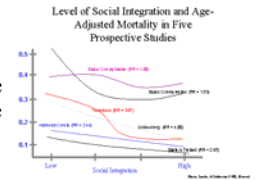


Mild Psychological Stress and Loneliness: Autonomic and Neuroendocrine Responses

John T. Cacioppo
University of Chicago

American Individuals and Society in the 21st Century

- Sociodemographic changes:
Family relations
- The aging of America
- Chronic diseases have become the major cause of death at the turn of the 21st century
- Social isolation is on the rise
- Social isolation predicts broad based morbidity and mortality



Isolation

- "I lack companionship"
- "I feel left out"
- "I feel isolated from others"
- "I am unhappy being so withdrawn"

Connectedness

- "There are people to whom I feel close"
- "There are people who really understand me"
- "There are people to whom I can talk"
- "There are people to whom I can turn"

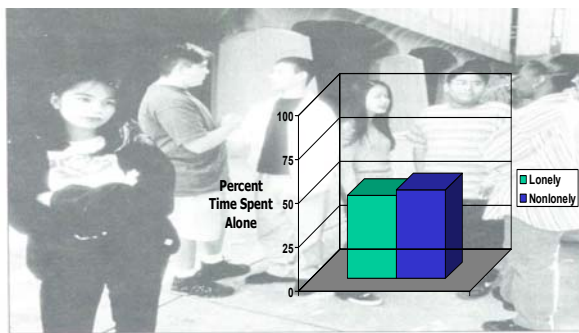
Belongingness

- "I feel in tune with the people around me"
- "I feel part of a group of friends"
- "I have a lot in common with the people around me"
- "My interests and ideas are not shared by those around me"

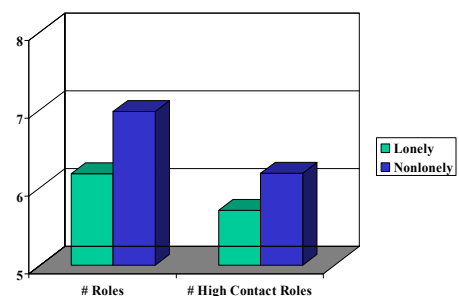
The Feeling of Social Isolation

I am 62 and have been divorced since 1980. I have learned the difference between being alone and lonely. I remember when I was married and told someone I was lonely and they responded with, "but you are married." I am often alone, but always lonely. Either while married, in a crowd, at work, on the train or bus and even in a family setting with my married children, I always feel lonely. It can be overwhelming at times and yes even a physical feeling. The doctors over the years have called it depression, but there is a definite difference. I read once, you are born alone and you die alone. But what about all of the years in between? Can you belong to someone? How do you resolve that inner feeling of loneliness? Shopping won't do it. Eating won't do it. Random sex doesn't make it go away. If and when you find any answers, please share them with me.

Do Lonely and Nonlonely Individuals Differ in the Time Spent Alone?



Social Network



$p < .01, n.s.$
Social Network Index

Behavioral & Catabolic Mechanisms



Stress and Disease (Baum, 1994)

Indirect Health Behavioral Effects

- Decreased compliance
- Increased delay in seeking care
- Obscured symptom profile
- Decreased likelihood of seeking care

Indirect Behaviorally Mediated Effects

- Increased smoking, alcohol use
- Decreased exercise
- Decreased nutrition
- Decreased sleep
- Increased drug use

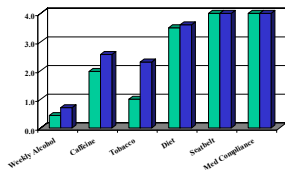
Direct Physiological Effects

- Elevated blood pressure
- Increased sympathetic activity
- Increased hormonal activity
- Decreased immunity

Health-Related Behaviors: Ohio State University Sample

- Lonely individuals have comparable BMI and engage in comparable exercise
- Lonely individuals engaged in comparable or *better* health-related behaviors than nonlonely individuals, including alcohol consumption, smoking, caffeine and soda consumption, and illegal substance abuse

