Science & Practice of Disasters, Resilience and Aging

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## Resilient cities

### Cities

<table>
<thead>
<tr>
<th>City</th>
<th>Resilience Score</th>
<th>Vulnerability Score</th>
<th>Adaptive Capacity Score</th>
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<tbody>
<tr>
<td>Toronto</td>
<td>100</td>
<td></td>
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<tr>
<td>Vancouver</td>
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<tr>
<td>Calgary</td>
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<td>Chicago</td>
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<td>Stockholm</td>
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<tr>
<td>Boston</td>
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<tr>
<td>Zurich</td>
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<td></td>
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<tr>
<td>Washington DC</td>
<td>94</td>
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</tbody>
</table>

The three most resilient cities? They're all in Canada.

Resilient Vancouver is a citywide strategy that looks at the challenges facing our city - now and in the future - and makes recommendations on how to build our capacity for dealing with them.
Oumar Barou Togola: Why diversifying our diets is one step toward climate resilience

More than 63 per cent of Canadians are “desperately concerned” about climate change, and it’s easy to see why.

Douglas Todd: Riddled by machine-gun fire, my grandfather showed the resilience we need today

My grandfather’s First World War ordeal has me thinking about human resilience. How can a farm boy who survived the machine guns, drowning mud and corpse-eating rats of the Battle of Passchendaele actually turn out OK?

Japanese Hall in Downtown Eastside marks 90th year and a history of resilience

Elderly and spirited alumni who attended the Vancouver Japanese Language School in the late 1920s and 1930s recently gathered at the school’s Japanese Hall in the Downtown Eastside.

City of Vancouver appoints first chief resilience officer

A fortune built on oil money will pay for a new position at Vancouver City Hall aimed at preparing for potential disasters including, among other things, oil spills.

Canucks 3 Kings 2: Push back, resilience and an actual first power play unit

Cities stand at the forefront of the challenges and opportunities for the 21st century. Aging infrastructure, extreme weather and mass migration all disproportionately affect urban centres.
Yoga and love in a school that helps children of color excel
The mats rarely go a day without use as a counselor teaches which helps them to improve resilience, mood and self-regulation. Therapeutic practice is based on research that shows the health

Trade war comes to Louisville, Jack Daniels takes tariff hit
But the company showed its resilience to the trade disputes by posting sales growth in emerging global markets. It also posted sales growth.

Pine Bluff officials: Flood won't sink Arkansas city's hopes
Its banks, but local officials said even after the waters recede, the community's resilience will bolster recovery.

84 environmental rules on the way out under Trump
A executive order promoting "climate resilience" in the region of Alaska, which withdrew local waters from oil established a tribal advisory council to consult on local

Ethiopian PM visits Sudan in bid to mediate crisis
After al-Bashir's ouster, the Ethiopian prime minister had congratulated the Sudanese people for their "resilience in leading change" toward a democratic

Amid trade war, China's Xi talks up economy, heads to Moscow
BEIJING (AP) -- Chinese President Xi Jinping is talking up the Chinese economy's resilience as he heads to Moscow

Jaguars QB Foles credits wife for his return to practice
Foles raved about his wife's resilience. A volleyball player at Ariz Foles was out of college and working at Nike in 2013 when she

Black women build in an era of danger
Beyond these resilience-building program an America where everyone can thrive to resources for supporting the leadership of
Message 1: Resilience is More Than Just a Buzzword; **Risk** (Vulnerability) and Resilience are different
“Resilience” means the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.
Resilience and Health

Strengthening resilience: a priority shared by Health 2020 and the Sustainable Development Goals

NIH National Institute on Aging
Resilience and Aging Funding Opportunity
overcome by younger individuals. For the purposes of this discussion, resilience is defined as a dynamic property which enables cells, organs, organisms or individuals to resist or recover from the effects of a physiological or pathological stressor (i.e., physical in nature).

Resilience

EUROPEAN CIVIL PROTECTION AND HUMANITARIAN AID OPERATIONS

European Commission > European Civil Protection and Humanitarian Aid Operations > What we do > Humanitarian aid

What is it?

Resilience is the ability of an individual, a community or a country to cope, adapt and recover quickly from stress and shocks caused by a disaster, violence or conflict. Resilience covers all stages of a disaster, from prevention (when possible) to adaptation (when necessary), and includes positive transformation that strengthens the ability of current and future generations to meet their needs.
Risk -- “a situation involving exposure to danger [threat].”

Vulnerability -- “The quality ... of being exposed to the possibility of [threat].”

Security -- “the state of being free from danger or threat.”

Resilience -- “the capacity to recover quickly from difficulties.”

