Understanding the Psychological and Neurobiological Nature of Resilience

Craig S. Neumann, Ph.D.

UNT Distinguished Research Professor

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Resilience has become an important topic throughout all levels of science

Word “resilience” originates from the Latin verb resilire, or, “to leap back”

OED: “being able to withstand or recover quickly from difficult conditions”

In psychology, the ability to bounce back from negative emotional experiences and flexibly adapt to the changing demands of stressful experiences
Resilience is a dynamic process that changes over time…

e.g., personality and genetic factors are fundamental to resilience

e.g., youth resiliency involves the importance of social support

   e.g., successful aging and physical health

… there are different types of stressors, adversities and life events
   that can affect us at various levels such as biological, individual, familial and community
Resilience Domains

Interpersonal

Family Cohesion

Strong family bonds
Enjoyment of being with family
Resilience Domains

Interpersonal

Family Cohesion
- Strong family bonds
- Enjoyment of being with family

Social Support
- Have people who really care about me
- Someone who helps me when needed
Resilience Domains

Intrapersonal

Social Competence

Good at getting in touch with people
Easy to establish new friendships
Resilience Domains

Intrapersonal

Social Competence
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Personal Structure
- Regular routines
- Planned actions
Resilience Domains

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- Social Competence
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- Personal Competence
  - Believe in my own abilities
  - Believe I can overcome difficult times

- Personal Structure
  - Regular routines
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Resilience Domains

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  - Regular routines
  - Planned actions
Psychometric Analysis and Refinement of the Connor–Davidson Resilience Scale (CD-RISC): Validation of a 10-Item Measure of Resilience

Laura Campbell-Sills
Department of Psychiatry, University of California San Diego, La Jolla, CA

Murray B. Stein
Department of Psychiatry, University of California San Diego, La Jolla, CA; Department of Psychology, San Diego State University; and VA San Diego Healthcare System, San Diego, CA

Resilience refers to an individual’s ability to thrive despite adversity. The current study examined the psychometric properties of the Connor–Davidson Resilience Scale (CD-RISC). Three undergraduate samples (N > 500) were used to determine the factor structure of the CD-RISC. The first two samples were used to conduct exploratory factor analysis (EFA), and the third was used for confirmatory factor analysis. The EFA showed that the CD-RISC had an unstable factor structure across two demographically equivalent samples. A series of empirically driven modifications was made, resulting in a 10-item unidimensional scale that demonstrated good internal consistency and construct validity. Overall, the 10-item CD-RISC displays excellent psychometric properties and allows for efficient measurement of resilience.
### 10-item Scale:
0 = not at all like me
to
4 = very much like me

Average score = 27
(max = 40)

<table>
<thead>
<tr>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Able to adapt to change</td>
</tr>
<tr>
<td>Can deal with whatever comes</td>
</tr>
<tr>
<td>Tries to see humorous side of problems</td>
</tr>
<tr>
<td>Coping with stress can strengthen me</td>
</tr>
<tr>
<td>Tend to bounce back after illness or hardship</td>
</tr>
<tr>
<td>Can achieve goals despite obstacles</td>
</tr>
<tr>
<td>Can stay focused under pressure</td>
</tr>
<tr>
<td>Not easily discouraged by failure</td>
</tr>
<tr>
<td>Thinks of self as strong person</td>
</tr>
<tr>
<td>Can handle unpleasant feelings</td>
</tr>
</tbody>
</table>
Resilient coping in the general population: standardization of the brief resilient coping scale (BRCS)

Rüya-Daniela Kocalevent1,2*, Markus Zenger3,7, Andreas Hinz4, Burghard Klapp5 and Elmar Brähler4,6

Abstract

Background: There has been a marked tendency for researchers, clinicians, and policy makers to shift their focus from risk to resilience. This should be assessed by comparing the outcome to a context specific reference group. The objectives of the study were to generate normative data for the BRCS for different age groups for men and women and to further investigate the construct validity and factor structure in a general population.

Methods: Nationally representative face-to-face household surveys were conducted in Germany in 2013 (n = 2508).

Results: Normative data for the BRCS were generated for men and women (53.2% female) and different age levels (mean age (SD) of 49.7 (18.0) years). Men had significantly higher mean scores compared with women (14.9 [SD = 3.2] vs. 14.6 [SD = 3.1]). The results of the EFA and CFA clearly indicate a unidimensional solution with one factor. Furthermore, the invariance of the one-factor model was tested for the whole sample across gender and six age groups.

Conclusions: The normative data provide a framework for the interpretation and comparisons of resilience with other populations.

