

SUBCLINICAL CARDIOVASCULAR RISK AMONG POLICE: A LONGITUDINAL STUDY OF BASELINE CORTISOL AWAKENING RESPONSE (CAR) AND CHANGE IN BRACHIAL ARTERY REACTIVITY OVER TIME: THE BCOPS STUDY.

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Statement of the problem

Persons who work in the stressful occupation of policing are at increased risk for cardiovascular disease (CVD). Chronic exposure to the stressors experienced in this occupation may lead to the neurobiological disruption of the hypothalamic-pituitary-adrenal (HPA) axis and subsequent CVD. Such disruption can be manifested by changes in the pattern of cortisol secretion found following various challenges and conditions. Brachial flow-mediated dilation (FMD), a physiologic measure of endothelial function, has been associated with cardiovascular disease. The present study examined the cortisol awakening response (CAR) pattern at baseline and change in brachial artery reactivity among police officers over a seven-year period.

Procedures

Participants were police officers from the Buffalo Cardio-Metabolic Occupational Police Stress (BCOPS) study. The officers were recruited from Buffalo, New York and the baseline examination occurred between 2004 and 2009 when 464 participants were examined. Of these, 276 were evaluated again after seven years (between 2010 and 2015). For assessment of the CAR pattern at baseline, officers collected saliva samples immediately after awakening, and 15, 30, and 45 minutes thereafter. The four cortisol values were used to estimate area under the curve with respect to increase (AUCI). This parameter was derived using a trapezoidal formula and captures cortisol change (increase or decrease) with respect to baseline level. AUCI, which measures the awakening cortisol profile, served as the predictor variable.

FMD was assessed using ultrasound at baseline and at the seven-year follow-up using the same standardized procedure. FMD percentage was derived as the increase in arterial diameter (maximum minus baseline) expressed as a percentage of the baseline diameter. Seven-year change in FMD% was calculated for each officer by subtracting FMD% in the baseline exam from that of the follow-up exam and served as the outcome variable.

Analyses

Analysis of variance and covariance (ANOVA and ANCOVA) were used to compare the seven-year mean change in brachial reactivity across tertiles of AUCI. Regression analysis was used to test for linear trend. The current analyses included officers who had complete data for AUCI at baseline and FMD% at both exams ($n = 172$; 139 men and 33 women). Overall and stratified analyses by gender were conducted.

Results

The cohort was relatively young with a mean age at baseline of 41 years ($SD=7.6$) and a majority were men (81%), white (80%), married (75%), and patrol officers (70%). Overall, brachial reactivity as measured by FMD% declined significantly during the seven year period (baseline: 5.75 ± 2.9 ; follow-up: 3.72 ± 2.2 ; $p<0.0001$). A similar magnitude of decline was observed in men (baseline: 5.58 ± 2.6 ; follow-up: 3.60 ± 2.2 ; $p<0.0001$) and women (baseline: 6.50 ± 3.7 ; follow-up: 4.20 ± 3.0 ; $p=0.0123$).

The association between baseline AUCI and seven-year decline in FMD% was statistically significant only among male officers. After adjustment for potential covariates including age, race/ethnicity, education, smoking status, marital status, police

rank, alcohol use, and physical activity, officers in the lowest tertile of AUCI had a significantly larger seven-year mean decline in brachial reactivity (-2.56 ± 0.64) compared to officers in the highest tertile of AUCI (-0.89 ± 0.69) (pairwise comparison p -value= 0.0087). Analysis of trend of the seven-year change in brachial reactivity showed that the decline in brachial reactivity decreased with increasing baseline AUCI values but this linear trend was marginally significant (trend p = 0.0897). Officers in the lowest tertile of AUCI had an atypical cortisol pattern and exhibited the worst mean change in brachial reactivity.

Practical implications

The results of this study may be useful in developing programs aimed at officer physical and psychological well-being. In addition to the potential CVD effects, debilitating psychological difficulties, including posttraumatic stress disorder (PTSD), may result from exposure to police-related stressors. Stressors should be identified and assessed in order to determine the correct approach to reducing or eliminating them and their consequences on officer health. Psychological support and timely interventions are important to help officers deal with the stressors inherent in policing and the possible biological consequences in this occupation.