Reported Health-Related Behaviors: Chicago Study (M = 64 yrs)



- Alcoholic drinks/day
- Caffeinated drinks/day
- Cigarettes/day
- Healthiness of diet
- Number times seatbelt worn last 10 trips
- Medical compliance

Behavioral & Catabolic Mechanisms



Stress and Disease (Baum, 1994)

Indirect Health Behavioral Effects

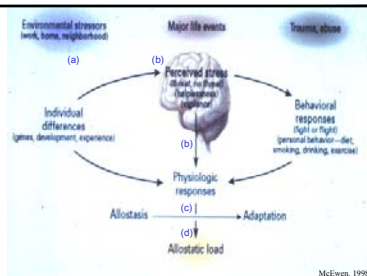
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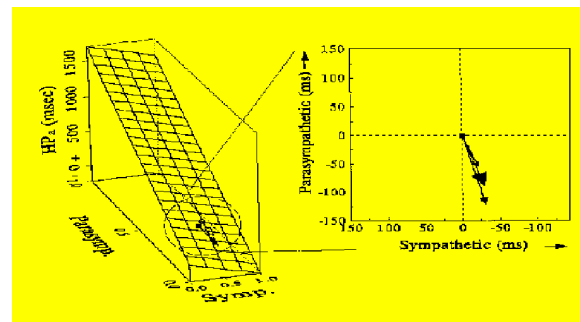


1. Catabolic Mechanisms: Modulates insult-based wear and tear (e.g., stress)

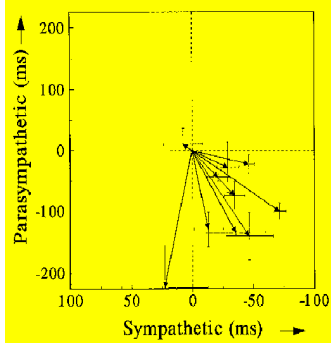
- Differential exposure to stressors
- Differential reactivity to stressors
- Differential stress termination and recovery from stressors
- Differential cumulative load

Not All Stressors are the Same

(with Gary G. Bertson, Philip F. Binkley, Bert N. Uchino, Karen S. Quigley, & Annette Fieldstone)

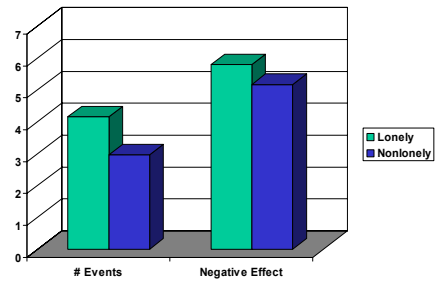


Neural Organization Differs for Psychological and Orthostatic Responses



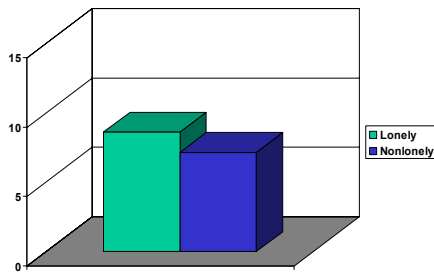
The orthostatic stressor, the response to which is controlled by lower levels of the neuraxis (i.e., the baroreflex), revealed little individual differences in mode of autonomic activation. In contrast, the active coping stressors, the response to which is controlled by more rostral levels of the neuraxis, revealed stable individual differences in mode of autonomic activation.

