A Practical Measure of Workplace Resilience

Developing the Resilience at Work Scale

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Objective: To develop an effective measure of resilience at work for use in individual work-related performance and emotional distress contexts. **Methods:** Two separate cross-sectional studies investigated: (1) exploratory factor analysis of 45 items putatively underpinning workplace resilience among 397 participants and (2) confirmatory factor analysis of resilience measure derived from Study 1 demonstrating a credible model of interaction, with performance outcome variables among 194 participants. **Results:** A 20-item scale explaining 67% of variance, measuring seven aspects of workplace resilience, which are teachable and capable of conscious development, was achieved. A credible model of relationships with work engagement, sleep, stress recovery, and physical health was demonstrated in the expected directions. **Conclusion:** The new scale shows considerable promise as a reliable instrument for use in the area of employee support and development.

It is arguable that the twenty-first century world of work has become characterized by the demand for increasingly greater output from increasingly fewer workers (supported by increasingly sophisticated technology). In the process, there are indications that the phenomenon of "work intensification" has reached the limits of human capacity to withstand.[1] As a consequence, there has been a substantial increase in the incidence of work-related stress injury. Such injury has been estimated to cost the Australian community not less than $AUD 25 billion annually.[2] In addition, overwork and fatigue has been implicated in at least half the $AUD 60 billion cost of physical injuries at work.[2] Such phenomena are not confined to the antipodes. The European Agency for Safety and Health at Work reported that in 2005 nearly one in four workers was affected by it; that 50% to 60% of all lost working days were related to it; and that its financial cost was not less than €22 billion. In the United States, Kalia[3] estimates the cost of stress-related effects to be not less than 0.3% of gross domestic product at US$ 45 billion.

At the organizational level, such costs, including absenteeism (formal and informal), lost time because of injury, compensation, litigation, employee resignations (rehiring and retraining costs), insurance costs, and lost productivity, have been estimated to absorb as much as 45% of company operating profits.[4] Such costs are inevitably destined to increase as occupational health and safety legislation extends the ambit of employer's "duty of care" responsibility. For example, under the Victorian (Australia) 2004 Occupational Health and Safety Act, employers are mandated to be aware of "... the likelihood of work-related stress hazards and risks eventuating," and also "... what is known or ought, reasonably, to be known about work-related stress." Nevertheless, it should be acknowledged that in addition to such mandatory requirements, many progressive employers are, in contrast to the attitudes prevailing in the latter quarter of the twentieth century, developing an awareness of the importance and value of their employees to them as human capital and a most (if not the most) significant asset the organization possesses, meriting appropriate and meaningful protection.

Nevertheless, it has been consistently observed that some individual workers across the work spectrum seem to manifest a capacity to cope with high work demands far more successfully than others. They are said to possess "high resilience." Surprisingly, there is no universal definition of such resilience[5]; nevertheless, most attempts to define resilience include at least two commonalities. First, resilience involves some form of adversity or challenge, and second, this is followed by some degree of positive adaptation. A conceptual review by Windle[6–8] suggests:

> [Resilience is] the process of negotiating, managing, and adapting to significant sources of stress or trauma. Assets and resources within the individual, their life and environment facilitate the capacity for adaptation and "bouncing back" in the face of adversity. Across the life course, the experience of resilience will vary.[8]

Some descriptions of resilience identify it as a personality trait or genetic predisposition.[8] Several studies, for example, have suggested that notable resilience to stress experience has a genetic underpinning.[9,10] Nevertheless, there is no evidence that such genetically determined resilience factors are consciously modifiable.[11–13] They simply represent the individual's relative vulnerability (or otherwise) to the maladaptive effects of their environment. Nonetheless, within this existential reality, there is an emerging view that resilience can also be conceptualized as a dynamic and interactive process.[14] Such a perspective views it as a function of individuals' conscious interaction with their external environment.[7,8,15] This is highly significant because it suggests that rather than being a fixed quantity determined by relatively unchanging genetic factors, resilience is a malleable epiphenomenon, and as such it is capable of development. More importantly is to suggest the possibility that it is *teachable*.[16–18]

Consequently, the current challenge faced by researchers is to identify the processes and mechanisms underlying the resilience construct more completely, in addition, to be able to measure its important aspects with a view to being able to teach its conscious development to those who may not spontaneously manifest it in sufficient measure to meet fully the everyday challenges of their work demands.[14,19]

A number of extant psychometric scales have been created that seek to assess resilience. The Resilience (RS 14) scale[20–22] and the Connor–Davies Resilience scale[22,23] are two such validated scales. Nevertheless, typically such scales seek to assess resilience as a broad and general personal attribute, rather than as a specific capacity within the work environment.