Keywords: Resilience, Coping, Normative data, BRCS, General population
I look for creative ways to alter difficult situations

Regardless of what happens to me, I believe I can control my reaction to it

I believe that I can grow in positive ways by dealing with difficult situations

I actively look for ways to replace the losses I encounter in life
**Brief Resilience Coping Scale (BRCS)**

**I look for creative ways to alter difficult situations**

1 = does not describe me at all
2 = does not describe me very well
3 = neutral
4 = describes me fairly well
5 = describes me very well
Brief Resilience Coping Scale (BRCS)

Regardless of what happens to me, I believe I can control my reaction to it

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<table>
<thead>
<tr>
<th>Sum Score</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14-24</td>
<td>25-34</td>
</tr>
<tr>
<td>4</td>
<td>0.2</td>
<td>1.1</td>
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<tr>
<td>5</td>
<td>0.6</td>
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<tr>
<td>6</td>
<td>0.9</td>
<td>2.7</td>
</tr>
<tr>
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<td>1.5</td>
<td>3.0</td>
</tr>
<tr>
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</tr>
<tr>
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<td>4.9</td>
<td>6.8</td>
</tr>
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<td>10</td>
<td>8.2</td>
<td>11.4</td>
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<tr>
<td>11</td>
<td>12.7</td>
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</tr>
<tr>
<td>20</td>
<td>96.3</td>
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*Percentiles indicate the rank of the subject compared to other subjects of the same age group and gender*
Understanding resilience

Gang Wu¹, Adriana Feder¹, Hagit Cohen², Joanna J. Kim¹, Solara Calderon¹, Dennis S. Charney¹ and Aleksander A. Mathé³ *

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² Ben-Gurion University of the Negev, Beer-Sheva, Israel
³ Department of Clinical Neuroscience, Karolinska Institutet, Stockholm, Sweden

Resilience is the ability to adapt successfully in the face of stress and adversity. Stressful life events, trauma, and chronic adversity can have a substantial impact on brain function and structure, and can result in the development of posttraumatic stress disorder (PTSD), depression and other psychiatric disorders. However, most individuals do not develop such illnesses after experiencing stressful life events, and are thus thought to be resilient. Resilience as successful adaptation relies on effective responses to environmental challenges and ultimate resistance to the deleterious effects of stress, therefore a greater understanding of the factors that promote such effects is of great relevance. This review focuses on recent findings regarding genetic, epigenetic, developmental, psychosocial, and neurochemical factors that are considered essential contributors to the development of resilience. Neural circuits and pathways involved in mediating resilience are also discussed. The growing understanding of resilience factors will hopefully lead to the development of new pharmacological and psychological interventions for enhancing resilience and mitigating the untoward consequences.

Keywords: resilience, stress, neurobiology, depression, PTSD
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# Gene variants (SNPs)

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Number of Stressful Life Events vs. Probability of Major Depressive Episode

Serotonin Gene variants

## Gene variants (SNPs)

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SNPs

SNP = single nucleotide polymorphism

Figure 6. Early Life Stress – HPA axis Gene Interaction
This diagram represents the function of the adult amygdala. It continually compares neural inputs containing external sensory information with emotion-related internal memory to rapidly activate systems leading to tolerance to aversion and resilience vs. the fight or flight, fear and stress reaction. The data reviewed here suggests that with sufficiently supportive development, a dynamic amygdala-dependent emotional circuit is created allowing proper interpretation of threat responses. In contrast, child abuse combined with biological risk factors (e.g. increased stress-dependent cortisol interacting with FKBP5 or CRHR1 polymorphisms) may lead to an adult amygdala-dependent emotional circuit that is always ‘primed’ for stress responsiveness. It is hypothesized that this latter hyper-active stress response may, in the presence of adult trauma, lead to a higher risk for trauma-related psychopathology.

Developmental Cortisol

Early Life Stress

FKBP5
CRHR1

Stress, fear

resilience
tolerance

External sensory
Internal memory

Amygdala

Figure 6. Early Life Stress – HPA axis Gene Interaction

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PTSD & Resilience

LPA1 = Resilient subtype
LPA4 = PTSD subtype
LPA2 = High neuroticism (false positive PTSD?) subtype

Erin Sullivan Thesis
PTSD & Resilience

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Erin Sullivan Thesis
“Regardless of what happens to me, I believe I can control my reaction to it”

