	χ^2 P
Plantar fasciitis pain severity	Less than severe†	21 (4.65, 2.56–8.75)	.009
	Severe	17 (11.05, 5.63–16.46)	
Region	Northeast	4 (4.45, 0–9.11)	.862
	Midwest	10 (5.82, 2.12–9.53)	
	West	9 (7.51, 2.34–12.68)	
	South†	15 (6.75, 3.20–10.30)	
Sex	Male	9 (6.45, 1.87–11.02)	.944
	Female†	29 (6.26, 3.92–8.61)	
Years with diagnosis of PF	2 Years or less†	25 (6.72, 3.99–9.45)	.625
	3 Years or more	13 (5.63, 2.32–8.94)	

*Defined as a diagnosis of plantar fasciitis and PF.

†Referent group.

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Table 7

Associations between Participant Characteristics and Use of Prescription Medications to Manage Plantar Fasciitis Pain

		Use of Any Prescription Pain Medicine Specifically for Plantar Fasciitis* (N = 270)			
		Unadjusted OR		Adjusted OR†	
		Point Estimate	95% Wald CI	Point Estimate	95% Wald CI
Who diagnosed plantar fasciitis pain?	Medical specialist‡	2.23	1.06–4.72	2.12	1.01–4.46
	Medical nonspecialist§	Ref		Ref	
Covariate					
Age	18 to 44	Ref		Ref	
	45 to 64	.72	.34–1.56	.75	.34–1.68
	≥65	.28	.08–1.07	.34	.07–1.66
Ethnicity and race	Non-Hispanic white	Ref		Ref	
	Non-Hispanic black	2.87	1.11–7.46	3.02	1.05–8.70
	Hispanic, white	1.51	.43–5.30	1.22	.30–4.97
	Other	2.96	1.02–8.57	2.75	.94–8.08
Health insurance	Private	Ref		Ref	
	Public	.57	.22–1.45	.57	.19–1.68
	Uninsured	1.25	.46–3.41	1.02	.39–2.66
Highest education	< College education	1.06	.53–2.14	1.07	.50–2.26
	College graduate	Ref		Ref	
Region	Northeast	.64	.19–2.21	.69	.19–2.45
	Midwest	.86	.35–2.07	.99	.39–2.50
	West	1.12	.44–2.86	.93	.36–2.40
	South	Ref		Ref	
Sex	Male	1.03	.44–2.43	1.04	.43–2.49
	Female	Ref		Ref	
Plantar fasciitis pain severity	Less than severe	Ref		Ref	
	Severe	2.55	1.23–5.26	2.12	.99–4.51

Abbreviation: Ref, reference

*Defined as a diagnosis of plantar fasciitis and PF.

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† The multivariable logistic regression model includes all listed variables

‡ Orthopedist, rheumatologist, or pain management specialist

§ Primary care physician or general practitioner or internist, nurse practitioner, or physician assistant, other