The United States National Health and Nutrition Examination Survey and the Epidemiology of Ankylosing Spondylitis

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Abstract: Currently available U.S. population–based data for ankylosing spondylitis (AS), spondyloarthritis and inflammatory back pain (IBP) from the nationally representative U.S. National Health and Nutrition Examination Survey (NHANES) include both NHANES I (1971–1975) and NHANES II (1976–1980) surveys. The pelvic radiographs obtained in NHANES I provided U.S. prevalence estimates for radiographic sacroiliitis, an important component of the AS case definition. AS and spondyloarthritis prevalences cannot readily be calculated from NHANES I survey data; however, IBP prevalence (Rudwaleit et al Criteria 7b) can be estimated from NHANES II. The NHANES II estimate for IBP is 0.8% of the adult population ages 25 to 49 years. The prevalence of IBP in the subset of persons with a history of a back pain episode lasting 2 or more weeks was 6.7%. The 2009–2010 NHANES U.S. Inflammatory Back Pain/Spondyloarthritis survey is currently fielded.

Key Indexing Terms: Spondyloarthritis; Inflammatory back pain; NHANES; Survey; Prevalence; United States. **[Am J Med Sci 2011; 341(4):281–283.]**

Comparatively few population-based studies in the United States have described the prevalence of spondyloarthritis (SpA), and none are national in scope. SpA is a family of diseases that includes ankylosing spondylitis (AS), reactive arthritis and SpA that is found among juveniles, in psoriasis and in inflammatory bowel disease. SpA is thought to be associated with the specific syndrome of inflammatory back pain (IBP). Although clinical case criteria for IBP have been available since the late 1970s, there have been no previous reports on the prevalence of IBP from population-based studies. In this article, some of the prevalence estimates currently available for SpA and IBP in the United States are reviewed, with particular emphasis on data available from the U.S. National Health and Nutrition Examination Survey (NHANES). In addition, an overview is provided of the study protocol for the currently fielded 2009–2010 NHANES study of IBP and SpA.

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Submitted December 15, 2010; accepted in revised form January 10, 2011.

This study was supported by the U.S. Centers for Disease Control & Prevention and an unrestricted grant to the CDC Foundation from the Spondyloarthritis Association of America (SAA).

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Presented at the annual research and education meeting of Spondyloarthritis Research and Treatment Network (SPARTAN), Houston, Texas, July 23–24, 2010.

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METHODS

The medical literature was reviewed to identify epidemiologic publications on the prevalence of SpA and IBP in the United States. In addition, the publicly available data from previous NHANES arthritis surveys were systematically reviewed to see if retrospective analyses could be performed to provide national-level SpA or IBP prevalence estimates for these earlier survey years. NHANES is a cross-sectional survey monitoring the health and nutritional status of the civilian, noninstitutionalized population of the United States Health interviews, health examinations and laboratory tests are performed in mobile examination centers. The NHANES survey samples are selected through a complex, multistage design to be nationally representative. In the early NHANES surveys, the survey design included little oversampling, so only overall national prevalence estimates could be obtained. More recent NHANES surveys incorporate oversampling of the major demographic subgroups such as race/ethnic groupings, persons with low income and others to ensure reliable subgroup prevalence estimation. The U.S. prevalence of IBP was calculated using the following NHANES II questionnaire items: history of back pain; duration of the longest episode of back pain $\geq$4 months; age at onset of back pain; history of morning stiffness in the back $>$30 minutes; back pain improving with exercise; and back pain present when resting at night.[1] Statistical data analysis was performed using sample weights accounting for the complex survey design, nonresponse and noncoverage. Variance estimates used Taylor series linearization. Statistical analyses used SAS (Release 9.2; SAS Institute, Cary, NC)[2] and SUDAAN (Release 10.0; Research Triangle Institute, Research Triangle Park, NC).[3]

RESULTS

The available literature for population-based studies of SpA in the United States is limited. No population-based studies of IBP have been reported. The earliest U.S. SpA study was the Tecumseh, Michigan Community Health Survey (1959–1960) of AS conducted by the University of Michigan and sponsored by the U.S. National Institutes of Health.[4] This was a survey of a small Michigan community of 9500 persons and had an 87% response rate. The prevalence of AS was estimated by medical history, clinical examination and review of available radiologic studies performed by personal physicians; however, modern AS criteria were not used. AS was diagnosed in 16 of 7027 adults. The overall prevalence in the community was 0.22%. A second AS community study was performed by the Mayo Clinic, which surveyed medical records from 1935 to 1989 for all the residents of Olmstead County, Minnesota.[5] AS case classification was by the modified New York Criteria.[6] Some 158 AS cases were identified during the 55-year period. Although population prevalence was not estimated in this study, the overall age and sex-adjusted incidence rate for AS was 7.3 per 100,000 person-years.