Traumatic Events



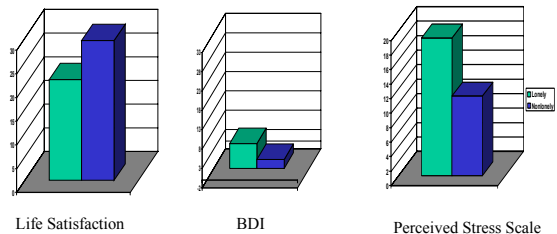
Traumatic Events Survey (72% Response Rate)

Major Life Events

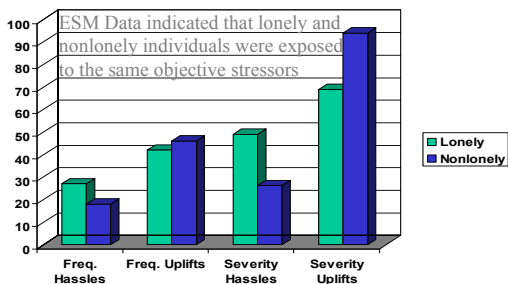


Life Events-R College Student Version

Stress and Happiness



Daily Hassles and Uplifts: Differential Exposure or Differential Reactivity

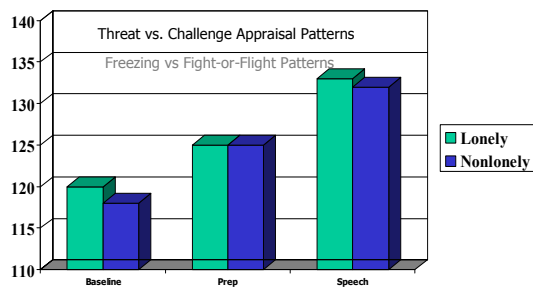


Daily Hassles & Daily Uplift Scales

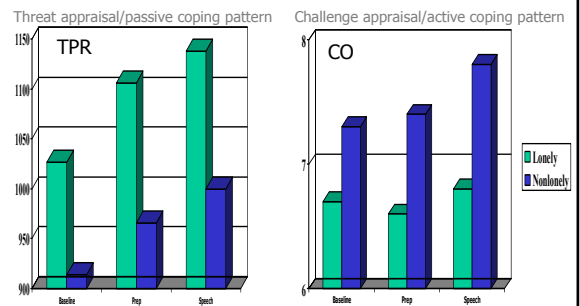
Coping With Stress

- Active coping*
- Planning
- Suppression of competing activities
- Restraint coping
- Seeking instrumental support from others*
- Seeking emotional support from others*
- Alcohol/Drug use
- Positive reinterpretation
- Acceptance
- Turning to religion
- Venting emotions
- Denial
- Behavioral disengagement*
- Mental disengagement
- Humor

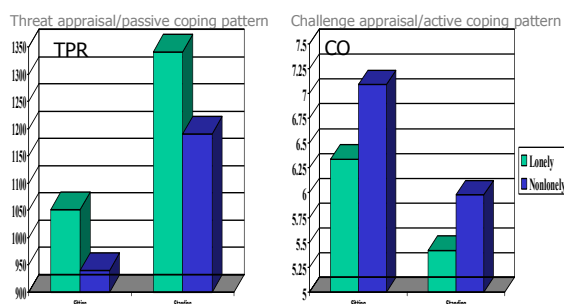
Systolic Blood Pressure as a Function of Loneliness: Ohio State Study



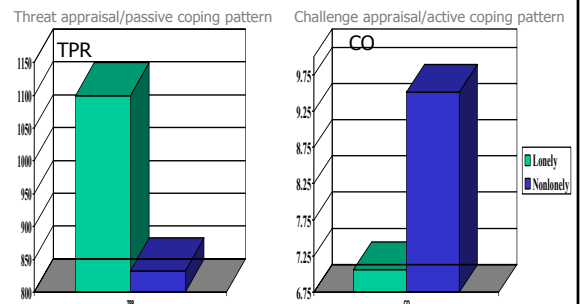
Autonomic Activation as a Function of Loneliness



