

Short or Rapid Communication

Evaluation of high blood pressure and obesity among US coal miners participating in the Enhanced Coal Workers' Health Surveillance Program

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Abstract

Since 2005, the Enhanced Coal Workers' Health Surveillance Program (ECWHSP) has offered respiratory examinations to coal miners in a mobile examination unit. As little is known about the cardiovascular health of coal miners, we describe the prevalence of high blood pressure (BP) and obesity among ECWHSP participants. During 2015, 1402 ECWHSP health examinations were performed. The prevalence of BP consistent with hypertension (systolic BP ≥ 140 mm Hg or diastolic BP ≥ 90 mm Hg), prehypertension (systolic BP 120–139 mm Hg or diastolic BP 80–89 mm Hg), and hypertensive crisis (systolic BP ≥ 180 mm Hg or diastolic BP ≥ 110 mm Hg) were calculated and compared with the US adult population using standardized morbidity ratios (SMRs). Most participants were male ($N = 1317$, 94%), White ($N = 1303$, 93%) and non-Hispanic ($N = 1316$, 94%). Thirty-one percent ($N = 440$) of participants had BP in the hypertensive range and 87% ($N = 1215$) were overweight/obese. Twenty-four participants (2%) had a BP reading consistent with a hypertensive crisis. Prevalence of obesity (52%, SMR = 1.52, 95% confidence interval = 1.41–1.64) and BP consistent with hypertension (31%, SMR = 1.60, 95% confidence interval = 1.45–1.76) was higher than the US adult population. The prevalence of obesity and BP consistent with hypertension in this population of coal miners is substantial, indicating a need for cardiovascular health interventions in coal mining communities. *J Am Soc Hypertens* 2017; ■(■):1–5. Copyright © 2017 Published by Elsevier Inc. on behalf of American Society of Hypertension.

Keywords: Coal; miners; occupational health; mobile health screening.

Introduction

Since 2005, the National Institute for Occupational Safety and Health has administered the Enhanced Coal Workers' Health Surveillance Program (ECWHSP) which

offers medical examinations to coal miners at no cost to themselves in a mobile examination unit that travels to coal mining regions throughout the country. Outreach has been primarily directed to active coal miners, but former miners have been invited in the past. Examinations are focused on the detection of radiographic and lung function abnormalities. Spirometry testing is performed along with radiographic examinations and occupational history questionnaires. To assess for contraindications to spirometric testing, blood pressure (BP) screening and a health history questionnaire are offered. A limited assessment of cardiovascular health risk factors, including hypertension and obesity, can be made using information gathered during these evaluations.

Hypertension is an important risk factor for cardiovascular disease and affects almost one-third of the US adult population.¹ Cardiovascular disease is the leading cause of death in

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the United States with one of every three deaths caused by heart disease or stroke.^{2,3} As the leading cause of preventable death in people aged 40–65 years, or before retirement age, cardiovascular disease can be caused or exacerbated by occupational exposures.^{3,4} Mining-related risk factors for cardiovascular disease include particulate matter,⁵ carbon monoxide,⁶ noise,⁷ vibration,⁸ temperature extremes,⁹ and shift work.¹⁰ These occupational-related factors combined with personal risk factors can put miners at greater risk of poor cardiovascular health. One US-based study found that during 1997–2007, compared with other industrial sectors, workers in the mining sector had the highest rates of diagnosed hypertension.¹¹ However, this estimate might not reflect the burden of disease among coal workers specifically. Most studies evaluating hypertension in coal miners have occurred outside of the United States.^{12–14}

Using BP readings and body mass index (BMI) collected during ECWHSP encounters, we describe the prevalence of BP in the hypertensive range and obesity among coal miners participating in the ECWSHP. Early detection of these cardiovascular risk factors, with appropriate referral and follow-up, can lead to interventions to prevent stroke, heart attack, and other cardiovascular events.

Methods

In 2015, 1402 ECWHSP health examinations were performed in West Virginia, North Dakota, Montana, Wyoming, Colorado, Utah, Ohio, Virginia, and Kentucky. Health evaluations included occupational history and a selected health history to rule out contraindications for spirometry. Miners were asked if they have had any surgeries in the past 90 days, if they have ever had a stroke, if they have ever been told by a doctor that they had an aneurysm, if they are troubled by shortness of breath when hurrying on level ground or walking up a slight hill, and if they have to walk slower than people of their own age on level ground because of shortness of breath. BP was measured once for each miner using an automated sphygmomanometer (General Electric Carescape V100 Vital Signs Monitor). BP was taken with the participant seated and after they had rested, usually while completing their occupational and health history. If BP readings appeared unusually high or low, the measurement was repeated to assure consistency and to rule out contraindications for spirometry. Only one BP measurement per participant was recorded. Height and weight were measured with footwear and any tools, safety gear, or other equipment removed. Automated sphygmomanometers and scales were maintained according to the manufacturer's instructions.

Definitions

BMI (kilogram per square meter) was classified using the current Centers for Disease Control and Prevention (CDC) standard definition: underweight was defined as a BMI

<18.5 kg/m², normal weight 18.5–24.9, overweight 25.0–29.9, and obese ≥30.0 or higher.¹⁵ Categories of BP were defined using the American Heart Association's recommendations for healthy BP¹⁶:

- Normal blood pressure = systolic measure <120 mm Hg AND diastolic measure <80 mm Hg
- Prehypertension = systolic measure 120–139 mm Hg OR diastolic measure 80–89 mm Hg
- Hypertension = systolic measure ≥140 mm Hg OR diastolic measure ≥90 mm Hg
- Hypertensive crisis = systolic measure ≥180 mm Hg OR diastolic measure ≥110 mm Hg

Statistical Analysis

Data were analyzed using SAS V.9.3 and V.9.4 (SAS Institute, Cary, NC, USA). Statistically significant differences were assessed using chi-square tests or Fisher's exact test when cell sizes were <5. We considered two-sided $P \leq .05$ to be statistically significant.

We compared the observed prevalence of blood pressures consistent with prehypertension, hypertension, hypertensive crisis, and measures of overweight/obesity among participants to expected values for the US adult population obtained from the National Health and Nutrition Examination Survey (NHANES) from the 2007 to 2012 continuous datasets. NHANES is a set of surveys using interviews and physical examinations to assess the health and nutrition of the US population.¹⁷ To be consistent with how blood pressure was measured among most ECWHSP participants, hypertension for NHANES participants was determined from the first blood pressure measured during the NHANES medical examination. We calculated standardized morbidity ratios (SMRs) using indirect standardization for race/ethnicity (non-Hispanic White, non-Hispanic Black, or Hispanic), sex, age (20–39, 40–59, or ≥60 years), and cigarette smoking status (ever vs. never smoker).^{18,19}

Results

A majority of the 1402 participants were male (94%), White (93%), and non-Hispanic (94%; Table 1). The median age was 54 years with a range of 15–88 years. Forty-six percent of participants had a blood pressure reading consistent with prehypertension and 31% had a reading consistent with hypertension. The prevalence of blood pressures consistent with prehypertension was higher among males compared with females (48% vs. 35%, $P = .0244$); there was not a significant statistical difference in the prevalence of blood pressures consistent with hypertension by sex. Blood pressures in the hypertensive range were more prevalent among non-Hispanic miners than Hispanic miners (33% vs. 22%, $P = .0478$). Among the 440

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