Mindful of the criticisms of adequately defining resilience, we deliberately avoid attempting to achieve a global definition of resilience. In this article, we have confined ourselves to reporting the development of a scale intended to measure a more limited but nevertheless realistic and practical construct of "resilience at work." In order for such a scale to have practical relevance, and not just academic interest, we have focused, where possible, on identifying

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those elements of resilience that can be *consciously and deliberately* considered and modified through appropriate skills training, that is, behaviors and strategies that are *not limited* by fixed genetic and personality factors. In approaching this task, we have been guided by two broad influences.

In the first instance, we have been mindful of the evolving insights into the neurophysiology of the human stress response, particularly the consequences of prolonged exposure to high-order stressful experience, which is increasingly common in the modern workplace.[24–26] This literature has demonstrated the value of consciously chosen behaviors having the effect of activating the "pleasure reward" neural architecture, which downregulates the stress response mechanism, and which in turn mediates "recovery" from its influence.[27] Such recovery has been shown to mitigate the otherwise erosive effects of stress exposure, notably chronic maladaptive fatigue.[27–29] In addition, the significance of recovery to building what has been described as "psychological toughness" to resist stress (ie, enhanced workplace resilience) has been clearly demonstrated, and cannot be overemphasized.[30,31]

In the second instance, we have drawn upon several decades of the authors' experience in the field of organizational psychology; observing and working successfully with thousands of workers (both individually and in groups or teams) in high-demand workplaces as diverse as hospitals, prisons, and factories, to achieve better daily functioning, leading to more positive psychological health outcomes. To this end we are not focused on an instrument that is relevant to particular work areas or types, but on the workers' capacities, wherever they work.

In this article, we report on two studies leading to the development of an alternative measure of *personal* resilience in the workplace (the resilience at work [RAW] scale), in particular, elements of resilience that are open to development through conscious choice and decision. In other words, we were looking to understand the elements of *workplace resilience as a skill* that could be taught, practiced, and developed. On the basis of the literature, it was anticipated that this scale would be associated with behaviors that reliably facilitated *recovery* from work stress experience.[28]

We hypothesize that scores on the scale we seek to develop will correlate highly and positively with the following:

1. A measure of recovery (from work demands)
2. A measure of engagement at work
3. A measure of physical health
4. Measures of chronic fatigue and poor sleep

Pearson's r correlations 0.4 or more would be regarded as significant.

STUDY 1

Method

The extant literature on stress exposure and its consequences as well as of resilience was reviewed. In addition, the experience of 25 years of working with various client groups, including health workers (various), teachers, bank offices, corrections officers, and various manufacturing industry group workers,[32] underpinned the authors' thematic analysis of observed behaviors, which seemed to be consistently associated with moderating work-related stress problems, and mediating recovery, at both the individual and corporate levels.

This led to the formulation of 45 statements, reflecting states, attitudes, and behaviors, which were believed to underpin resilient behavior in the specific workplace context. Each of these behaviors, states, and attitudes had been noted (both in the literature and clinical practice) as contributing to individual resilience. Nevertheless, more importantly for our purpose, they were consciously accessible and therefore (at least potentially) open to conscious and deliberate development, either personally or within a teaching/training context. In other words, they could be deliberately changed or developed by any worker motivated to develop their resilient capacity.

