# Predictive 6 Factor Resilience Scale – Domains of Resilience and Their Role as Enablers of Job Satisfaction

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**ABSTRACT** Continuing from previous research on the Predictive 6 Factor Resilience Scale (PR6), this study provides further domain-level validation in addition to investigation of resilience as an enabler of job satisfaction.

**Methods:** A multi-stage testing format was employed using a group of primarily professional adults (n=617). Domain-level scales were developed through ratings from the research panel. Validation data was collected through an online measurement device. Multiple versions of the scales were tested for internal consistency, with scales retained, modified or rejected based on resulting scores. From this, domain-level scales were finalised, an extended 50-item resilience scale (PR6-50) was developed, and the 16-item PR6 was revised. Analysis was conducted against the Brief Index of Affective Job Satisfaction (BIAJS) and demographic data.

**Results:** Scales for each domain were validated with good internal consistency (>0.70). The PR6-50 showed high internal consistency (0.9372), while the revised 16-item PR6 showed improved internal consistency (0.8398). Resilience results showed a correlation of 0.536 (P value <0.001) with BIAJS, while the Vision domain showed the highest correlation at 0.607 (P value <0.001).

**Conclusion:** The result strengthens the internal consistency and domain validity of the PR6, as well as establishing an extended version (PR6-50) for further resilience research and clinical purposes. The relationship of resilience to job satisfaction, in particular the Vision domain, provides additional pathways for exploration to improve employee engagement and performance in organisations.

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Automation advances now stretch beyond manufacturing and agriculture, and increasingly into service jobs traditionally considered as secure careers. A study by Oxford university estimates that 47% of jobs may be automated in the next two decades (Frey & Osborne, 2017). The impact of automation on developing countries may be up to 85% (Frey et al, 2016). Faster technological advances bring with it increased uncertainty about one's own future. Increasing personal resilience provides psychological skills and techniques to manage uncertainty and adapt faster to a changing environment. Understanding resilience at a deeper level for each domain (Rutter, 1985; Olsson et al, 2003) and their relevant relationships provides more effective ways for organisations to train and develop resilience capacity in people, as resilience can be improved throughout life (Herrman et al, 2011). This illustrates the growing importance of resilience as a critical life skill for a time of rapid change.

The Predictive 6 Factor Resilience Scale (PR6) published in 2016 described the overall validation of the scale as a resilience psychometric (Rossouw & Rossouw, 2016). Domains were identified through their neurobiological foundations building on work from Davidson on the emotional styles of the brain (Davidson & Begley, 2012). Theoretical foundations were explored in relation to other major resilience scales (Windle et al, 2011) to construct a meta-model of resilience. Research identified that physiological health hygiene factors also contribute to the resilience construct. These include nutrition, exercise, and sleep hygiene factors. Approach and avoidance motivational factors were shown to have a positive correlation and impact on internal consistency, adding a predictive component through prediction of future goal achievement (Jackson et al, 2009).
Primary objectives of this study are as follows: 1. Conduct further domain-level validation of the PR6 model, constructing separate domain scales alongside a Momentum scale. 2. Compile an extended version of the PR6 for future research projects. 3. If relevant, revise the 16-item PR6 to increase overall and domain-level consistency. 4. Correlate resilience to job satisfaction to determine relevant relationships.

In addition, areas for further investigation were identified in the previous research paper which will be revisited. These include gender differences where females scored higher in Health, while males scores slightly higher in Tenacity and Reasoning. Differences in resilience scores over age groupings could not be validated due to insufficient data in the original research. Expectations were for resilience to stabilise with additional data, and therefore will be revisited. Sleep hygiene indicated lower correlation with resilience. Consequently, this research expands sleep into component factors to investigate relative importance. One Collaboration item related to working with others also indicated lower correlation with overall resilience, leading to further investigation.

## METHOD

### Research design

To achieve the research objectives, individual domains were built out as separate scales to measure each component of resilience. Item generation was conducted with the named panel of researchers in accordance to the thematic concept and theoretical foundation of each resilience domain. Items were combined alongside research references and justification. All original items of the PR6 were included as a standard measure. Excluding demographic and job satisfaction items, 101 items were developed.
Item development was approached from the perspective of domains as representatives of the neurobiological constructs. Each domain therefore presents a thematic construct for practical intervention. Interaction between the domains is expected, however their continued

separation is valuable for further treatment development. Each domain is investigated separately relating to its theoretical foundations, allowing further granularity for enhancing resilience overall.

