

## Occupational Disparities in Physiological Stress Among U.S. Workers

Miami Occupational Research Group

30th International Congress on Occupational Health, Cancun, Mexico  
Monday, March 19, 2012 | Gran Cancun 3 | JD1070

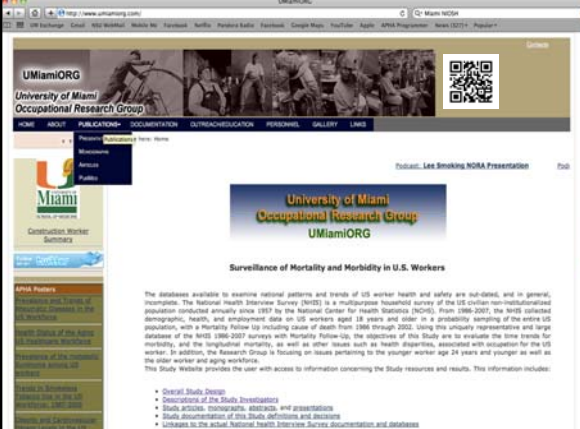

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### AGENDA

- Background
  - Occupational Stress
  - Allostatic Load
  - Objective / Hypothesis
- Methods
  - Data Source
  - Analytic Plan
- Results
  - Descriptive tabulations
  - Regression Analysis
- Conclusions

OCCUPATIONAL DISPARITIES PHYSIOLOGIC STRESS

### Occupational Stress



- U.S. worker health issue
- Stressful stimuli, events, environmental constraints from occupational characteristics
- Occupational tasks can cause cascade of neuro-biochemical events leading to physiologic systemic effects
- Variation by individual and job type, depending on stress perception

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### Mechanism of Occupational Stress

- Occupation as a modifier of stress – possibly measured by biomarkers.
- Measurement by income, job type, workplace strain, demonstrate increased rates of morbidity.
- Less certain mechanisms of translating occupation type into biological risk (stress levels) after control for access to care and health behaviors.
- Chronic stress influenced by job type and characteristics.

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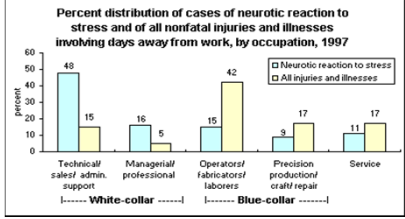


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### White-Collar Vs Blue Collar Stress

- 1997, 2/3 of cases of occupational stress involving days away from work occurred in white-collar occupations




| Occupation                        | White-collar (%) | Blue-collar (%) |
|-----------------------------------|------------------|-----------------|
| Technical/sales/admin. support    | 48               | 15              |
| Managerial/professional           | 16               | 5               |
| Operators/fabricators/laborers    | 15               | 42              |
| Precision production/craft/repair | 8                | 17              |
| Service                           | 11               | 17              |

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### Allostatic Load

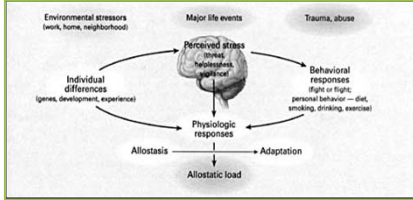
- Defined: *Process whereby an organism maintains physiological stability by changing parameters of its internal milieu by matching them to environmental demands.*
- Traditional homeostatic models - all physiological parameters operate within normal values
- The 'wear and tear' the body experiences when repeated allostatic responses are activated during stressful situations.



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### Allostatic Load Model

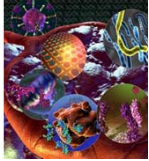


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### Allostatic Load in the Literature

- Diverse health indicators (e.g. pregnancy outcome, excess mortality, and disability), have found age patterns by race consistent with AL scores.
- Link biomarkers to social measures to better understand underlying physiological mechanisms of social disparities in health.
- Cortisol levels, sympathetic nerve activity, blood-pressure reactivity, cytokine production, waist-to-hip ratio, and glycated hemoglobin levels have been related to socioeconomic status, occupation, birth outcome, and environmental risk.