The authors' extensive e-mail contact lists, including individuals and groups who had been past clients and/or industry contacts, were used as the basis for recruitment to a survey questionnaire accessed on-line, and hosted on a stable and reliable survey hosting site, (Qualtrics Asia), which has a comprehensive data security structure including Transport Layer Security encryption (HTTPS) and survey security options, including password protection and HTTP referrer checking. Data are hosted by third-party data centres that are audited and SAS 70 certified. The study questionnaire of 103 items comprised the potential items of the new scale and several validated scales as outcome variables (such as physical health and work engagement) against which the new scale could be assessed. Each potential participant was directly approached via e-mail and provided with an information sheet (approved by the University of South Australia Human Research Ethics Committee). This initial contact explained the nature and intent of the study and contained a hyperlink to the on-line survey. In addition to direct personal approach, a "snowballing" technique was used to recruit participants. Thus, each directly contacted participant was asked to forward the survey hyperlink to any of *their* contacts who they thought might be interested in contributing to the project. Given that the initial contacts were known former clients and contacts of the second author, the dangers of this invitation being circulated inappropriately were judged to be minimal.

Participants

A total of 355 participants with a mean age of 44.6 years (standard deviation [SD] = 11.8 years) participated in Study 1, of whom 85 (24.1%) were male. This number (which was not fewer than 15 cases per extracted factor) was considered adequate to undertake an exploratory factor analysis of the items selected to form the new measure.

Table 1 indicates the distribution of other characteristics of the study population. Taken together, they suggest that the population was suitably diverse, representing various occupations, work forms (work contracts), and amounts of time worked per week.

Materials

The study questionnaire contained a total of 103 items. Of these 45 were statements, which were believed to exemplify "resilience promoting" behaviors. They included, for example, "I really try to interact positively with people I have to deal with at work", "I know my personal strengths and make sure I use them regularly in my work," "I make sure I take breaks to maintain my strength and energy when I'm working hard," "I am careful to maintain a good level of physical fitness," and "I am able to change my mood at work when I need to."

Participants were asked to indicate their agreement with the items on a seven-point Likert response scale (0 to 6) from "strongly disagree" to "strongly agree."

In addition to the items on resilience, the following validated psychometric scales were included.

Sleep Health

Six items were from the Psychological Injury Risk Indicator scale[33] (which have been shown to identify sleep health and hygiene).

Recovery Between Shifts

This was measured with the five-item Recovery subscale of the Occupational Fatigue Exhaustion Recovery scale.[28] This scale is the only scale currently measuring elements of both fatigue and recovery.

TABLE 1. Distribution of Sex, Country, Work Hours, Work Area, and Work Contract Within Study Population

Characteristic	*N* (%)
County of origin	
Australia	319 (91)
USA	15 (4.2)
UK	5 (1.4)
Canada	7 (2.0)
Other	5 (1.4)
Hours Working	
Unemployed	5
1–15	13 (3.7)
16–25	26 (7.3)
26–40	200 (56.5)
≥40	108 (30.8)
Area of work	
Health	138 (39)
Education (broadly)	67 (18.9)
Commerce (broadly)	27 (7.6)
IT	9 (2.5)
Finance	13 (3.7)
Manufacturing	3 (0.8)
Other	96 (27.2)
Work contract	
Permanent	273 (77.1)
Fixed term	33 (9.3)
Casual (uncertain)	16 (4.5)
Self-employed	23 (6.5)
Contractor	8 (2.3)

IT, information technology.

Chronic persistent fatigue (fatigue not recovered by normal rest) was assessed with Chronic Fatigue subscale of the Occupational Fatigue Exhaustion Recovery scale. This construct is closely analogous to reactive depression.[28]

Emotional health was assessed using the General Health Questionnaire 12 (GHQ 12).[34]

Engagement with work was assessed using the Utrecht Work Engagement scale.[35]

General Physical Health

The items for this measurement were simple ones, which are common indicators of broad physical health and in particular resistance to common but generally mild health conditions. Whether or not such conditions are regularly experienced is indicative of the relative strength of immune system function. By comparison, regular and/or consistent poor health is typically found in individuals with low resilience to extant work stresses whose immune system has become dysregulated.[36]

Results

All responses to the questionnaire were automatically coded into an SPSS data file by the Qualtrics Asia on-line survey system. This was downloaded for analysis, and where appropriate, negatively keyed items were recoded.

Factor Analysis

All of the 45 resilience-based items (recoded where necessary) were examined using the dimension reduction (exploratory factor analysis) analyses available in SPSS v 19.