The Facets of Mindfulness

<table>
<thead>
<tr>
<th>Facet</th>
<th>Example item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observing</td>
<td>I notice the smells and aromas of things.</td>
</tr>
<tr>
<td>Nonreactivity to inner experience</td>
<td>I perceive my feelings and emotions without having to react to them.</td>
</tr>
<tr>
<td>Describing</td>
<td>I’m good at finding words to describe my feelings.</td>
</tr>
<tr>
<td>Nonjudging of inner experience</td>
<td>I think some of my emotions are bad or inappropriate and I shouldn’t feel them. (R)</td>
</tr>
<tr>
<td>Acting with awareness</td>
<td>I find myself doing things without paying attention. (R)</td>
</tr>
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Note: R = reverse-scored item (higher scores represent higher levels of mindfulness)
Neural mechanisms of symptom improvements in generalized anxiety disorder following mindfulness training

Britta K. Höfzel a,b,1, Elizabeth A. Hoge a,1, Douglas N. Greve a,1, Tim Gard a,b,1, J. David Creswell c, Kirk Warren Brown d, Lisa Feldman Barrett a,e,1, Carl Schwartz a,1, Dieter Vaitl b, Sara W. Lazar a,1

a Massachusetts General Hospital, 120 2nd Ave., Charlestown, MA, 02129, USA
b Bender Institute of Neuroimaging, Justus-Liebig University, Otto-Behaghel-Str. 104, 35394 Giessen, Germany
c Department of Psychology, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA 15213, USA
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e Department of Psychology, Northeastern University, Boston, MA, 02115, USA

A R T I C L E   I N F O
Article history:
Received 27 November 2012
Received in revised form 13 March 2013
Accepted 17 March 2013
Available online 25 March 2013

Keywords:
Generalized anxiety disorder
Emotion regulation
Intervention
Longitudinal
Amygdala
Prefrontal cortex
Connectivity
Ventrrolateral prefrontal cortex
Beck Anxiety Inventory
Stress

A B S T R A C T
Mindfulness training aims to impact emotion regulation. Generalized anxiety disorder (GAD) symptoms can be successfully addressed through mindfulness-based interventions. This preliminary study is the first to investigate neural mechanisms of symptom improvements in GAD following mindfulness training. Furthermore, we compared brain activation between GAD patients and healthy participants at baseline. 26 patients with a current DSM-IV GAD diagnosis were randomized to an 8-week Mindfulness Based Stress Reduction (MSBR, N = 15) or a stress management education (SME, N = 11) active control program. 26 healthy participants were included for baseline comparisons. BOLD response was assessed with fMRI during affect labeling of angry and neutral facial expressions. At baseline, GAD patients showed higher amygdala activation than healthy participants in response to neutral, but not angry faces, suggesting that ambiguous stimuli reveal stronger reactivity in GAD patients. In patients, amygdala activation in response to neutral faces decreased following both interventions. BOLD response in ventrolateral prefrontal regions (VLPFC) showed greater increase in MSBR than SME participants. Functional connectivity between amygdala and PFC regions increased significantly pre- to post-intervention within the MSBR, but not SME group. Both change in VLPFC activation and amygdala–prefrontal connectivity were correlated with change in Beck Anxiety Inventory (BAI) scores, suggesting clinical relevance of these changes. Amygdala–prefrontal connectivity turned from negative coupling (typically seen in down-regulation of emotions), to positive coupling; potentially suggesting a unique mechanism of mindfulness. Findings suggest...
Fig. 2. CAD patients (N = 26) show greater activation in a cluster in the right amygdala when viewing neutral facial expressions when compared to healthy participants (N = 26; p = 0.0001; size = 440 mm3; multiple comparison corrections within area of bilateral amygdalae; cluster overlaid over a FreeSurfer subcortical parcellation image).
Mindfulness training group shows greater activation of frontal areas compared to stress reduction group.
Mindfulness training group shows greater activation of frontal areas compared to stress reduction group and this is associated with a reduction in anxiety (BAI) scores pre-to-post.
Mindfulness training group shows greater connectivity between amygdala and frontal areas compared to stress reduction group and this is associated with a reduction in anxiety (BAI) scores post-intervention.
Association Between Older Age and More Successful Aging: Critical Role of Resilience and Depression

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Gauri N. Savla, Ph.D.
Wesley K. Thompson, Ph.D.
Ipsit V. Vahia, M.D.
Danielle K. Glorioso, M.S.W.
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Barton W. Palmer, Ph.D.
David Rock, B.A.
Shahrokh Golshan, Ph.D.
Helena C. Kraemer, Ph.D.
Colin A. Depp, Ph.D.