AS is only 1 component of overall SpA. The U.S. National Arthritis Data Workgroup, jointly sponsored by the National Institute for Arthritis and Musculoskeletal and Skin Diseases, the U.S. Centers for Disease Control and Prevention, the American College of Rheumatology, and the Arthritis Foundation, meets periodically to review U.S. public health arthritis data needs based on the most current U.S. and international data available. It publishes estimates of the national prevalence of arthritis overall and by subtype. The current U.S. National Arthritis Data Workgroup estimate is that overall U.S. prevalence of SpA of all types may range from 0.4% to 1.3%.[7]

A systematic review of NHANES I and II arthritis data was performed to determine whether this earlier survey data would support a retrospective analysis that could produce U.S. population–based prevalence estimates for SpA and/or IBP. A major focus of these surveys was to estimate the national prevalence and burden of back and neck pain and of osteoarthritis. NHANES II did not collect data to support prevalence estimation for SpA. NHANES I did collect most of the data items that would be required to fulfill a modern SpA case definition, but these data were not collected for the full sample of adults who received the arthritis questionnaire. NHANES I data analysis is further impeded by item nonresponse and sample size limitations. The NHANES I data did, however, include a nationally representative set of pelvic radiographs that were read for sacroiliitis, a key component of AS, using the then current Atlas of Standard Radiographs.[8,9] The x-ray films were read independently by 2 rheumatologists with a final adjudicated reading made by a third rheumatologist. The prevalence of moderate to severe sacroiliitis was 0.4% among men aged 25 to 34 years; 0.6% percent among men aged 65 to 74 years; and 0.4% among women aged 65 to 74 years.

Both NHANES I and NHANES II had extensive back pain questionnaires that could be used to estimate the U.S. prevalence of IBP. The 2 back pain questionnaires were similar, but the NHANES II instrument was modified based on the experience with the earlier NHANES I version.[1] In addition, NHANES II had a much larger survey sample size than NHANES I. The NHANES II back pain data are significant because they were the basis for a major publication that defined the prevalence of chronic back pain in the United States.[10] There are 5 major published case classification definitions for IBP.[11–14] In 4 of these, IBP prevalence could not be calculated because of missing variables. For example, there was no NHANES II question regarding a gradual (insidious) onset of chronic back pain (central to 3 of the 4 IBP case definitions), and data for buttock pain were not collected. However, a U.S. national IBP estimate can be produced using 1 of the 2 preferred classification criteria (7b) published by Rudwaleit et al.[13] The estimates are presented in Table 1. These criteria are validated only for adults younger than 50 years. The NHANES II estimate for IBP prevalence by these criteria is 0.8% in U.S. adults aged 25 to 49 years, 6.7% among those who have had an episode of back pain lasting for 2 weeks and 20.2% among those who have had an episode of back pain lasting ≥4 months.

A cross-sectional survey of IBP and SpA is currently fielded in NHANES 2009–2010. Current estimates of the prevalence of IBP and SpA in the United States are desirable for public health planning because of the recent introduction of new case criteria, improved therapy (tumor necrosis factor-α blockers) and advances in genetic testing. The goals of this new NHANES survey are to provide a modern U.S. prevalence estimate for IBP and to provide a preliminary national prevalence estimate for SpA. Furthermore, a national prevalence estimate for human leukocyte antigen (HLA)-B27 will be obtained. HLA-B27 is an arthritis biomarker thought to be closely related to AS, SpA and IBP. Genetic samples and stored surplus sera samples will be collected. The target age range for the study is adults aged 20 to 69 years, with about 2500 persons per year studied. The study is designed to produce prevalence estimates by gender and for the major U.S. race/ethnicity subgroups.

TABLE 1. Inflammatory back pain prevelance, Rudwaleit et al. Criteria 7b: U.S. adults ages 20 to 49 years, NHANES II (1976–1980)[13]

	Total sample	Ever had back pain episode	
		2 Weeks	4 Months
Sample size (N)	4481	578	189
IBP cases (n)	38	38	38
% Prevalence IBP	0.8	6.7	20.2
Standard error	0.1	1.0	2.9
95% Confidence interval	(0.5–1.1)	(4.5–8.8)	14.2–26.2)

IBP, inflammatory back pain.