A review round commenced where the research panel cross-examined all of the 101 items. Each reviewer ranked items on a confidence level of their contribution to the domain. Through multiple review rounds, items were discussed and revised until ratings were finalised. Resulting ratings were aggregated for each item to produce an overall confidence score.

Confidence scores were used to produce two extended test scales which also included the original PR6 items for comparison. The first was a High Confidence (HC) scale constructed from the items with the highest scores, maintaining a balance of positive and negative scored items. Each domain, including Momentum was allocated six items, except for the Health domain which was allocated 11 items to further investigate health hygiene (particularly sleep) factors. A second Wildcard (WC) scale was constructed by swapping the two lowest-scoring items from the HC scales with the next two items below that. The aim of the WC scale was to test a wider range of items without extending the overall test scale sizes beyond practical limitations for organizational application.

The HC and WC versions of the domain-level scales were then tested for validity. Scores were compiled and a progression determination was made based on relative scores. Where needed, modifications to the scales were applied until sufficient internal consistency was achieved. This included the addition of items for low consistency domains to conduct a deeper search as needed. For these domains, item omission analysis was conducted to establish acceptable internal consistency scores.

Following the multi-stage testing format, the domain-level scales were established and the combination of the domains were tested as an extended version of the PR6 (TESTPR6). Internal consistency was tested alongside demographic and other dimensions. Domain-level relationships were tested, including correlations to the original PR6 (OPR6) to determine potential adjustments. The extended domain-level scales were then analysed for highest internal correlation, taking the top two items (balance of positive and negative items, except for Health) and were proposed as revised items for the 16 item PR6 where they represent an improvement on previous values.

The Brief Index of Affective Job Satisfaction (BIAJS) developed by Thompson and Phua (2012) was chosen as a measure to correlate with resilience factors. This BIAJS was chosen due to its comprehensive validation and reliability as a job satisfaction measurement. Our interest is in determining a potential relationship between resilience and job satisfaction, as well as determining which domain of resilience is a stronger enabler of job satisfaction.

Positive Impression Management was also tested through the inclusion of items to potentially control for this effect. Of interest is Crowne and Marlowe's (1960) social desirability scale and its intent to measure the desire of a person to be presented in a positive light. This effect may result in individuals artificially inflating scores on the resilience scale due to social desirability. A mitigating factor within this study is that confidentiality is assured for each participant, reducing the need to inflate scores that others will not see. We include items for consistency measurement related to alcohol use to potentially measure differences and inconsistencies in scoring. Analysis may reveal further exclusion criteria to refine results. We note that Crowne later criticized the use of his original scale to 'decontaminate' study samples (Crowne, 1991), as well as criticism from others (Odendaal,

2015). We also note that Positive Impression Management is generally not a feature of resilience psychometrics, potentially relating to difficulty in attaining meaningful insights. Data analysis is conducted with this in consideration.

**Resilience and the basic needs**

Adding to the foundation of the resilience domains, we propose connections to the four basic needs identified by Epstein. He suggested that there is no single basic need for psychological functioning, but instead that there are four basic needs of relative equivalence (Epstein, 2003). The four basic needs provide further explanatory power to the diversity of the resilience domains, indicating inputs into one or more of the basic needs. Domains contribute to the needs through positive affect, while ineffective functioning of a domain can produce negative affect to the relevant need. An individual's skill in implementing the relevant resilience domain therefore determines their ability to contribute positive affect to the basic needs.

Maximisation of pleasure and minimization of pain is the first basic need. It draws on the work of Dollard and Miller (1950), and also Freud (1909) at an earlier stage. Through the individual's experience of predominantly pleasure or pain, a basic belief is fuelled about whether or not the world is a malevolent or benign place. A belief that the world is benign adds to optimism, while the opposite may produce pessimistic attitudes. We summarise this need for pleasure and the avoidance of pain as the need for *Motivation*.

Control and orientation is a need for a sense of stability and predictability related to the world in which we exist. This includes concepts such as controllability and justice existing in the world, indicating a sense of meaningfulness. As Epstein (2003) viewed this need, the opposite is a sense of "unpredictability, uncontrollability, and lack of justice" (pg14). This builds on the work of Rogers (1951), and gives rise to a belief of relative meaningfulness or meaninglessness of one's life. We summarise this as the need for C*ontrol*.