Autonomic Activation as a Function of Loneliness: Orthostatic Stressor



Autonomic Activation as a Function of Loneliness: Ambulatory Measurements

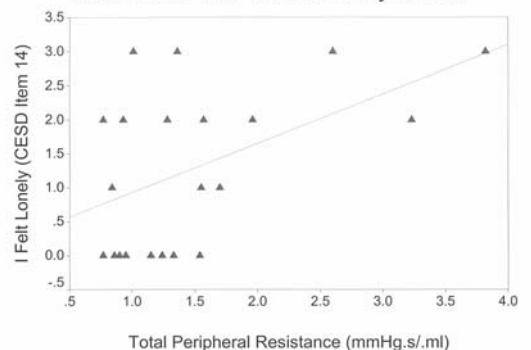


Method

Marcellus M. Merritt, Ph.D., Darrell R. Abernethy, M.D., Ph.D., Michele K. Evans, M.D. (Deputy Director NIA/IRP), John J. Sollers III, Ph.D., Alan B. Zonderman, Ph.D. & Julian F. Thayer, Ph.D. (2002)

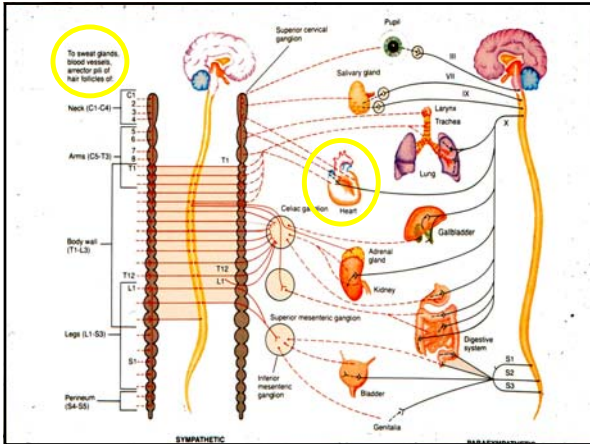
- **Participants**
 - African-American adults (11 female, 21 male)
 - Mean age = 56.18 yrs
 - Range = 36 - 83
- **Instrument**
 - Port-a-pres: beat-to-beat recordings of heart rate and blood pressure
 - Perception of Affect Test (PAT)
 - Two subtasks that ask the participant to evaluate emotional expressions (and their intensity) in faces and in sentences.
 - CESD – Depression Inventory

Baseline CESD - I Felt Lonely & TPR

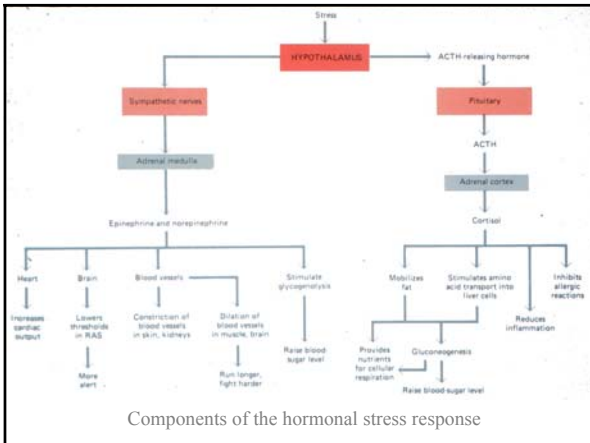
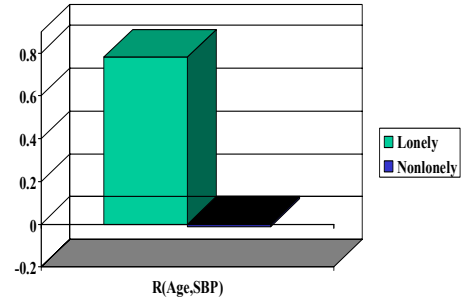


All Women n=21, $r = .497$, $p < .023$

(Marcellus et al., 2002)



Age-Related Increases in SBP: The Chicago Study



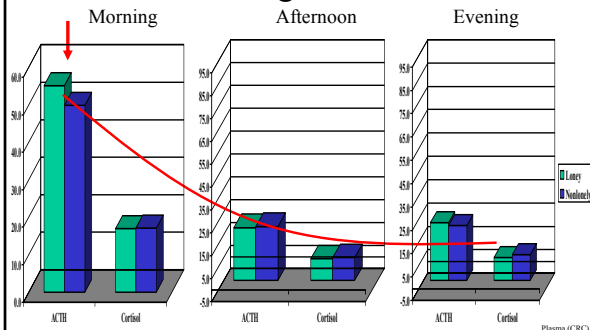
Components of the hormonal stress response