The primary study aim is to measure the U.S. prevalence of IBP. The survey has limited peripheral joint data collection, no radiologic imaging and no data collected for reactive arthritis. Therefore, the U.S. prevalence SpA will be a lower bound estimate, reflecting mainly the prevalence of axial (spinal) SpA. The study supports IBP and SpA prevalence estimates by the major published criteria, except the Assessment of Spondylo-Arthritis international Society criteria, which were published after the survey was fielded.[12,15–17] Table 2 lists the NHANES 2009–2010 study components.

An IBP/SpA questionnaire was developed for the 2009–2010 NHANES survey. Questionnaire items were initially selected to support prevalence estimates for the major published IBP/SpA case definitions. Back pain and arthritis questionnaires from the medical literature and from previous

TABLE 2. NHANES 2009–2010 inflammatory back pain and spondyloarthritis study content

Household interview questionnaire
Descriptive questions for chronic back pain
Spinal pain location diagram
Inflammatory back pain criteria questions
Spondyloarthritis indicator questions
Previous medical diagnoses (iritis, psoriasis, inflammatory bowel disease)
Metrology studies
Occiput-to-wall distance
Chest circumference (inspiration-expiration)
Modified Schobers test
Laboratory and other studies
HLA-B27 biomarker
High-sensitivity C-reactive protein
Hematology, biochemistry profiles
DXA scan of proximal femur, lumbar spine
Spirometry

DXA, dual-energy x-ray absorptiometry.

NHANES surveys were then reviewed for possible questionnaire items, question wording and data formats. Preliminary data and focus group results from a U.S. study developing an AS questionnaire were also available.[18] A questionnaire was drafted, cognitively tested, then revised and piloted in 2008. It was then finalized based on pilot study results and interviewer staff input. A copy is available at the NHANES website.[19]

The NHANES IBP/SpA questionnaire has 3 subsections. In the first, a set of general questions is presented about a history of chronic spinal pain. A spinal pain diagram[20] captures a history of pain at 5 locations (the neck, the upper, mid and lower back and the buttocks); for each location, data collected include age of pain onset, pain variability over time (periodic/constant), pain duration (6-week episode, 3-month episode and current pain/when last had pain) and whether there was also a history of aching or stiffness at that site. The second subsection is a set of IBP indicator questions, which include items for the pattern of pain onset, morning stiffness, history of rest pain, whether awakened from sleep by pain (overall and in the second half of the night) and pain response to exercise. The third subsection is a set of SpA indicator questions, including a history of alternating buttock pain, heel or calcaneal tendon pain, data for the response to nonsteroidal anti-inflammatory drugs and questions about a previous diagnosis of psoriasis, iritis/uveitis and inflammatory bowel disease.

The NHANES 2009–2010 survey also includes SpA-related metrology data collection performed in the NHANES anthropometry examination. The aim is to obtain nationally representative data for 3 clinical tests: the occiput-to-wall distance, chest circumference measurement (inspiration versus expiration) and the modified Schöbers test of lumbar flexion. Normative reference ranges will be published for these clinical measures. Laboratory data collection includes HLA-B27 testing by sequence-specific polymerase chain reaction, high-sensitivity C-reactive protein and hematology and biochemistry studies in addition to other laboratory studies routinely collected for NHANES. Other examination data currently being collected for the adult sample include a dual-energy x-ray absorptiometry scan of the proximal femur and lumbar spine and spirometry. Finally, serum and genetic samples will be obtained and stored with the participant's consent and maintained for future analysis.

DISCUSSION

Diagnostic and classification criteria for IBP/SpA and the HLA-B27 biomarker have been in routine use in clinical and epidemiologic studies since the late 1970s. However, prevalence estimates for IBP or SpA are not yet adequate in the U.S. population. This article reviews the existing data for IBP and SpA in the United States and provides an estimate for the U.S. prevalence of IBP based on a retrospective analysis of data from NHANES II. Also presented is an overview of the study design of the NHANES 2009–2010 IBP/SpA survey, which is designed to provide more modern data to help support U.S. public health planning.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the efforts of the Spondyloarthritis Association of America (SAA) to help support and field the 2009 NHANES study. The work of Dr. Paul Beatty at NCHS and of Kay Apodaca, Jeffrey Kewin and the professional interviewing staff at Westat, Inc. is gratefully acknowledged. The authors especially acknowledge the generous voluntary participation of the U.S. citizens who have given their personal time to make the NHANES surveys possible.

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