Mental Health Resilience and Aging: Measurement and Analytic Issues
Theodore D Cosco, PhD (Cantab) CPsychol
Overview

Positive aging models
  • Successful aging & resilience

Resilience
  • What it is (and what it is not)
  • Conceptualization
  • Operationalization
  • Measurement
  • Application
Objectives

Framework for resilience research

• How is resilience defined?
• What variables are necessary?
• How is it measured?
• Which methods are best suited to my data?

Is this reasonable? Does it make sense?
Positive aging models

• Disengagement Theory (Cumming & Henry, 1961)
  • "aging is an inevitable, mutual withdrawal or disengagement, resulting in decreased interaction between the aging person and others in the social system he belongs to"

• Activity Theory (Havighurst, 1961)
  • “successful aging occurs when older adults stay active and maintain social interactions”
Successful Aging

Low probability/absence of disease

Engagement

Physical and Cognitive Functioning

“Usual aging”
**Operational definitions of successful aging: a systematic review**

Theodore D Cosco, A Matthew Prina, Jaime Perales, Blossom C M Stephan and Carol Brayne

1 Department of Public Health and Primary Care, Cambridge Institute of Public Health, University of Cambridge, Cambridge, UK
2 Centre for Global Mental Health, Department of Health Services and Population Research, Institute of Psychiatry, King’s College London, London, UK
3 Parc Sanitari, Sant Joan de Déu, Universitat de Barcelona, Barcelona, Spain
4 Institute of Health and Society, Newcastle University, Newcastle upon Tyne, UK

Figure 1: Study Inclusion

- **Abstract Screening (n=7,282)**
  - Ineligible Articles (n=1,506)
  - No SA Analysis (n=5,213)

- **Full-Text Extraction (n=563)**
  - Ineligible Articles (n=54)
  - No SA Analysis (n=406)
  - Included Studies (n=103)

- **Included Studies (n=26)**
  - Quantitative
  - Qualitative

- **Ineligible Articles (n=1,506)**
  - No SA Analysis (n=5,209)
Conceptualization

Successful aging

Functioning

Adversity

Cosco, Howse, Brayne (2017)
Resilience

Adversity + Positive Response = Resilience
- Expected functioning given adversity experienced

Resilience

Functioning

Adversity

Cosco, Howse, Brayne (2017)
Successful aging

Functioning

Adversity

Cosco, Howse, Brayne (2017)
Expected functioning given adversity experienced

Resilience

Successful aging

Functioning

Adversity

Cosco, Howse, Brayne (2017)
Expected functioning given adversity experienced

Resilience

Successful aging

Costo, Howse, Brayne (2017)
Editorial

Successful Aging 2.0: Resilience and Beyond

Rachel Pruchno¹ and Deborah Carr²
Operationalization

Psychometric-driven

Data-driven

Definition-driven
<table>
<thead>
<tr>
<th>Variable-centered</th>
<th>Individual-centered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychometric-driven</td>
<td>Residuals</td>
</tr>
<tr>
<td>Continuous</td>
<td>Categorical</td>
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<tr>
<td>Researcher-driven</td>
<td>Latent Class Approach</td>
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</table>

<table>
<thead>
<tr>
<th>Acceptable Variable Types</th>
<th>Minimum Sample Size Requirements</th>
<th>Statistical Power</th>
<th>Granularity&lt;sup&gt;a&lt;/sup&gt;</th>
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Conceptualising and operationalising resilience in older adults
Theodore D Cosco<sup>a,b</sup>, Almar Kok<sup>c</sup>, Andrew Wister<sup>a</sup> and Kenneth Howse<sup>b</sup>

<sup>a</sup>Level of detail possible.
Psychometrics

Resilience measurement in later life: a systematic review and psychometric analysis

T. D. Cosco, A. Kaushal, M. Richards, D. Kuh and M. Stafford

DEVELOPMENT OF A NEW RESILIENCE SCALE:
THE CONNOR-DAVIDSON RESILIENCE SCALE (CD-RISC)

Kathryn M. Connor, M.D.,* and Jonathan R.T. Davidson, M.D.