Relatedness is the need for stable and secure relationships with others with whom we can form meaningful connections. Epstein (2003) references work from Bowlby (2008) as a basis for this need through his founding concept of attachment theory. A basic belief regarding whether people are trustworthy and loving vs untrustworthy and rejecting develops based on relatedness experiences through life. We summarise this concept as the need for *Connection*.

Self-enhancement is the need to improve the status of the self. Work from Kohut (1971) and Allport (1961) contribute to the concept of personal growth and improvement. Related beliefs cover whether the self is viewed as competent, worthy, moral and strong, vs incompetent, unworthy, immoral and weak. We summarise this as the need for *Self-esteem*. Relationships to resilience is considered.

**Resilience and Neuropeptide Y**

Neuropeptide Y (NPY) has been implicated previously as being inversely related to the stress response (Zhou et al, 2008). Subjects with major depressive disorder (MDD) have also been shown to have less NPY, and that a genetic variation or lower NPY expression predisposes to MDD (Mickey et al, 2011). This has led to conclusions that NPY upregulation has an anxiolytic effect, lowering the stress response when released at higher levels (Morgan, 2002). Research on special forces military personnel during enemy capture and interrogation training revealed that NPY has a protective effect against dissociation (Morgan et al, 2000).

Differences found between special forces and non-special forces personnel indicate that additional training results in greater release of

NPY, suggesting training provides additional resilience effects through NPY upregulation. Recent research provided additional support, showing that chronic stress leads to epigenetic dysregulation of NPY receptors (Lomazzo et al, 2017). Epigenetics provide a mechanism for fast, generational changes in genetic encoding. In relation to resilience, these changes may either provide the next generation with stronger resistance against stress, or instead predispose them to psychological diseases due to the experiences and actions of the current generation.

Generational changes have already been witnessed through a study on transgenerational transmission of post-traumatic stress disorder following the Tutsi genocide (Perroud et al, 2014). Inherited alterations were witnessed within the HPA axis, as well as lower cortisol levels than those who have not been exposed to the genocide. Cortisol and NPY release during stress are positively correlated, where NPY provides a reduced stress response. Epigenetic changes in NPY receptors and related neurobiology may contribute to generational changes in stress management. We hypothesise that resilience domains acting on NPY may encourage epigenetic changes that improve stress response. These epigenetic changes provide a mechanistic pathway to build resilience on a generational level, resulting in a measure of stress-inoculation for future generations.

**Domains of resilience**

Details of the resilience domains and their neurological correlates are set out in the previous research. For the sake of clarity, a short overview is provided for each domain. Proposed relation of the resilience domains to the basic needs are explored.

Vision (VIS) refers to having a sense of purpose, clear goals, and the behaviour of goal-striving. Skills related to this domain includes an ability to define and clarify goals worth striving for, prioritise between goals, develop congruence between goals, self-motivate, and a belief in an ability to achieve goals. VIS is suggested to contribute to all the basic needs. Goals define a sense of purpose and direction in life, contributing to the orientation component of Control. One's sense of purpose and goals also define whether there is engagement in pleasurable activities (need for Motivation), and also if there is engagement with others on a psychosocial level (Connection). Collectively, these support the outcome of Self-esteem enhancement and a sense of self-efficacy, suggested by Bandura (1988) to be a key component of social cognitive theory. This central nature of VIS crossing all basic needs leads to the hypothesis of VIS as potentially the most important domain of resilience. Neural correlates include the prefrontal cortex (PFC) as the centre for long-term planning and executive functioning. The ventral striatum plays a role in risk/reward cognition and reinforcement (Davidson, 2012), facilitating decisions between various goals as options available for pursuit. Hippocampal/PFC interaction play a role in higher-order meaning assignment to memories (Preston & Eichenbaum, 2013).