Urinary Cortisol: Random Samples from Inpatients (N = 33)

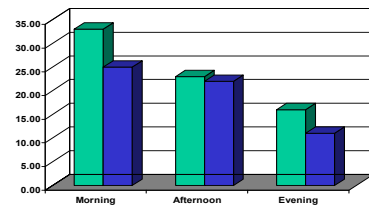
Kiecolt-Glaser, Ricker, George, Messick, Speicher, Garner, & Glaser, 1984



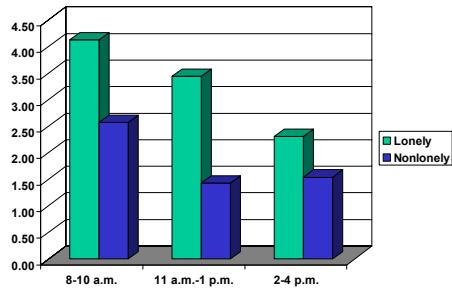
Plasma HPA Levels: Young Adults



Salivary Cortisol Across the Day: Ambulatory Component



Salivary Cortisol Across the Day as a Function of State Loneliness: The Chicago Study

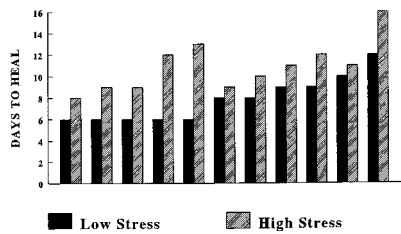


Salivary Assay (ESM)

Maintenance and Repair

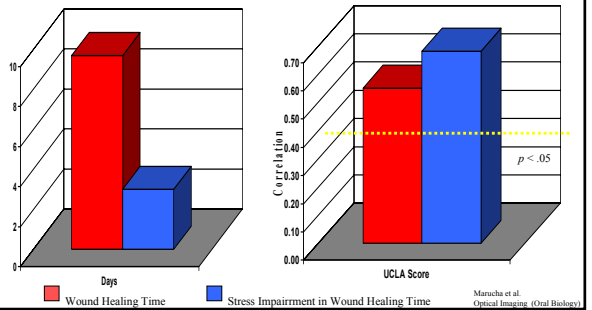
Repair and Maintenance: Wound Healing

Marucha, Kiecolt-Glaser, & Favagehi, 1998



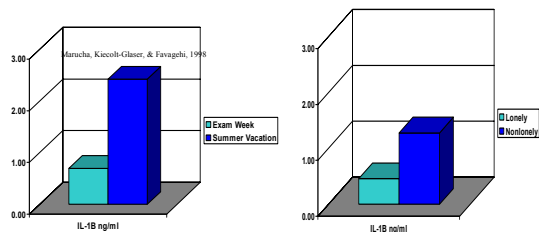
Low Stress High Stress

Wound Healing Time: Pilot Study



Marucha et al. Optical Imaging (Oral Biology)

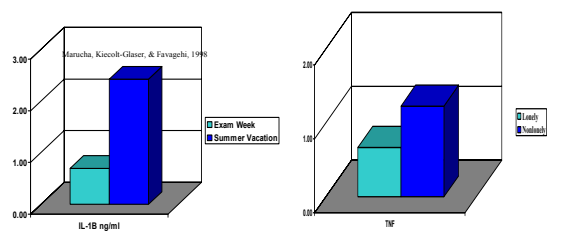
Early Acting Proinflammatory Cytokines: LPS stimulated IL-1 β



(IL-1 β cytokine (protein) is a primitive signal-transduction molecule for energy regulation)