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### Measuring Allostatic Load

- Multi-systemic index incorporates variant biomarker inclusions.



| TYPE           | BIOMARKERS                           | Type                    | Biomarkers               |
|----------------|--------------------------------------|-------------------------|--------------------------|
| Neuroendocrine | Cortisol                             | Metabolic (con't)       | Triglycerides            |
|                | Dehydroepiandrosterone               |                         | Glycosylated hemoglobin  |
|                | Epinephrine                          |                         | Glucose                  |
|                | Norepinephrine                       |                         | Insulin                  |
|                | Dopamine                             |                         | Albumin                  |
| Immune         | Aldosterone                          | Cardiovascular and Resp | Creatinine               |
|                | Interleukin-6                        |                         | Homocysteine             |
|                | Tumor necrosis factor-alpha          |                         | Systolic Blood Pressure  |
|                | C-reactive protein                   |                         | Diastolic blood pressure |
| Metabolic      | Insulin-like growth Factor-1         | Anthropometric          | Peak expiratory flow     |
|                | Fibrinogen                           |                         | Heart rate and pulse     |
|                | High density lipoprotein cholesterol |                         | Waist-to-hip ratio       |
|                | Low density lipoprotein cholesterol  |                         | Body mass index          |

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### Allostatic Load



- Self-reported questionnaires to approximate perceived job stress levels.
- First study of AL in the workplace: older male German industrial workers with higher job demands had higher AL.
- Age, fatigue, and lack of recovery related to higher AL in female Swedish public health care workers.
- Shifts in increasingly older American adults, found AL steadily increases with age up through the 20s–60s and then plateaus throughout the 60s–90s during the period of greatest mortality risk (NHANES).

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### Weathering Hypothesis

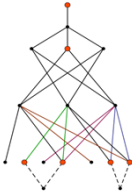

- McEwen and colleagues developed the concept of allostatic load.
- Conceptualized AL as the physiological burden imposed by stress as:
  - Primary mediators: substances the body releases in response to stress:
    - Norepinephrine
    - Epinephrine
    - Cortisol
    - Dehydroepiandrosterone sulfate (DHEA-S)
  - Effects of primary mediators:
    - Elevated systolic & diastolic blood pressures
    - Cholesterol levels
    - Glycated hemoglobin levels
    - waist-to-hip ratio

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### Weathering Hypothesis (Con't)



- AL operationalized by algorithms of primary mediators or secondary effects, with associated risks - dichotomous scale and summed.
- First AL algorithm had 10 components, has been modified on the basis of available data to encompass 8, 13, 14, or 16 components, with common certain components (e.g., diastolic and systolic blood pressures)

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### Weathering Hypothesis (Con't)




- Higher AL scores associated with older age, increased mortality, lower socioeconomic status, cognitive decline, and unsupportive childhood and adult relationships.
- Empirical question: Does an allostatic load algorithm provide a useful summary measure of occupational weathering?
- Its usefulness for detecting differences among different occupational groups has not been tested.

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### Objective(s)

- Examine nationally representative data for average allostatic load scores and the proportion of high scores by employment type, 40 specific occupational groups, and four broad-based sectors; and
- We describe the association between job type and allostatic load after controlling for confounders.
  - $H_0$ : Workers employed in white-collar occupations would experience higher AL scores than their blue-collar counterparts.

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### Data Source



- National Health & Nutrition Examination Survey (NHANES)**
  - Conducted by the National Center for Health Statistics (NCHS) part of the Centers for Disease Control and Prevention (CDC).
  - Early 1960s has been conducted as a series of surveys focusing on different population groups or health topics.
  - In 1999, the survey became a continuous program that has a changing focus on a variety of health and nutrition measurements.
  - Examines a nationally representative sample of about 5,000 persons each year.

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### Data Source (Cont)



- National Health & Nutrition Examination Survey (NHANES)**
  - In-depth interviews plus clinical examination and lab tests.
  - Used to determine actual (distinguished from self-reported) prevalence of major diseases and risk factors.
  - Used to assess nutritional status and its association with health promotion and disease prevention.
  - Basis for standards for height, weight, and blood pressure.

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### Study Sample



- National Health & Nutrition Examination Survey (NHANES)**
  - 2003-2004 NHANES participants
  - Adults (17 years and older)
  - Completed both a comprehensive medical examination and questionnaire component
  - Reported on their occupational status and job type (n=5,328).

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### Allostatic Load Construct




- Ten biomarkers selected:
  - Systolic and diastolic blood pressures
  - Body mass index (BMI)
  - Glycated hemoglobin
  - Albumin
  - Creatinine clearance
  - Triglycerides
  - C-reactive protein
  - Homocysteine
  - Total cholesterol
- Assign biomarker reading of 1 if standard threshold point for each respective biomarker was met or zero if the threshold was not met.
- Biomarkers points were summed to obtain allostatic load score, with maximum score of 10.
- Workers with an allostatic load index of three or greater were classified as physiologically stressed, as reported in Geronimus.

