

# RESEARCH NEEDS AND GAPS: CARDIOVASCULAR DISEASES IN MINERS

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# Overview: cardiovascular diseases (CVD)

- Chronic diseases, including heart disease, cancer and stroke, are the leading causes of death in the US.
- More than **81 million Americans** have cardiovascular disease, at an estimated cost of \$503 billion in 2010.
- **Multiple risk factors** (personal & occupational) for CVD.
- Estimated proportion of CVD associated with work-related factors ranges from **15 – 35%**.
- Workers are much more likely to make health behavior changes, such as quitting smoking, when health promotion programs are coupled with workplace hazard assessment and changes in the work environment.

# Key research needs: cardiovascular diseases in miners

- Better epidemiologic data on rates of and risk factors for cardiovascular diseases in US miners
- Exposure monitoring for relevant hazards: noise, vibration, fine particulates, shift work
- Assessment and integration of both personal and occupational risk factors
- Data on effectiveness of integrated workplace health promotion and hazard reduction in improving miners' health

# Cardiovascular diseases (CVD)

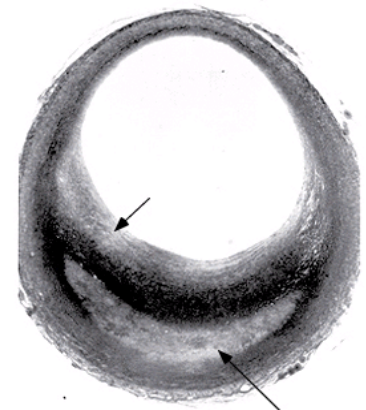
## Spectrum of CVD

- Hypertension
- Ischemic heart disease
- Congestive heart failure
- Arrhythmias
- Sudden death
- Other vascular diseases: stroke, PVD, aortic aneurysm

## Pathogenesis of atherosclerosis

- Inflammation
- Oxidative stress
- Endothelial dysfunction

Fatty streak



Cross-section of a human coronary artery demonstrates the early atherosclerotic changes of a fatty streak with thickening of the intima (short arrow) and a soft lipid core (long arrow).  
*Courtesy of Charles E Rackley, MD.*


# Multiple risk factors for cardiovascular diseases

## Personal

- Smoking
- High lipids/cholesterol
- Physical inactivity
- Diet/alcohol
- Hypertension
- Obesity
- Diabetes mellitus
- Family history of heart disease

## Occupational/**Mining**

- Noise**
- Particulates (PM 2.5)**
- Stress (high demand/ low control work; shift work; long hours)**
- Temperature extremes**
- Vibration**
- Carbon monoxide**
- Lead**
- Some chemicals (solvents, CS<sub>2</sub>, nitrates)**



Workplace exposures and work schedule factors contribute to obesity, smoking, alcohol use, and lack of exercise as well as to work-family stress and conflict.

# Studies from Scandinavia, Germany, South Africa show increased death from CVD in miners.

- *Weiner J et al. Ischemic heart disease mortality among miners and other potentially silica-exposed workers. Am J Indus Med 2007;50:403-408*
  - ▣ Data from Swedish National Census, 1970-1995
  - ▣ 11,896 silica-exposed men (mine and stone workers) compared to working male reference group (with similar smoking rates)
  - ▣ Increased mortality from **ischemic heart disease (SMR 1.31, 95% CI 1.24 – 1.38)**

# Little scientific information on cardiovascular disease risks in US miners.

- *Enterline PE. A review of mortality data for American coal miners. Ann NY Acad Sci 1972;200: 260-72*
  - Work accidents and respiratory disease did **not** account for the excess in total mortality (mortality rates remained 1.4 to 1.7 times the death rates for all working males).
  - *USPHS death certificate data: SMR > 200 for general arteriosclerosis (233) and “other myocardial degeneration” (238); strokes (148); hypertensive heart disease (148)*
  - *1967 Society of Actuaries study: coronary heart disease SMR 126*
  - *Cohort of 553 miners followed prospectively for 28 years: increased SMR for stroke (205) and heart disease (124)*



It will be important to leverage existing federal resources, databases and expertise.

- NIOSH
- MSHA
- Department of Labor
  - Comprehensive **mining occupational histories (exposures)**
  - Smoking and medical **histories** (including cardiovascular diseases)
  - Validated spirometry and chest x-rays with B readings
  - **EKGs**
- Health Resources & Services Administration –Miners Clinics network

# HRSA-funded Miners Clinics

1. Screening and surveillance for lung diseases , with counseling and referral for those with pneumoconiosis
2. Screening and surveillance for other medical conditions, with case management, follow-up and referral as needed
3. 15 clinics (CO, WY, NM, IL, KY, WVA, VA, PN, OH)
4. Miners Clinic of Colorado: 1982 miners screened since 2004 (259 in past year)
  - ▣ Medical and occupational questionnaires, physical exam, spirometry, chest x-ray with B reading