Composure (COM) concerns emotion awareness, emotion regulation and stress management. Skills related to this domain include emotional granularity, emotional reappraisal, self-calming through breathing and related techniques. As an emotional domain, COM factors into the need for Motivation through striving for pleasure and the avoidance of pain. The earliest identification of this was by Walter Bradford Cannon in 1929, noting that pain and suffering in this context activates the HPA axis, leading to a loss of emotional composure. The COM domain then refers to the ability of someone to regain and retain a sense of composure. HPA activation may also lead to a loss of personal control, or a reduction in Control as a basic need may lead to reduced

composure. Conversely, being able to maintain a sense of composure contributes to Control within the experienced situation. Related neural structures include the insula as an interpreter and processor of audio-visual signal integration, as well as interoceptive capabilities that enable cognitive emotional regulation techniques (Critchley et al, 2004). The insula has pathways to limbic structures such as the amygdala, enabling potential regulation of the HPA axis to achieve physical and mental composure.

Reasoning (RES) relates to problem-solving, resourcefulness and being ready for change. Skills related to RES includes cognitive abilities such as planning for adverse situations to mitigate outcomes in advance, challenging and changing beliefs through introspective questioning, and building one's own ability to be resourceful. This domain closely relates to the need for Control, striving to devise options available to act on to achieve goals, and also through planning to produce better solutions to problems to attain control over outcomes. This relates closely to one's internal map of the world and understanding of potential outcomes through cause-effect relationships. Neural structures include the enablers of logical thought such as Wernicke's and Broca's areas in their role to interpret and produce symbols and language for rational thought. PCF connection to the anterior cingulate cortex (ACC) in its role to screen for errors and optimise responses assist in rational learning and improvement (Peterson, 2014). Preparatory exercises and planning for adverse situations such as those practiced by the military align with RES skills. These have been shown to increase NPY release, providing an improved stress response and promoting resilience (Morgan et al, 2000).

Tenacity (TEN) relates to hardiness and perseverance. Skills include beliefs concerning optimism for the future and being persistent in the face of adversity. Research by Duckworth et al (2007) has indicated that the capacity to persist has a higher correlation to goal achievement than intelligence. In this sense, TEN relies on the need for Control via orientation to know what to persist towards, while also contributing to Control through one's conscious ability to continue along the chosen path. This conscious decision not to give up may align internal reward systems towards chosen objectives, feeding into how the need for Motivation as pleasure aligns to achievement and pain to failure, or giving up. Perceptual changes effected by a conscious appraisal of stress in this context may reduce mortality, as indicated in research by Keller et al in 2012. Neural structures include the ability of the PFC to downregulate HPA activation to overcome adversity and sustain goal-directed activity. Dopaminergic neurons emerging from the ventral tegmentum play a key role in motivation required for persistence despite adversity and challenge.

Collaboration (COL) includes secure attachment, relationships, and maintaining social perceptions. Skills include one's social skills, ability to build support networks, awareness of social context and willingness to ask for help. COL relates most strongly to the need for Connection, combining the importance of support received and provided, and awareness of social context and perceptions. The functioning of this domain is therefore enabled through the basic belief that people are trustworthy and loving, therefore support is available when needed and it is worthwhile to support others in turn. Neural structures include the right PFC which has been implicated in the process of secure attachment (Schore, 2000). In particular, the orbito-medial PFC serves a crucial role in sensitivity to context, detecting social cues and changes in the environment (Schoenbaum & Takahashi, 2011). These may function in concert with the fusiform gyrus, responsible for interpreting visual signals to identify faces and related associations to identified individuals. Produced results include deeper understanding

of what support is appropriate from whom given the situation, where higher skills here aid in producing appropriate behaviour when facing challenges.

Health (HLT) includes physical hygiene factors such as quality sleep, healthy nutrition, and regular exercise, as well as perceptions regarding one's own health. Primary skills include the ability to research and understand which healthy habits to follow, the motivation to implement the habits, and the persistence to maintain these habits in the long term. HLT outputs to the need for Self-esteem enhancement, providing internal validation XXthat the self is worth looking after and to be enhanced through physical means, not just emotional. Key neural relationships within the HLT components related to the regulation of BDNF as an enabler of neuroplasticity, enhancing neurogenesis in the hippocampus, as well as increasing NDMA expression and AMPA release and expression during synaptic connection strengthening. Exercise is also shown to increase NPY, potentially further enhancing the stress response and aiding in resilience (Lewis et al, 1993; Morris et al, 1986; Lundberg et al, 1985).

**Momentum**

Momentum (MTM) is a forward-looking measure, standing in contrast with the resilience domains that represent a point-in-time measurement. MTM measures approach and avoidance motivational schemas which have been indicated as a potential predictor of goal achievement (Jackson et al, 2009). The measure investigates individual attitudes toward future opportunities, appraisal of new challenges, problem-solving approach, as well as avoidance attitudes such as procrastination tendencies.