Principal components extraction of factors with an Eigen value more than 1.0 was undertaken, specifying varimax rotation to determine orthogonal factors. To isolate items of medium/strong item/factor correlation, item/factor correlations (<0.50) were suppressed. In addition, a scree plot, Keiser–Meyer–Olkin test of sampling adequacy, and Bartlett's test of sphericity were requested.

The Keiser–Meyer–Olkin value of 0.890 and Bartlett's test of sphericity chi-squared value of 5627.6 ($P = 0.000$) indicated that the data set was adequate for the intended analysis.

A total of 13 factors with Eigen values above 1.0 were extracted, explaining a total of 72.9% of variance. Given this large number of potential factors, and a substantially flat scree plot after four clear factors, the number of factors was further investigated using Monte Carlo PCA Parallel Analysis.[37] By comparing the actual Eigen values generated from the factor analysis with randomly generated values produced by the parallel analysis software, it was evident that the most reliable number of factors was a total of seven.

The factor analysis was repeated, invoking a forced extraction of seven factors. The extraction converged after 18 iterations, and explained a total of 67.87% of variance. This proportion of explained variance is substantial.

Table 2 reports the component matrix with item/factor correlations for this seven-factor analysis solution. (For simplicity, only the items extracted into factors are shown.) A total of 20 items, forming seven components (factors), were thereby identified. Each item had a minimum item/factor loading of 0.510, which was deemed to be adequate.

After careful consideration, these components (factors) were interpreted and labeled as follows:

- Component 1 = Living authentically (three items). Interpretation: This factor is seen to represent knowing and holding onto personal values, deploying personal strengths, and having a good level of emotional awareness and regulation.
- Component 2 = Finding one's calling (four items): Interpretation: This factor is essentially associated with seeking work that has purpose, a sense of belonging and a fit with core values and beliefs.
- Component 3 = Maintaining perspective (three items). Interpretation: This factor concerns having the capacity to reframe setbacks, maintain a solution focus, and manage negativity.
- Component 4 = Managing stress (four items). Interpretation: This factor speaks of using work and life routines that help manage everyday stressors, maintain work life balance, and ensure time for relaxation.
- Component 5 = Interacting cooperatively (two items). Interpretation: This factor refers to a workplace work style that includes seeking feedback, advice, and support as well as providing support to others.
- Component 6 = Staying healthy (two items). Interpretation: This factor identifies a pattern of maintaining a good level of physical fitness and a healthy diet.
- Component 7 = Building networks (two items). Interpretation: This factor concerns a pattern of developing and maintaining personal support networks (which might be both within and outside the workplace).

The Cronbach α for the scale total (20 items) was 0.84. Alpha values for the individual subscales were also examined and found to vary between 0.89 (building networks), 0.63 (interacting cooperatively), and 0.60 for (staying healthy). These latter subscale results were less than optimal; however, the fact that both subscales have only two items renders a high Cronbach α difficult to achieve. Nevertheless, these subscales were retained as discrete entities, rather than collapsing them into other subscales, because they both represent areas of deliberate behavior that are considered valuable (strategic) activity in resilience at work development.

TABLE 2. Rotated Component Matrix for Exploratory Factor Analysis*

	Component						
Questionnaire Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I have important core values that I hold fast to in my work life	0.587						
I am able to change my mood at work when I need to	0.541						
I know my personal strengths and I use them regularly in my work	0.539						
The work that I do helps to fulfill my sense of purpose in life		0.792					
My workplace is somewhere where I feel that I belong		0.768					
The work that I do fits well with my personal values and beliefs		0.713					
Generally I appreciate what I have in my work environment		0.624					
When things go wrong at work, it usually tends to overshadow the other parts of my life			− 0.661				
Nothing at work ever really "fazes me" for long			0.554				
Negative people at work tend to pull me down			− 0.548				
I make sure I take breaks to maintain my strength and energy when I am working hard				0.700			
I have developed some reliable ways to relax when I am under pressure at work				0.628			
I have developed some reliable ways to deal with the personal stress of challenging events at work				0.582			
I am careful to ensure that my work does not dominate my personal life				0.553			
I often ask for feedback so that I can improve my work performance					0.638		
I believe in giving help to my work colleagues, as well as asking for it					0.519		
I am very willing to acknowledge others' effort and successes in my workplace							
I have a good level of physical fitness						0.787	
I am careful about eating well and healthily						0.780	
I have friends at work whom I can rely on to support me when I need it							0.735
I have a strong and reliable network of supportive colleagues at work							0.714

*Extraction method—principal component analysis; rotation method—varimax with Kaiser normalization. Rotation converged in 26 iterations.