Development and Psychometric Evaluation of the Resilience Scale

Gail M. Wagnild, PhD, RN
Heather M. Young, PhD, RN
### Table 2: Psychometrics characteristics of the Connor-Davidson Resilience Scale

<table>
<thead>
<tr>
<th>Scale</th>
<th>n</th>
<th>Mean score</th>
<th>SD</th>
<th>Cronbach’s α</th>
<th>Number of factors</th>
<th>Correlation (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EFA CFA</td>
<td>CES-D GSES PSMS MOS-SSS</td>
</tr>
<tr>
<td>Lamond, et al. (2008) [24]</td>
<td>CD-RISC 1395</td>
<td>75.7</td>
<td>13.0</td>
<td>0.92</td>
<td>4</td>
<td>-</td>
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<tr>
<td>Goins, et al. (2013) [25]</td>
<td>CD-RISC 160</td>
<td>83.0</td>
<td>13.4</td>
<td>0.93</td>
<td>- 1</td>
<td>-0.51**</td>
</tr>
<tr>
<td></td>
<td>CD-RISC10</td>
<td>33.5</td>
<td>6.2</td>
<td>0.88</td>
<td>-</td>
<td>-0.51**</td>
</tr>
</tbody>
</table>

SD standard deviation; EFA Exploratory Factor Analysis; CFA Confirmatory Factor Analysis; CES-D Center for Epidemiologic Studies Depression Scale; GSES General Self-Efficacy Scale; PSMS Personal Self-Mastery Scale; MOS-SSS Medical Outcomes Study Social Support Survey.

*p < .01
**p < .001

### Table 3: Psychometrics characteristics of the Wagnild & Young Resilience Scale

<table>
<thead>
<tr>
<th>Scale</th>
<th>n</th>
<th>Cronbach’s α</th>
<th>Number of factors</th>
<th>Correlation (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>EFA CFA</td>
<td>ER GHQ BDI-II</td>
</tr>
<tr>
<td>Girtler, et al. (2010) [26]</td>
<td>RS 178</td>
<td>0.86</td>
<td>6</td>
<td>0.59* 0.45* -0.31*</td>
</tr>
<tr>
<td>Resnick &amp; Inguito (2011) [28]</td>
<td>RS 101</td>
<td>0.91</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>RS 163</td>
<td>0.83</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>von Eisenhart Rothe, et al. (2013) [27]</td>
<td>RS-11 3712</td>
<td>0.86</td>
<td>1</td>
<td>-</td>
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<td></td>
<td>RS-5</td>
<td>0.80</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>

SD standard deviation; EFA Exploratory Factor Analysis; ER Ego-Resilience Scale; GHQ General Health Questionnaire; BDI-II Beck Depression Inventory Second Edition.

*p < .0001
<table>
<thead>
<tr>
<th>Acceptable Variable Types</th>
<th>n/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Sample Size Requirements</td>
<td>No</td>
</tr>
<tr>
<td>Statistical Power</td>
<td>n/a</td>
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<tr>
<td>Granularity(^a)</td>
<td>Moderate</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Resilience Quantified Limitations</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitations</td>
<td>Must be included in existing dataset or collected prospectively</td>
</tr>
<tr>
<td>Strengths</td>
<td>Integrate levels of resilience into a single psychometrically-robust score</td>
</tr>
</tbody>
</table>

\(^a\)Level of detail possible.
Operationalising resilience in longitudinal studies: a systematic review of methodological approaches

T D Cosco, A Kaushal, R Hardy, M Richards, D Kuh, M Stafford

**Theory and methods**

**Title & Abstract Screen**
(Duplicates removed)

- Ineligible: n = 157
- No resilience analysis: n = 4357

**Full-text Screen**

- Ineligible: n = 13
- No longitudinal resilience operationalisation: n = 1106
- Non-English: n = 240