MTM in the previous research showed a high correlation with the resilience construct. We expand the items in the current research to develop a specific approach/avoidance scale for further research and predictive analysis.

**Study sample**

Participants for the study were recruited through workshops (primarily education and healthcare workers) and through an online survey using social media platforms (broader diversity of participants). Though the PR6 is currently used by students, eligibility for the research was set at 18 years or over. Incomplete surveys were removed from the study sample.

The overall study sample (n=671) was screened, with entries removed which were incomplete (n=46), under 18 years were removed (n=6), and a duplicate entry was removed (n=2). The remainder (n=617, 73% female) entered into data analysis. Median age was 43 (StDev 10.98). Demographic data was incomplete for some entries (n=7). Of the used sample, n=93 was entered into HC, n=98 was entered into WC, while the remaining n=426 proceeded on to TESTPR6.

## RESULTS

Comprehensive analysis using the OPR6 as a standard component of all samples collected indicated data normality of the population (n=617). Negatively scored items were reversed, then domain scores were calculated through the mean, averaging all domain means together to create the overall resilience scores. Scoring between 0 (lowest resilience) and 1 (highest resilience), the mean for the sample was 0.65215 (StDev 0.569) at a 95% CI ranging from 0.6409 and 0.6634. Internal consistency for the OPR6 was validated at an alpha of 0.8004. No significant differences were found between male and female populations. Age grouping reveals a statistically significant increase in resilience scores as age increases (Table 1, Fig 1 and Fig 3).

The BIAJS showed high internal consistency with an alpha of 0.9107 (n=617). Mean was 0.7404 (StDev 0.8383).