The new scale was entitled the RAW scale.

Correlations between the RAW scale (and its subscales) scores with the other outcome variable scores were then examined, and are reported in Table 3.

The correlations reported in Table 3 are all in the expected direction for a measure of resilience, indicating management of the pressures of work. Notably, they are all in conformity with the hypotheses upon which the study was based.

The RAW scale total correlates highly and negatively with maladaptive outcomes of work pressure such as chronic fatigue, poor sleep, and physical and emotional health problems (GHQ 12). By contrast, RAW scores correlate highly and positively with recovery, health, and engagement, as expected. Notably, negative correlation with GHQ 12 scores suggests that the RAW scale is measuring a construct that is strongly associated with emotional/psychological health and well-being. Furthermore, careful examination of the RAW subscales' correlations is also indicative. For example, "finding one's calling" (being a "round peg in a round hole" in one's workplace) is strongly and positively correlated with engagement at work, as would be expected. Similarly, the ability to "maintain perspective" is associated with lower levels of fatigue, sleep problems, and emotional strain. "Managing stress" is seen to correlate positively with health, but negatively with poor sleep, also as might be expected.

These initial results indicated that a simple yet contextual measure of resilience in the workplace had been developed. The seven factors that emerged as of importance were entirely consistent with the extensive experience of the authors and their professional colleagues. The RAW scale developed thus arguably manifests appropriate face and ecological validity.

A second study was then undertaken, *within a different study population*, to examine RAW scale scores, and their association with validated outcome variables. It was hypothesized that the strong associations between resilience measured on the RAW scale with both adaptive and maladaptive health and engagement outcomes noted in Study 1 would be confirmed by confirmatory factor analysis of data obtained from a different study population. This study is reported in the next section.

STUDY TWO

Method

The same method for recruiting participants to Study 2, namely direct e-mail contact with the information sheet and invitation to participate in an on-line study, was used. This mail contained a hyperlink to a new on-line questionnaire also hosted by Qualtrics (Asia) survey site. The balance of the second author's e-mail contacts with former clients and wide industry contacts were used in the first instance, with a "snowballing" technique of inviting participants to extend the invitation to other interested friends and colleagues was used as in Study 1.

Participants

A total of 195 responses to Study 2 were received from a new group of participants, with the average age of 47.9 years (SD = 10.8 years) of whom 63 (36.5%) were male. Other characteristics of the study population are indicated in Table 4.

Table 4 indicates that Study 2 population was drawn from a diverse background, which was desirable for this study, with an overall sample size of 195.

TABLE 3. Pearson's r Bivariate Correlations Between Study 1 Variables: RAW Scale, Subscales, and Outcome Variables[a]

	RAW Total	Living Authentically	Finding Calling	Maintaining Perspective	Managing Stress	Interacting Cooperatively	Keeping Healthy	Supportive Networks	Chronic Fatigue	Poor Sleep	Engagement	Physical Health	Recovery	GHQ 12
RAW total	1.00													
Living authentically	*0.58**	1.00												
Finding calling	*0.65**	0.34*	1.00											
Maintaining perspective	*0.66**	0.26*	0.26*	1.00										
Managing stress	*0.71**	0.26*	0.19*	*0.47**	1.00									
Interacting cooperatively	*0.59**	*0.39**	0.27*	0.32*	*0.35**	1.00								
Keeping healthy	*0.44**	0.19*	0.12**	0.13**	*0.29**	0.09	1.00							
Supportive networks	*0.44**	0.12**	0.37*	0.10	0.13**	0.17*	0.09	1.00						
Chronic fatigue	*−0.55**	−0.14**	*−0.47**	*−0.49**	*−0.41**	−0.28*	−0.12**	−0.20*	1.00					
Poor sleep	*−0.47**	−0.15*	−0.32*	*−0.45**	*−0.39**	−0.19*	−0.17*	−0.10	0.60*	1.00				
Engagement	*0.53**	*0.31**	*0.64**	0.32*	0.15*	*0.35**	0.10	*0.29**	−0.52*	−0.38*	1.00			
Physical health	*0.39**	0.15*	0.20*	0.31*	*0.36**	0.22*	0.20*	0.11**	−0.52*	−0.51*	0.29*	1.00		
Recovery	*0.42**	0.18*	0.28*	*0.39**	0.32*	0.19*	0.14*	0.14*	−0.56*	−0.57*	0.35*	0.45*	1.00	
GHQ 12	*−0.55**	−0.21*	*−0.37**	*−0.53**	*−0.40**	0.26*	0.15*	0.21*	−0.67*	−0.58*	−0.45*	−0.48*	−0.53*	1.00