Whole Blood Assay (CRC)

Early Acting Proinflammatory Cytokines: LPS stimulated TNF



Whole Blood Assay (CRC)

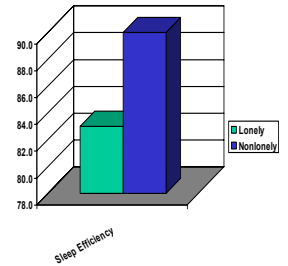
The Quintessential Restorative Process: Sleep

- Telephone interviews were conducted between October 25, 2000 and January 3, 2001 among a random sample of 1004 adults (National Sleep Foundation 2000 Survey in America).
 - 62% of American adults experience a sleep problem a few nights per week or more.
 - 43% of adults say they are so sleepy during the day that it interferes with their daily activities a few days a month or more.
 - 20% of adults experience this level of daytime sleepiness at least a few days per week or more.
- Spiegel et al. (1999) – effects of sleep debt on metabolic (e.g., lower glucose tolerance), neural (e.g., increased sympathetic tonus), & hormonal (e.g., cortisol) regulation . . . mimicking many of the effects of aging

Nightcap Sleep Measures

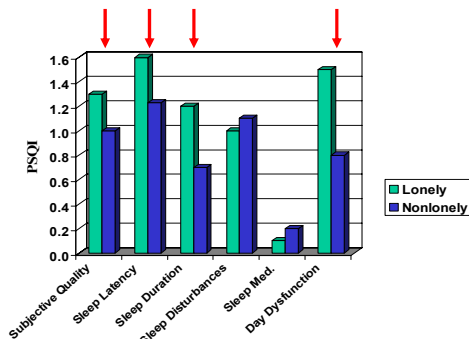
Lonely, relative to nonlonely, individuals showed:

- Poorer Sleep Efficiency
- Greater Wake Time After Sleep Onset



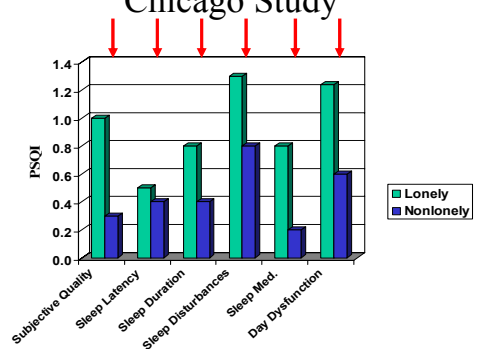
Nightcap (CRC)

Reported Sleep Quality



Pittsburgh Sleep Quality Index

Reported Sleep Quality: Chicago Study



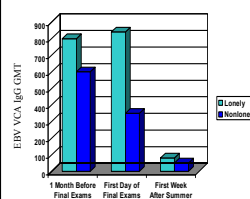
Pittsburgh Sleep Quality Index

Social Connectedness and Health

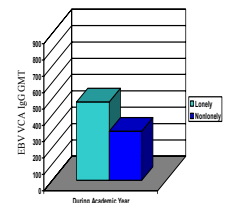
1. Behavioral Mechanisms: Lifestyle and health care utilization
 - a) Improved health behaviors & access to healthcare (social control hypothesis)
2. Catabolic Mechanisms: Decreases insult-based wear and tear (e.g., stress)
 - a) Differential reactivity to stressors (lab)
 - b) Differential stress termination and recovery from stressors (lab)
 - c) Differential exposure to stressors (ESM)
 - d) Differential cumulative load
3. Anabolic Mechanisms: Diminishes the salubrity of maintenance and restorative processes

Measurement Issues:

