Geronmetrics: A Discipline Whose Time Has Come?

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Introduction
Whither “geronmetrics”?

• “Measurement of constructs in aging”
  – a.k.a.: econometrics, psychometrics, biometrics
  – e.g.: generalized inflammation; frailty; aging

• Boring, no?
  – NO!

• Rather: essential to
  – Sensitivity for genetic, other discovery
  – Theory operationalization, testing
  – Specificity for genetic, other discovery
  – Correctly targeted, evaluated interventions
Measurement Paradigm
Inflammatory Dysregulation

\[ \text{biology} \]

\[ \text{Inflammation} \]

\[ \text{Determinants} \quad D \]

\[ \text{Adverse outcomes} \]

\[ e_1 \quad Y_1 \]

\[ \ldots \]

\[ e_p \quad Y_p \]
• Central role: cellular repair

• A hypothesis: dysregulation key in adverse aging
  – Muscle wasting \((Ferrucci\ et\ al.,\ JAGS\ 50:1947-54;\ Cappola\ et\ al,\ J\ Clin\ Endocrinol\ Metab\ 88:2019-25)\)
  – Receptor inhibition: erythropoietin production / anemia \((Ershler,\ JAGS\ 51:S18-21)\)

\[
\begin{align*}
\text{Stimulus} &\quad \rightarrow \quad \text{IL-1} \# \\
\text{TNF} &\quad \rightarrow \quad \text{IL-6} \\
\text{CRP} &\quad \rightarrow \quad \text{up-regulation}
\end{align*}
\]

\# Difficult to measure. IL-1RA = proxy
Measurement: In CHIANTI finding

IL-18
IL-1RA
IL-6
CRP
TNF-α

Up-regulation
Inhibition

+ -
Is there Value Added? In CHIANTI findings

- **YES!**

- Independent of age, sex, smoking, diseases:
  - **Up-regulation associated with**
    - Worse mobility functioning [\(~ -0.1\) effect size]
    - Heightened frailty prevalence [by \(~ 30\%\)]

- “Up-regulation” is specific, sensitive
  - No individual cytokine adds to prediction
  - Up-regulation affords superior prediction over individual cytokines

- Next: 2 R01 applications; AOA Initiative (KBR, PI)
Translation and Training

Research funding
- Women’s Health and Aging Study III – Merit Award
- Johns Hopkins Older Americans Independence Center

Publications
- Cappola et al., J Clin Endocrinol Metab, 2001
- Ferrucci et al., JAGS, 2002
- Leng et al., J Gerontol Med Sci, 2005
- Bandeen-Roche et al., J Gerontol Med Sci, in press
- Bandeen-Roche et al., JASA, 1997
- Bandeen-Roche et al., AJE, 1999
- Xue & Bandeen-Roche, Biometrics, 2002
- Huang & Bandeen-Roche, Psychometrika, 2004

Education
- Training Program in the Epidemiology & Biostatistics of Aging
Future Goals

• Extension across biological systems

• Cross-validation across populations

• Assessment of extent to which “associations” ↔ “mechanisms”

• Translation into interventions