*$P < 0.01$ level (two-tailed); **$P < 0.05$ level (two-tailed).
[a]Notable RAW scale and subscale correlations are italicized.
GHQ, General Health Questionnaire; RAW, resilience at work.

TABLE 4. Work Characteristics of Study 2 Population

Work Characteristics	*N* (%)
Hours working	
Unemployed	0 (0)
1—15	4 (2.3)
16—25	11 (6.2)
26—40	100 (56.5)
≥40	62 (35)
Area of work	
Health	63 (35.6)
Education (broadly)	19 (10.7)
Commerce (broadly)	8 (4.5)
IT	5 (2.8)
Finance	4 (2.3)
Manufacturing	4 (2.3)
Other	74 (41.8)
Work contract	
Permanent	136 (76.8)
Fixed term	21 (11.9)
Casual (uncertain)	4 (2.3)
Self-employed	14 (7.9)
Contractor	2 (1.1)

IT, information technology.

Appropriateness of sample size for SEM analysis has been a controversial issue. Some authors argue that larger sample sizes bias toward achieving high goodness of fit,[38] whereas, more recently, others have argued that sample size adequacy on the basis of the ratio of the number of indicators/factors requires higher numbers than are commonly used.[39] Despite acknowledging that a higher sample size might have been desirable, having regard for the broadly exploratory nature of this study, we believe that the number of 195 was adequate for our purpose.

Materials

A second on-line questionnaire was created on the Qualtrics (Asia) site, using the 20 items for the RAW scale, which had been derived from Study 1 as the measure of resilience. Measures of sleep, chronic fatigue, recovery, physical health, and work engagement, identical to that of Study 1 (already described), were included in the questionnaire. Nevertheless, in addition to Study 1 measures, a measure of work demands and work resources[40] and a measure of acute (end of shift) fatigue[28] were also included.

Results

Using AMOS v 19 software, a model of the interactions between the measure of the resilience total scale score (developed in Study 1) and other variables from the Study 2 questionnaire, including work demands and resources, acute end of shift fatigue, engagement, recovery between shifts, and (physical) health, was developed. Figure 1 reports the SEM model of these factors that was achieved.

The SEM model developed from the Study 2 data shows an excellent fit to the study data, as evidenced by the fit statistics (ie, goodness-of-fit index = 0.968; Tucker–Lewis index = 0.975; root mean square error of approximation = 0.038).[1]

The path diagram shown in Fig. 1 indicates the significant (standardized) path coefficients between the variables.[2]

This model identifies, as expected, that the experience of acute (end of shift) fatigue because of work demands is moderated by resources (available to the worker within the workplace). High resilience (as measured by the RAW scale) is seen to be associated with enhanced recovery from this fatigue, and this in turn is associated with better physical health. In addition, where resilience is high, so too is engagement, as might be expected. Interestingly, direct paths