Objective: There is growing public health interest in understanding and promoting successful aging. While there has been some exciting empirical work on objective measures of physical health, relatively little published research combines physical, cognitive, and psychological assessments in large, randomly selected, community-based samples to assess self-rated successful aging.

Method: In the Successful AGing Evaluation (SAGE) study, the authors used a structured multicohort design to assess successful aging in 1,006 community-dwelling adults in San Diego County, ages 50–99 years, with oversampling of people over 80. A modified version of random-digit dialing was used to recruit subjects. Evaluations included a 25-minute telephone interview followed by a comprehensive mail-in survey of physical, cognitive, and psychological domains, including positive psychological traits and self-rated successful aging, scaled from 1 (lowest) to 10 (highest).

Results: The mean age of the respondents was 77.3 years. Their mean self-rating of successful aging was 8.2, and older age was associated with a higher rating, despite worsening physical and cognitive functioning. The best multiple regression model achieved, using all the potential correlates, accounted for 30% of the variance in the score for self-rated successful aging and included resilience, depression, physical functioning, and age (entering the regression model in that order).

Conclusions: Resilience and depression had significant associations with self-rated successful aging, with effects comparable in size to that for physical health. While no causality can be inferred from cross-sectional data, increasing resilience and reducing depression might have effects on successful aging as strong as that of reducing physical disability, suggesting an important role for psychiatry in promoting successful aging.

(Am J Psychiatry 2013; 170:188–196)
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*(Am J Psychiatry 2013; 170:188–196)*
Mail-In Survey

The survey questionnaire included detailed demographic questions and a number of rating scales and other measures. Several provided data for this study. Health-related quality of life and functioning were assessed with the Medical Outcomes Study 36-Item Short-Form Health Survey (Cronbach’s alpha=0.90) (19), which measures current physical and mental health functioning. Subjective cognitive functioning was tested with the Cognitive Failures Questionnaire (Cronbach’s alpha=0.96) (20). The severity of depressive symptoms was evaluated with the 9-item version of the Patient Health Questionnaire (Cronbach’s alpha=0.86–0.89) (16). Two instruments provided ratings of positive psychological constructs: the Life Orientation Test–Revised for optimism (Cronbach’s alpha=0.78) (21) and the 10-item version of the Connor-Davidson Resilience Scale (Cronbach’s alpha=0.85) (22). The participants were also asked to rate the extent to which they thought they had aged successfully, on a 10-point Likert-type scale ranging from 1 (least successful) to 10 (most successful) (7). The subjects were instructed to use their own conceptualization of successful aging rather than any investigator-defined construct.
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<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilience: total score on 10-item Connor-Davidson Resilience Scale</td>
<td>0.396</td>
<td>0.044</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Depression severity score on 9-item Personal Health Questionnaire</td>
<td>0.258</td>
<td>0.047</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Physical functioning: score on physical component of Medical Outcomes Study 36-Item Short-Form Health Survey</td>
<td>0.405</td>
<td>0.044</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Age</td>
<td>0.397</td>
<td>0.042</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

a Residual standard error: 1.231 on 1,001 degrees of freedom. Multiple $R^2$=0.300.

b Each variable was standardized by subtracting the mean and dividing by the standard deviation.

c The depression score was reversed by multiplying by $-1$ for the purpose of comparison with other variable coefficients.
Resilience and coping as predictors of general well-being in the elderly: A structural equation modeling approach

José M. Tomás\textsuperscript{a*}, Patricia Sancho\textsuperscript{a}, Juan Carlos Melendez\textsuperscript{b} and Teresa Mayordomo\textsuperscript{b}

\textsuperscript{a}Department of Methodology for the Behavioural Sciences, University of Valencia, Valencia, Spain; \textsuperscript{b}Department of Developmental and Educational Psychology, University of Valencia, Valencia, Spain

(Received 20 April 2011; final version received 7 August 2011)

**Objectives:** The aims of this article are: (a) to test for the validity of the three constructs involved in the structural model; (b) to test for the effects of both coping strategies and resilient coping on well-being in a sample of elderly, by means of a structural model with latent variables; (c) to empirically study whether a brief scale of resilient coping could predict well-being over and above that predicted by the coping resources.

**Methods:** The research is a survey design. The sample consisted of 225 non-institutionalized elderly people living in the city of Valencia (Spain). The three constructs measured were: well-being, resilient coping, and coping strategies.

**Results:** The analyses consist of a series of alternative structural models with latent variables with resilience, problem-focused coping, and emotion-focused coping as the potential predictors of well-being as measured by Ryff's well-being scales. Due to parsimony reasons, the model retained is that with a single predictor of well-being: resilient coping.