**Included**

- n = 36
Operationalization

- Psychometric-driven
  - Definition-driven

- Data-driven
  - Resilient Class
  - Functioning over Time
  - Adaptation vs. Adversity
Secondary Data

Adversity

- Acute Event n=12
  - Disaster n=7
  - Injury n=5

- Non-Acute Event n=20
  - Cancer n=7
  - Bereavement n=2
  - Prisoner of War n=1
  - Childhood Trauma n=4
  - Hazardous Vocation n=3
  - Other n=4

Adaptation

- Low/No Post-traumatic Stress Symptoms n=8
- Low/No Anxiety n=5
- Low/No Depression n=12
- Low/No Other Psychological Distress n=9
- Low/No Physiological Distress n=4
- Other* n=3

Legend:

- Dotted line n=1
- Dashed line n=2
- Dash-dotted line n=3
- Solid line n=4
- Double solid line n=5
Definition-driven

Individual-centred
• A priori thresholds
• Masten (2006)

<table>
<thead>
<tr>
<th>Adversity</th>
<th>Lowest Tertile</th>
<th>Middle Tertile</th>
<th>Highest Tertile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest Tertile</td>
<td>Maladaptive</td>
<td>X</td>
<td>Resilient</td>
</tr>
<tr>
<td>Middle Tertile</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Lowest Tertile</td>
<td>Highly Vulnerable</td>
<td>X</td>
<td>Competent</td>
</tr>
<tr>
<td>Study</td>
<td>Adversity</td>
<td>Adaptation</td>
<td>Subsample</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Boe et al</td>
<td>Disaster</td>
<td>No PTSD</td>
<td></td>
</tr>
<tr>
<td>Bonanno et al</td>
<td>Spousal bereavement</td>
<td>No or low† depression</td>
<td></td>
</tr>
<tr>
<td>Bonanno et al</td>
<td>Spousal bereavement</td>
<td>No or low† depression</td>
<td>HADS—anxiety</td>
</tr>
<tr>
<td>Ho et al</td>
<td>Hereditary cancer risk</td>
<td>Below HADS threshold of 7/8</td>
<td>HADS—depression</td>
</tr>
<tr>
<td>Jaffee</td>
<td>Childhood maltreatment</td>
<td>Meet or exceed national norms for mental health, academic achievement and social competence</td>
<td></td>
</tr>
<tr>
<td>Mlinac et al</td>
<td>External stressors or life events common to late life</td>
<td>Coaches felt that participants met their goals despite more significant stressors</td>
<td></td>
</tr>
<tr>
<td>Netuveli et al</td>
<td>Functional limitation, bereavement, marital separation, poverty</td>
<td>Return to pre-adversity GHQ scores postadversity</td>
<td></td>
</tr>
<tr>
<td>Solomon et al</td>
<td>War veterans</td>
<td>No PTSD</td>
<td>Control veterans</td>
</tr>
<tr>
<td>Werner</td>
<td>Offspring of alcoholics</td>
<td>No coping problems at age 18</td>
<td>ex-POWs</td>
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</tbody>
</table>

*Same data set used.
†<80th centile z-scores on the Center for Epidemiologic Studies—depression scale.
A prototypical resilience trajectory, that is, decreasing functioning followed by a return to pre-event functioning, was also identified. GHQ, General Health Questionnaire; HADS, Hospital Anxiety and Depression Scale; POWs, prisoners of war; PTSD, post-traumatic stress disorder.
<table>
<thead>
<tr>
<th>Researcher-driven Thresholds</th>
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<tr>
<td><strong>Acceptable Variable Types</strong></td>
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<tr>
<td><strong>Minimum Sample Size Requirements</strong></td>
</tr>
<tr>
<td><strong>Statistical Power Granularity</strong></td>
</tr>
<tr>
<td><strong>Resilience Quantified Limitations</strong></td>
</tr>
<tr>
<td><strong>Strengths</strong></td>
</tr>
<tr>
<td><strong>Subjective group membership criteria, i.e. set by researchers</strong></td>
</tr>
</tbody>
</table>
Data-driven