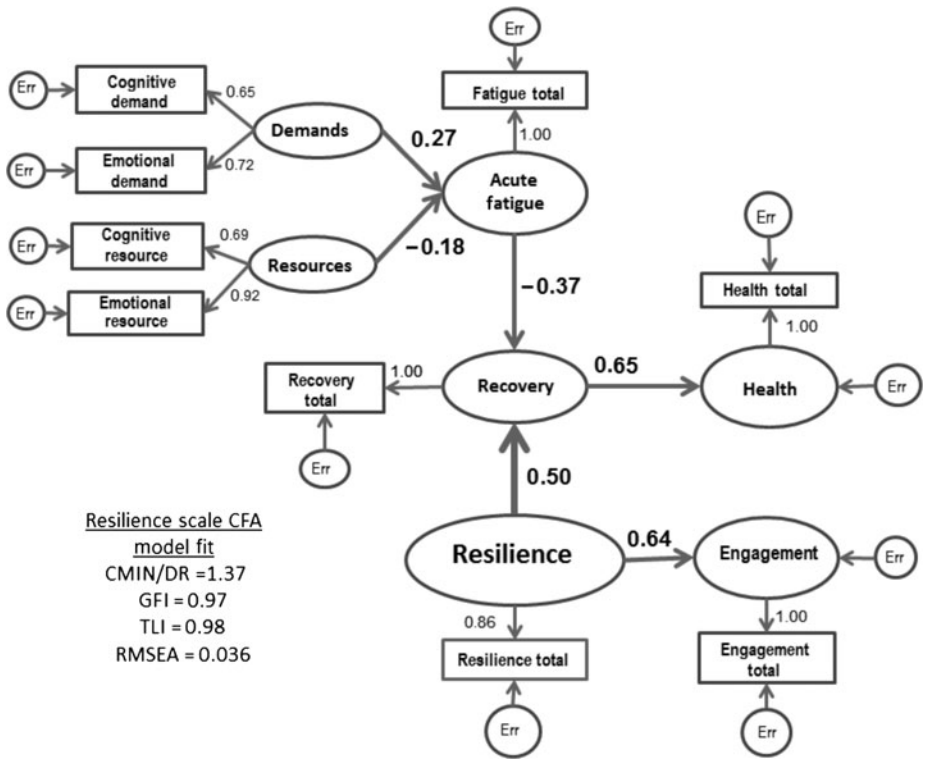

FIGURE 1. CFA model: resilience measured on the RAW scale. Generally figures for GFI and TLI above 0.90 and for RMSEA below 0.08 are considered as indicating an acceptable model fit. The numbered path (coefficients) represents the proportion of a SD change occurring in the connected factor for each SD change in its linked factor. All the coefficients indicated are statistically significant ($P < 0.05$). Path coefficients of 0.3 or more are generally considered as being noteworthy. CFA; GFI, goodness-of-fit index; RAW, resilience at work; RMSEA, root mean square error of approximation; TLI, Tucker–Lewis index.

between resilience and physical health, and engagement and physical health, were not significant, suggesting that the effect of resilience (as measured by the RAW scale) on physical health is mediated by recovery (from work-related fatigue).

A Sobel test of mediation confirmed this: $Z = 0.1654$; $P \leq 0.05$.

Taken together, these results fully support the hypotheses for the study. The two studies suggest a model of resilience at work (shown in Fig. 2).

This model accords with the initial intentions of the studies, that is, to develop a measure of practical and teachable behaviors, which enhance resilience. The resilience that is captured by the RAW scale is seen to have a significant impact on recovery (from work demand stress), which in turn is associated with improved engagement at work, and importantly, has a positive effect on physical health.

DISCUSSION

It is acknowledged that the process of developing the fullest understanding of resilience as an epiphenomenon of human response to stress exposure is an ongoing process. Although the resilience mediator factors identified in this work may be applicable in a wider context, the RAW scale is targeted specifically to the workplace. We have identified and incorporated seven factors affecting workplace resilience, which *are open to chang*e by any worker who is motivated to do so. In doing so, we base the value of such behavior modification firmly on the well-established insights into the neurophysiology of the central nervous system under conditions of work-related stress.

The inclusion of the factors of "living authentically" and "finding one's calling" could be argued to be at odds with the intention to identify resilience mediators, which are consciously modifiable and/or "teachable." Nevertheless, we would argue that any worker who experiences undue stress, in a working environment that is not compatible with his or her value system or fundamental interests, has the choice (essentially) to find other work, or stay and remain distressed, particularly if their condition has been identified by the RAW scale. Clearly, such changes are not always easily achieved in difficult economic times. Nevertheless, the growing insights into the neurobiology of the stress response indicate clearly that overlong exposure to excessive stress (particularly associated with being a "square peg in a round hole" in a workplace) is *inevitably* associated with progressive and serious deterioration in health and well-being, and is simply not sustainable. Any individual score on the RAW scale overall, with notably low values on these particular subscales, would strongly suggest that counseling for a job change is not only appropriate but also essential to preserved health.