# Characteristics of MCC miner population, 2011-2012



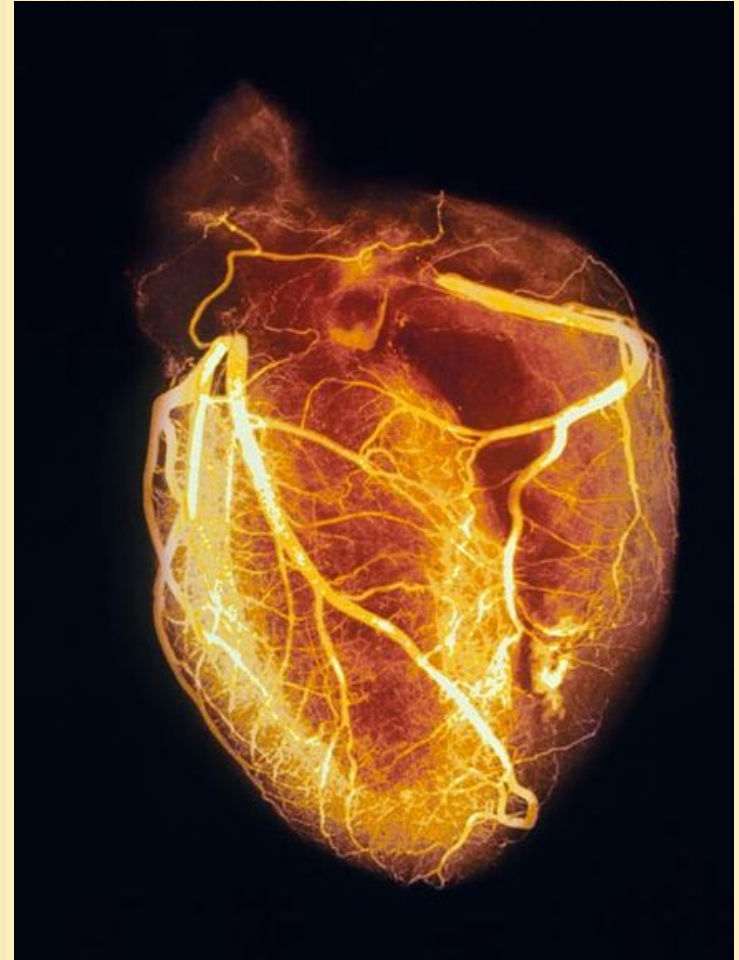
- Mean Age: 65 years (range 29-87)
- Gender: 95% male
- Commodity: ( $\neq 100\%$ )
  - Coal – 169 (65%)
  - Metal – 129 (28%)
  - Aggregate – 9 (3%)
  - Nonmetal – 7 (3%)
  - Other – 15 (6%)
  - Multiple – 65 (25%)

# Approach/Methods

- We queried our HRSA database for FY 2011-2012:
  - High blood pressure [measured] or MD diagnosis of hypertension [questionnaire]
  - Heart conditions: chest pain, angina, heart attack, stroke, diabetes, high cholesterol [questionnaire]
  - Depression [questionnaire]
  - Obesity/Body Mass Index [measured]
  - Obstructive sleep apnea symptoms or MD diagnosis of OSA [questionnaire]

# Cardiovascular diseases in MCC miners

- 105 (42%) reported **high cholesterol**.
- 67 (26%) patients reported **chest pain**.
- 20 (8%) had experienced **angina**.
- 24 (9%) reported having had a **heart attack**.
- 16 (6%) reported having had a **stroke**.



# Hypertension

## High blood pressure in our miners

- 120 (47%) patients had been previously diagnosed with hypertension.
- 95 (36%) were found to have high blood pressure at their visit (BP > 140/90).

## Consequences of untreated hypertension

- 4 times as likely to die of stroke
- 3 times as likely to die of heart disease (CHF and CAD)
- Chronic kidney disease and kidney failure

# High rates of treatable and preventable CV diseases and risk factors in our miner group.

1. Obesity (BMI>30): 86%
2. High blood pressure: 47%
3. High lipids/cholesterol: 43%
4. Obstructive sleep apnea: 35%
  1. Poor concentration/inattention
  2. Errors and accidents (2-3x MVA rates)
5. Adult onset diabetes: 23%
6. Other cardiovascular diseases (angina, previous heart attack): 23%
7. Current smoking: 7% [Ex-smokers: 36%]

# Research opportunities

- **Health status surveys of mining communities** – to understand interactions of work and lifestyle factors that intensify or reduce cardiovascular disease risk
- **Exposure assessment** targeted at multiple mining risks – noise, stress (shift work), particulates (type, peak, particle size, geochemistry), vibration, heat
- **Biomarkers** – role of inflammatory markers of CVD risk for targeted intervention and prevention
- **Integrated health promotion and hazard reduction** – We can't just tell miners to work safer, lose weight and live better (exercise, smoking, alcohol).
- **COLLABORATION** and **ACCESS** to mines and miners





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# Questions?