**Conclusion:** A latent variable measuring resilient coping is able to predict a significant and large part of the variance in well-being, without the need of including coping strategies. Results impact on well-being literature of the elderly is discussed.
Figure 2. Best-fitting model to predict well-being.
Notes: PSC = problem-solving coping; PR = positive reappraisal; SSS = social support seeking; NAC = negative auto-focused coping; OEE = overt emotional expression; AC = avoidance coping; RC = religious coping; SA = self-acceptance; EM = environmental mastery; PG = personal growth; PL = purpose in life.
Resilient coping strongly linked with well-being

- Resilient coping
- Problem coping
- Emotional coping
- Well-being

- 0.18
- 0.65
- 0.42
- 0.81
Problem focused coping strongly linked with resilience
Emotion focused coping strongly linked with problem coping ability.
A meta-analysis of the trait resilience and mental health

Tianqiang Hu, Dajun Zhang*, Jinliang Wang

Research Center for Mental Health Education, Faculty of Psychology, Southwest University, Chongqing 400715, China

# Table 2

Fixed-model of the correlation between trait resilience and mental health.

<table>
<thead>
<tr>
<th>Mental health</th>
<th>$k$</th>
<th>$N$</th>
<th>Mean $r$ effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative indicators</td>
<td>76</td>
<td>45,188</td>
<td>$-0.361$</td>
</tr>
<tr>
<td>Positive indicators</td>
<td>35</td>
<td>20,092</td>
<td>$0.503$</td>
</tr>
</tbody>
</table>
- Resilience is not a stable trait, but a dynamic process.

- Resilience can be conceptualized as mental health in relation to stressor load.

- Resilience as a dynamic process of adaptation can potentially be trained.

FIGURE 1 | Promoting resilience in child rearing.
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<table>
<thead>
<tr>
<th>Resilience promoting in childhood</th>
<th>Resilience characteristics in adulthood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loving and supportive environment (family, community, school, and society)</td>
<td>Secure attachment, trust</td>
</tr>
<tr>
<td>Positive relationships with adults and peers</td>
<td>Strong social skills and social network</td>
</tr>
<tr>
<td>Supportive, attentive and responsible parenting (especially maternal care)</td>
<td>Self-confidence, positive identity</td>
</tr>
<tr>
<td>Prosocial romantic attachments</td>
<td></td>
</tr>
</tbody>
</table>
Resilience promoting in childhood

- Individual or group cognitive–behavioral trainings (e.g., stress inoculation training)
- Experiences of overcoming manageable life challenges

Resilience characteristics in adulthood

- Strong cognitive reappraisal and emotion regulation
- Realistic optimism
  - Humor, positive thinking
  - Altruism, generosity
fini
<table>
<thead>
<tr>
<th></th>
<th>Disagree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>When I make plans I follow through with them.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>2.</td>
<td>I usually manage one way or another.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>3.</td>
<td>I am able to depend on myself more than anyone else.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>4.</td>
<td>Keeping interested in things is important to me.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>5.</td>
<td>I can be on my own if I have to.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>6.</td>
<td>I feel proud that I have accomplished things in my life.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>7.</td>
<td>I usually take things in stride.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>8.</td>
<td>I am friends with myself.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>9.</td>
<td>I feel that I can handle many things at a time.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>10.</td>
<td>I am determined.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>11.</td>
<td>I seldom wonder what the point of it all is.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>12.</td>
<td>I take things one day at a time.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>13.</td>
<td>I can get through difficult times because I’ve experienced difficulty before.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>14.</td>
<td>I have self-discipline.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>15.</td>
<td>I keep interested in things.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>16.</td>
<td>I can usually find something to laugh about.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>17.</td>
<td>My belief in myself gets me through hard times.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>18.</td>
<td>In an emergency, I’m someone people generally can rely on.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>19.</td>
<td>I can usually look at a situation in a number of ways.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>20.</td>
<td>Sometimes I make myself do things whether I want to or not.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>21.</td>
<td>My life has meaning.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>22.</td>
<td>I do not dwell on things that I can’t do anything about.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>23.</td>
<td>When I’m in a difficult situation, I can usually find my way out of it.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>24.</td>
<td>I have enough energy to do what I have to do.</td>
<td>1 2 3 4 5 6 7</td>
</tr>
<tr>
<td>25.</td>
<td>It’s okay if there are people who don’t like me.</td>
<td>1 2 3 4 5 6 7</td>
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