We do not doubt the role of personality traits and their genetic underpinnings that have been identified by others, for example.[9,41–43] Nevertheless, identifying these traits and conditions (essentially beyond individual control or modification) is not helpful for assisting workers to manage their responses to work-related stress exposure. The basis of the RAW scale is to identify individual performance, and current capacity, in relation to behaviors and actions that *can* be developed to offset work strain in the workplace. These include, for example, the interaction of simple exercise and the stress response architecture.[44] Further, as indicated, the importance of the other behaviors that the RAW scale identifies and measures, which are associated with maximizing rest/recovery between stressful work sequences, to minimize maladaptive outcomes of stress exposure and to develop a psychological "toughness" cannot be overemphasized.[31]

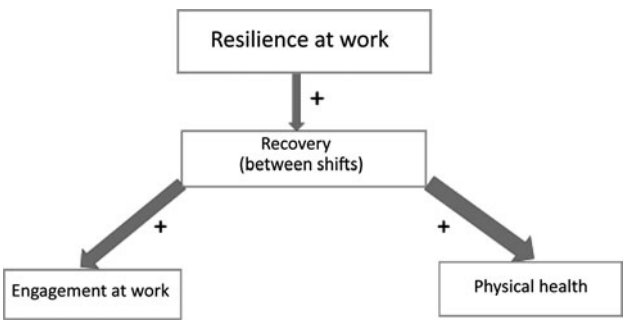

FIGURE 2. Theoretical model of the relationships between resilience (measured on the RAW scale and subscales), recovery, engagement, and physical health. RAW, resilience at work.

Assessment of individual worker performance on the RAW scale can be argued to give a simple and yet powerful guide to areas of behavior that are successful (and maintained) *as well as* suboptimal behaviors to be modified and developed. The RAW scale fills a gap in extant measures and provides two essential benefits to the individual and (where a work team's members are all assessed) the team.

In the first place, it can offer a diagnostic guide to the overall adaptive and effective performance that the individual (or team) is demonstrating. Second, it essentially provides *practical guidance* of things to continue to do, or things to change and/or to improve, to build resilience as a skill. This stands in distinction to the many approaches to resilience building that emphasize sophisticated changes in thinking about work. As valuable as such suggestions may seem to be, the reality is that under conditions of high-stress exposure (particularly enduring stress), the capacity for higher order mental processing skills of this sort is significantly reduced.[24,36,45]

CONCLUSION

The RAW scale (and Manual for Use)[46] is designed as a tool for the individual worker, particularly those experiencing stress-related difficulty in their workplace. In addition, it is suggested as of value to those health professionals whose roles include working with workers under stress (particularly where such stress is an inherent element of the job) to facilitate the development of capacity to survive and prosper in a twenty-first century world of work.

The twenty-first century workers are everywhere increasingly a specialist in their field, expensive to train, or replace if they are lost to stress-induced ill-health. They represent significant human assets to their organization worthy of protection. The RAW scale assessment is not suggested as a panacea. It is a tool, not a "rule." Nevertheless, it is arguably an additional vehicle for preserving the health and welfare of such assets via the identification of important, practical, workplace states, and behaviors that are related to developing and maintaining the essential resilience, which underpins successful adaptation to demanding work environments.

STUDY LIMITATIONS

All the data derived in both studies have been in the form of self-reports. For some researchers, this can raise the issue of "common method variance" bias problems. Although this possibility is acknowledged, the authors tend to side with those other workers who have largely discounted this issue as frequently being overstated.[47,48]

Both studies reported here are cross-sectional, and so it is not possible to attribute causality to any of the correlations noted, for example in Table 3.

FURTHER STUDIES

Although these studies have shown encouraging results, other studies, particularly longitudinal studies, are needed to confirm that interventions on the basis of the insights gained from RAW scale assessment lead to more positive worker health and welfare outcomes.

In addition, ongoing collection of normative data from the use of the RAW scale (currently underway) is needed to identify critical or "tipping point" values for RAW scale and subscale

components. This in turn may serve to inform the teaching and coaching interventions, which follow individual RAW scale assessment.

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