Conclusion

Results suggest that the waking AUCI pattern at baseline was significantly associated with a seven-year change in brachial reactivity. More specifically, low waking AUCI at baseline (i.e. atypical or flatter waking cortisol profile) predicted worsening of brachial reactivity during the seven-year follow-up, primarily in male police officers. Over time, the risk of subclinical CVD among male officers may increase due to the dysregulation of cortisol and the HPA axis. The strengths of this study are the longitudinal design and the study population, a group known to have high levels of occupational stress. The study would benefit from a larger number of female police officers. Additional research assessing other cortisol response patterns (e.g. diurnal) in relation to change in brachial reactivity may be warranted.

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THURSDAY, JUNE 8 (continued)

- Paper 2** The Association Between Work-Related Rumination and Heart Rate Variability
- Mark Cropley, PhD, University of Surrey, Guildford, Surrey, England, UK; Stefan Sütterlin, PhD; Davide Morelli, PhD; Ilke Inceoglu, PhD; Geoff Thomas, PhD; Chris Chu, PhD

- Paper 3** Subclinical Cardiovascular Risk Among Police: A Longitudinal Study of Cortisol Awakening Response (CAR) and Change in Brachial Artery Reactivity Over Time—The BCOPS Study
- John M. Violanti, PhD, University at Buffalo-SUNY, Buffalo, NY; Desta Fekedulegn, PhD; Michael E. Andrew, PhD; Tara A. Hartley, PhD; Luenda E. Charles, PhD; Diane B. Miller, PhD; Cecil M. Burchfiel, PhD

- Paper 4** Is Work Making Us Fat? Work and Nonwork Factors Associated With BMI for Each U.S. Labor Force Generation
- Jessica M. Streit, MS, NIOSH, Cincinnati, OH; Amy L. Bernard, PhD, MCHES

- Paper 5** Prevalence and Characteristics of Work Stress and Prediabetes in Workers in the Computer Industry
- Raquel Y. Reynolds, PhD, Texas A&M Health Sciences Center, College of Nursing, Round Rock, TX



Advancing Participation in Health Research and Practice With Minority and Immigrant Workers

(Symposium)

Conrad A

Chair: Marie-Anne S. Rosenberg, PhD, University of Michigan, School of Nursing, Ann Arbor, MI

- Paper 1** Successes and Challenges in Accessing Hotel Housekeepers for Research Studies
- Marie-Anne S. Rosenberg, PhD, University of Michigan, School of Nursing, Ann Arbor, MI
- Paper 2** Assessment and Removal of Participation Barriers for Policy Work Within Churches
- Doris Boutain, PhD, University of Washington, School of Nursing, Seattle, WA
- Paper 3** Integrating Worker Health Education in Community Agencies to Address Immigrant Worker Health
- Jenny Hsin-Chun Tsai, PhD, University of Washington, School of Nursing, Seattle, WA; Jerald R. Herting, PhD

Work Organization, Health, and Productivity

(Paper Panel Session)

Conrad B

Chair: Peter Kelly, MSc, Health and Safety Executive, United Kingdom

- Paper 1** Integrating Work Environment Considerations Into Lean and Value Stream Mapping
- Kasper Edwards, PhD, Technical University of Denmark, Lyngby, Denmark

- Paper 2** Safety Management and Safety Culture in the U.S. Construction Industry
- Xiuwen Sue Dong, DrPH, CPWR, The Center for Construction Research and Training, Silver Spring, MD; Xuanwen Wang, PhD; Rebecca Katz, MPH

- Paper 3** The Productivity Paradox—A Distracted Working Hypothesis
- Thomas J. Smith, PhD, University of Minnesota, Minneapolis, MN

- Paper 4** Boundary Management Tactics Using Smart, Mobile Technology
- Carrie A Bulger, PhD, Quinnipiac University, Hamden, CT; Mark E. Hoffman, PhD; Sara J. McKersie, MA; Larissa K Barber, PhD; Jade Jenkins, PhD; Joe Ammar, BA

4:30–4:45 p.m.

Break

4:45–6:15 p.m.

Film Screening of *A Day's Work*, including Q&A with Executive Producer David DeSario

Marquette IX

6:15 p.m.

Dinner (on your own)

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