Definitions by Oxford Dictionary
System Risk/Security and Resilience

After Linkov et al, Nature Climate Change 2014
Message 2: Resilience in Medicine and the Elderly can be conceptualized similarly to what is done in other fields.
Resilience as used in Medicine

- “Resilience means **being able to adapt** to life's misfortunes and setbacks” – Mayo Clinic
- “the **process of adapting** well in the face of adversity, trauma, tragedy, threats or significant sources of stress — such as family and relationship problems, serious health problems or workplace and financial stressors. It means "**bouncing back**" from difficult experiences.” – American Psychological Association
- “Resilience as the **capacity** of a dynamic system **to adapt** successfully”
- “Resilience as a **process** to harness resources **to sustain well-being**”
- “structural resilience —building robust structures in society that provide people with the wherewithal to make a living, secure housing, access good education and health care, and **realize their human potential**”
- “Sense-making” – **how you perceive** the past, the present, and the future
- “a **stable trajectory** of healthy functioning after a highly adverse event”
- “a **conscious effort to move forward** in an insightful and integrated positive manner as a result of lessons learned from an adverse experience”
- “the **capacity of a dynamic system to adapt** successfully to disturbances that threaten the viability, function, and development of that system”
- “a **process** to harness resources in order to sustain well-being”
- “Resilience is the **result of successful adaptation to adversity**…. a dynamic characteristic that may shift according to the circumstance”
- “Resilience emphasizes **the functions health systems need to respond and adapt to health shocks**, introducing a dynamic dimension into more static health system models which can help the system cope with surges in demand and adapt to changing epidemiology and population expectations of care”
- “A resilient health system **can reduce vulnerability**, prevent deterioration of health, and mitigate increased poverty” -USAID


# Resilience in Medical Literature

<table>
<thead>
<tr>
<th>Physical Resilience</th>
<th>“the ability to recover or optimize function in the face of age-related losses or disease”</th>
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<tbody>
<tr>
<td>Psychological Resilience</td>
<td>“an individual's capacity to overcome challenges and avoid decompensation, depression, apathy, and other types of negative psychological outcomes”</td>
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<tr>
<td>Emotional Resilience</td>
<td>“the ability to maintain the separation between positive and negative emotions in times of stress”</td>
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<tr>
<td>Cognitive Resilience</td>
<td>“an older adult's ability to overcome noted changes in his or her cognitive ability, negative comments he or she may hear from others, and associated stress related to cognitive performance and embarrassment”</td>
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Resilience in Aging

• “The concept of resilience is centered on the capacity to ‘bounce back’ from an adverse event” (Garmezy, Masten, & Tellegen, 1984)

• “No generally accepted definition of resilience” (Cosco et al., 2016)

• Two components common to all resilience definitions:
  1. some form of adversity  
  2. a positive response to that adversity, sometimes referred to as ‘adaptation’ (Cosco et al., 2017)

Resilience Goal: adaptation against increasing adversity that comes with aging
Resilience (National Academy of Sciences, Disaster Management)

![Diagram showing the timeline of resilience:
- Plan
- Absorb
- Recover
- Adapt

The graph illustrates the critical function over time, showing how resilience is achieved through planning, absorption, recovery, and adaptation.]
Resilience (National Academy of Sciences, Disaster Management)

Critical Function

- Plan
- Absorb
- Recover
- Adapt

Time

Baseline Wellness

Resilience

Gerontology Application (simplified)
There are many possible futures for health outcomes once a disruption occurs.
Message 3: Resilience Needs to be Quantified

1. Emphasis Upon Systems and Networks
2. Focus on Recovery and Adaptation Over Time
How to Measure Resilience?

After Kott, Linkov, 2019
Quantification Challenges in Public Health/Medicine

- Many deterministic health aspects are outside of an individual’s control (social ecological model)
- Threats are changing with society and environment
- Rare events are difficult or prohibitively costly to anticipate or prevent


Current Tools Used to Measure Resilience in Elderly

- **Metrics**
  - Biomarkers
    - Adiposity, BMI, metabolic markers, serum markets, etc.
  - Socio-economic data
    - income, education, race & ethnicity, gender, etc.
  - Self-reported data & surveys
    - Existing scales and instruments

- **Methods**
  - Data-driven methods
    - Data-driven vs. individual-centered
  - Outcomes often defined as binary

- No "gold standard"
Best Metrics-Based Approach: Resilience Matrix

System Domains
- Physical
- Information
- Cognitive
- Social

Disruptive Event Stages
- PREPARE
- ABSORB
- RECOVER
- ADAPT

Scale
- Home
- Neighborhood
- Town
- County
- Region
- State
- Country

After Linkov et al., 2013
Assessment using Physician Judgment, Clinical Data and Patient’s Values

Use developed resilience metrics to comparatively assess the risks, level of effort and benefits of different courses of action

After Fox-Lent et al., 2015
Results: Alternative Evaluation

• Baseline assessment can be used to evaluate proposed projects

After Fox-Lent et al., 2015
Vision for Systems Resilience
Resilience vs. General Wellness and Vitamins

Antibiotics

Vitamins
References