Multiple Determinants, Moderators, & Measurement Aggregation

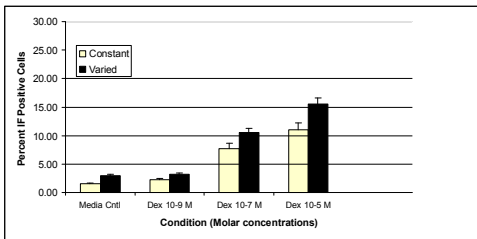


Glasser, Kiecolt-Glaser, Speicher, & Holliday, 1985



Measurement Issues: Kinetics

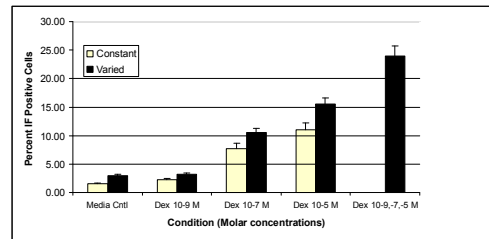
(e.g., Epstein Barr Virus Antibody Titers)



(Cacioppo, Kiecolt-Glaser, Malarkey, Laskowski, Rozlog, Poehlmann, Burleson, & Glaser, in press)

Measurement Issues: Kinetics

(e.g., Epstein Barr Virus Antibody Titers)



(Cacioppo, Kiecolt-Glaser, Malarkey, Laskowski, Rozlog, Poehlmann, Burleson, & Glaser, in press)

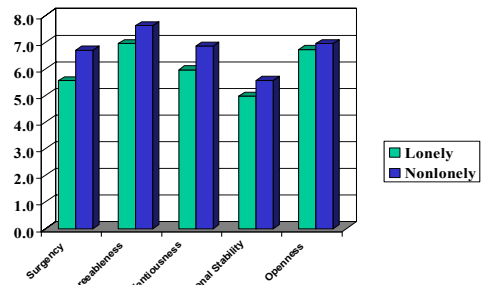
Is Loneliness an Invariant Trait or Can it Be Changed?

- Is loneliness a cause of poor health, a consequence, or a spurious correlate of a third factor (e.g., hostile or menacing personality)
- Genetics of loneliness
- Experimental manipulations of loneliness
- Effects of interventions
 - Primary prevention
 - Secondary prevention
 - Tertiary prevention



Russell Weston, 1998

Big Five Personality Structure



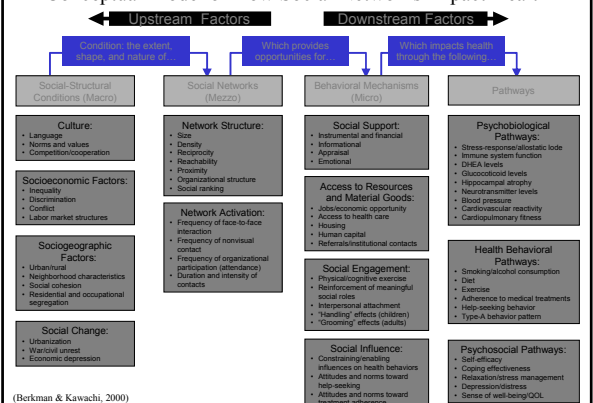
Big-Five Questionnaire

Social Connectedness and Mechanisms

- Interpersonal
- Psychological
- Behavioral
- Biological



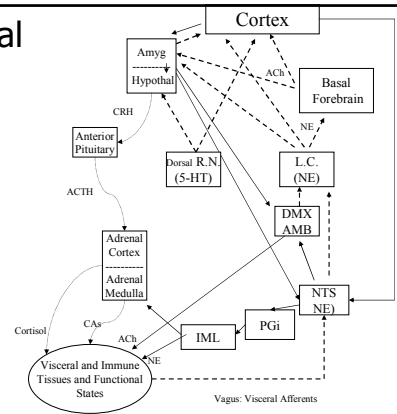
Conceptual Model of How Social Networks Impact Health



Psychological Mediators

- Health behaviors
- Cardiovascular activation:
Threat/Freezing/Passive Coping
- Circulating cortisol:
Perceived stress
- Disruptions of sleep:
Perceived stress
- Attachment, depression and hostility were not found to mediate any of the observed differences

The Social Brain:



(Bernston, Sarter, & Cacioppo, 1998)