Individual-centred

• Residual
Residuals - Applied

• Adversity – (Low) Physical Capability
  • Grip strength, chair rise time, standing balance time and timed-up-and-go
  • Rescaled, summed to create composite score (Guralnik et al., 2006; Cooper, et al. 2014)

• Adaptation – Psychological Wellbeing
  • Warwick-Edinburgh Mental Well-being Scale (WEMWBS) (Tennant, Hiller et al. 2007)
Residuals - Applied

Expectation

Reality
Figure 1. Well-being linearly regressed on summary objective physical performance at age 60–64 years (standardized regression coefficient $\beta = 2.68$, $p < 0.001$, 95% CI 1.82, 3.54). (a) Positive residual value indicating greater observed well-being score than would be expected by the fitted regression line; (b) Negative residual value indicating lower observed well-being score than would be expected by the fitted regression line.
Residuals - Applied

Expectation

Wellbeing

Reality

Physical Capability
<table>
<thead>
<tr>
<th></th>
<th>Continuous</th>
<th>Categorical</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acceptable Variable Types</strong></td>
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<td>Continuous</td>
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<tr>
<td><strong>Minimum Sample Size Requirements</strong></td>
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<td>Yes</td>
</tr>
<tr>
<td><strong>Statistical Power</strong></td>
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<td>Low</td>
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<tr>
<td><strong>Granularity</strong></td>
<td>High</td>
<td>Low</td>
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<tr>
<td><strong>Resilience</strong></td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Quantified Limitations</strong></td>
<td>Restrictive criteria for included variables</td>
<td>Restrictive criteria for included variables</td>
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<tr>
<td><strong>Strengths</strong></td>
<td>Greater insight into adversity-outcome relationship</td>
<td>Interpretation of analysis very straightforward</td>
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</tbody>
</table>
Data-driven

Variable-centred

Expectation  Reality

[Graph showing expected versus actual functioning over time, with a label for the resilient class]
<table>
<thead>
<tr>
<th>Acceptable Variable Types</th>
<th>Latent Class Approach</th>
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<td>Nominal, ordinal, continuous</td>
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<td>Yes</td>
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<tr>
<td>Statistical Power Granularity(^a)</td>
<td>Depends on sample Variable</td>
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<tr>
<td>Resilience Quantified Limitations</td>
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<tr>
<td>Group sizes are not known in advance</td>
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<tr>
<td>Strengths</td>
<td>Effective method for longitudinal studies</td>
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<td>Psychometric-driven</td>
<td>Variable-centered</td>
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<td>---------------------</td>
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<td></td>
<td>Residuals</td>
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</tbody>
</table>

*a* Level of detail possible.
Summary

• Positive models of aging
  • Successful aging 2.0

• Resilience
  • Better outcomes than expected
  • Broader public health concept
  • Matching methods to variables
    • Variety of options
Thanks.

Acknowledgements
Study participants: National Survey Health & Development, Cambridge City over-75 Cohort, Cognitive Function and Ageing Survey
Funding: Canadian Institutes of Health Research Postdoctoral Fellowship (MFE146676)
Coauthors: Andrew Wister, Carol Brayne, Kenneth Howse, Mai Stafford, Aradhna Kaushal, Diana Kuh

Contact
@tdcosco
TCosco@sfu.ca
https://www.researchgate.net/profile/Theodore_Cosco
Cosco, Prina, Perales, Stephan, Brayne (2014b)
Cosco, et al. (2014b)
Appendices: Mediation by physical activity

- Structural Equation Modelling
  - Mediation by physical activity (6%)
    - Many other factors to consider (94%)

Physical Activity (age 53) ➔ Resilience ➔ Physical Activity (age 60-64)

Indirect Effect: 0.03 (0.01-0.05)
Total Effect: 0.42 (0.04-0.72)

RMSEA: .04
CFI: 0.96
TLI: .92
SRMR: .02