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### Additional Measures & Analysis


- Employment status categorized participants by
  - Employment status
  - Specific occupation type
  - Sectors: white collar, service, farm and blue collar workers.
- Socio-demographic characteristics
  - Age
  - Gender
  - Race
- Mobile examination center (MEC) sampling weights and SPSS 18.0 with the Complex Sample Survey module

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### Results

**Table 1:** Mean Allostatic Load (AL) Score and Proportion With High Score, by Employment Type, Specific Occupation Type, and NCHS Sector, among participants of the 2003–2004 National Health and Nutrition Examination Survey

|                          | Total |                          |
|--------------------------|-------|--------------------------|
|                          | No.†  | Mean Score (% With AL≥3) |
| <b>TOTAL</b>             | 5328  | 2.35 (43.5)              |
| <b>Employment Status</b> |       |                          |
| Employed                 | 2768  | 2.14 (37.6)              |
| Unemployed               | 2560  | 2.73 (52.3)              |

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### Results

| Occupation Title  | No.† | Mean Score (% With AL≥3) |
|---|------|--------------------------|
| Other mechanics and repairers                           | 64   | 2.65 (37.8)              |
| Information clerks                                      | 49   | 2.60 (40.0)              |
| Cleaning and building service occupations               | 81   | 2.50 (34.8)              |
| Private household occupations                           | 41   | 2.50 (33.3)‡             |
| Related agricultural, forestry, and fishing occupations | 56   | 2.48 (42.7)              |
| Sales representatives, finance, business, & commodities | 74   | 2.43 (43.8)              |

| Occupation Title  | No.† | Mean Score (% With AL≥3) |
|---|------|--------------------------|
| Management related occupations                          | 83   | 1.76 (30.5)              |
| Cooks   | 90   | 1.74 (30.3)              |
| Executive, administrators, and managers                 | 241  | 1.67 (43.2)              |
| Health service occupations                              | 107  | 1.32 (27.5)              |
| Material recording, scheduling, and distributing clerks | 57   | 1.05 (44.5)              |

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### Results

| NCHS Sector         | No.† | Mean Score (% With AL≥3) |
|---------------------|------|--------------------------|
| White-Collar Worker | 1415 | 2.17 (37.4)              |
| Service Worker      | 523  | 1.99 (33.6)              |
| Farm Worker         | 86   | 2.20 (36.8)              |
| Blue-Collar Worker  | 734  | 2.17 (39.1)              |

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### Results

**Table:** Unadjusted and Adjusted Relative Odds with Corresponding 95% Confidence Intervals of Having an Allostatic Load Score of 3 or Higher among participants of the 2003–2004 National Health and Nutrition Examination Survey

| Predictors                                     | Unadjusted Odds Ratio [95% CI] | Adjusted Odds Ratio [95% CI] |
|--|--------------------------------|------------------------------|
| <b>NCHS Group (ref = White-Collar Workers)</b> | 1.00                           | 1.00                         |
| Service workers                                | 1.36 [1.03-1.85]               | 1.28 [0.98-1.80]             |
| Farm workers                                   | 0.96 [0.88-1.48]               | 0.94 [0.79-1.42]             |
| Blue-Collar Workers                            | 1.48 [1.14-1.97]               | 1.44 [1.09-1.91]             |
| <b>Age Categories (ref=18-24 year olds)</b>    | 1.00                           | 1.00                         |
| 25-34 year olds                                |                                | 2.91 [1.53-5.53]             |
| 35-44 year olds                                |                                | 5.07 [2.72-9.40]             |
| 45-54 year olds                                |                                | 9.82 [5.60-16.11]            |
| 55-64 year olds                                |                                | 10.21 [2.22-19.93]           |
| 65 and over                                    |                                | 12.01 [6.76-21.38]           |
| <b>Gender (ref=Males)</b>                      | 1.00                           | 1.00                         |
| Females  |                                | 1.40 [1.02-1.90]             |
| <b>Race/Ethnicity (ref=Non-Hispanic White)</b> | 1.00                           | 1.00                         |
| Non-Hispanic Black                             |                                | 1.18 [0.98-1.59]             |
| Mexican-American                               |                                | 1.20 [1.00-1.58]             |
| Other Race                                     |                                | 1.48 [1.07-2.05]             |
| Other Hispanic                                 |                                | 1.82 [1.39-2.49]             |

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### Summary

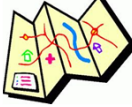
- Unemployed adults had significantly higher allostatic load scores than employed counterparts (healthy worker effect)
- Blue-collar workers had a greater proportion experiencing greater physiological stress level than white-collar workers.
- Variation noted across specific occupation types.
- Even after socio-demographic indicator control, blue collar workers experienced greater physiologic stress than their white collar counterparts.




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### Conclusion and Future Directions




- First preliminary population-based estimates of biological stress by occupation-type in a national sample of U.S. workers.
- Limitations:
  - Cross-sectional nature of data
  - Length of employment status and job type
- Identification of worker groups with higher levels of biological stress.

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### Future Directions



- Pool additional NHANES data
- Control for insurance status and chronic disease conditions
- Link with National Death Index data to assess influence on mortality
- Longitudinal biological data across occupational groups.

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