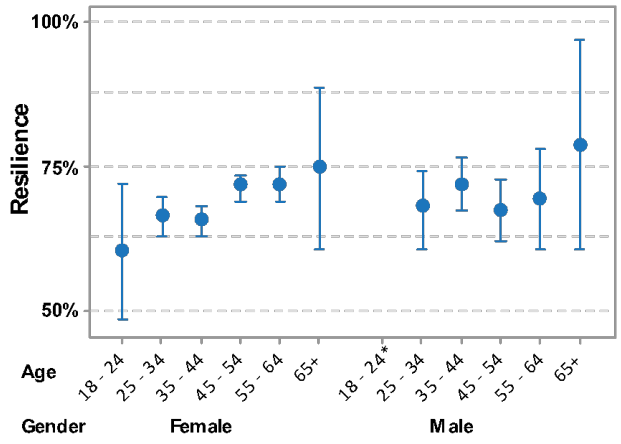


**FIG 1:** Interval plot – Resilience by age group and gender

*Insufficient data to plot

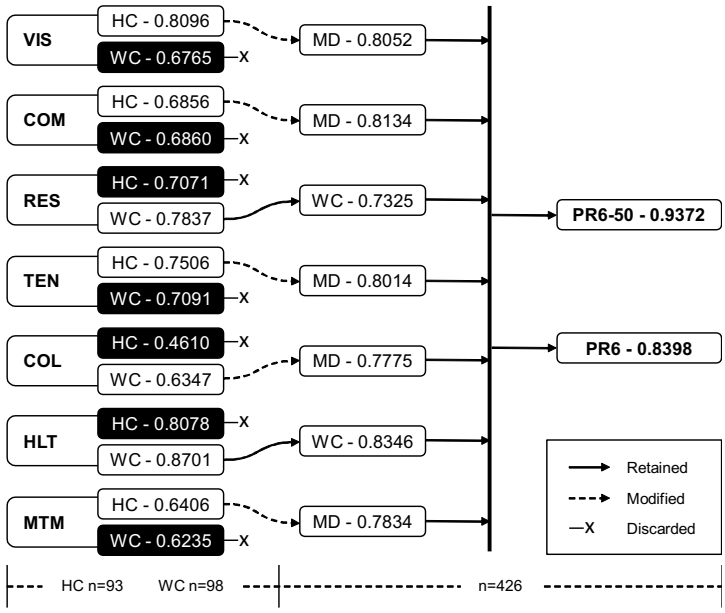


**FIG 2:** Multi-stage testing of resilience models.

## HC & WC validation

Validation of domains within HC and WC were conducted to determine which domains to discard, progress or modify (Fig 2). HC sample (n=93) achieved an overall alpha of 0.9305, compared to the WC sample (n=98) which achieved an alpha of 0.9202. HC VIS alpha was 0.8096 (vs WC VIS alpha = 0.6765) which was kept and modified due to one low performing item. HC COM alpha was 0.6856 (vs WC COM alpha = 0.6860) which was kept and modified with the addition of two items to investigate further. HC RES alpha was 0.7071 (vs WC RES alpha = 0.7837) which was discarded in favour of the WC model. HC TEN alpha was 0.7506 (vs WC TEN alpha = 0.7091) and was modified with a high performing item from the WC model. HC COL alpha was 0.4610 (vs WC COL alpha = 0.6347) which was discarded in favour of modifying the WC COL model with four additional items. HC HLT alpha was 0.8078 (vs WC HLT alpha = 0.8701) which was discarded in favour of the WC HTL model which was kept intact. HC MTM alpha was 0.6406 (vs WC MTM alpha = 0.6235) which was retained and modified with four additional items. Items added underwent panel scrutiny to determine consistency with theoretical underpinnings.

## TESTPR6 validation and refinement

Following modification, the second round of testing (n=426) was conducted on the composite TESTPR6 created from the retained and modified domains. Domains were targeted to finalise to six items each (three positive and three negative scored items), except for HLT which was targeted for ten items. MTM was also targeted to finalise to six items.

TESTPR6 domains alphas are as follows, targeting > 0.7. VIS alpha was acceptable at 0.8052. COM, after item omission to reach six items was 0.8134. RES alpha was 0.7325. TEN was 0.8014. COL at ten items prior to item omission analysis was 0.8261. Pure omission analysis aiming for highest alpha ended at 0.8284, though resulted in a narrower definition of COL with highly similar items. The authors

believe that a broader definition of COL to be more valuable in measurement and treatment, therefore undertook an item omission analysis focusing on broadness rather than pure alpha optimisation, reflecting views of other authors noting unnecessarily high alpha (Tavakol & Dennick, 2011; Sijtsma, 2009; Neuendorf, 2011). A broadness path for COL resulted in a final alpha of 0.7775. HLT alpha after one item omission resulted in a ten-item alpha of 0.8346. MTM alpha during omission analysis decreased significantly with each item removal, therefore a decision was made to retain the MTM scale to ten items resulting in an alpha of 0.7834. With these results, the domain and MTM scales were viewed as finalised and ready to contribute to the new extended scale.

Combining all the domain scales and MTM provided a final extended version of the PR6 with 50 items (six each for VIS, COM, RES, TEN, COL, and ten each for HLT and MTM). This version achieved a final alpha of 0.9372 with a mean of 0.6874 (SE 0.0264, StDev 0.5449), 95% CI 0.6744 to 0.7004 (n=426). This new extended 50 item scale is named as the PR6-50. See table 2 for the remaining item omission statistics.

**TABLE 2:** PR6-50 Item analysis

| PR6-50 Cronbach's alpha = 0.9372 | | | Item ID | Type | Alpha if omitted |
|---|---|---|---|---|---|
| Item ID | Type | Alpha if omitted | **COL (alpha = 0.7775)** | | |
| **VIS (alpha = 0.8052)** | | | 49 | Reverse | 0.6986 |
| 8 | Positive | 0.7606 | 50 | Reverse | 0.7159 |
| 21 | Reverse | 0.7611 | 44 | Positive | 0.7391 |
| 39 | Reverse | 0.7635 | 3 | Positive | 0.7584 |
| 15 | Positive | 0.7717 | 37 | Reverse | 0.7625 |
| 31 | Positive | 0.7817 | 43 | Positive | 0.7789 |
| 2 | Reverse | 0.8087 | **HLT (alpha = 0.8346)** | | |
| **COM (alpha = 0.8134)** | | | 13 | Positive | 0.8056 |
| 19 | Positive | 0.7615 | 20 | Positive | 0.8074 |
| 22 | Reverse | 0.7772 | 14 | Positive | 0.8077 |
| 47 | Positive | 0.7866 | 18 | Positive | 0.8119 |
| 4 | Positive | 0.7889 | 11 | Positive | 0.8139 |
| 35 | Reverse | 0.7927 | 30 | Positive | 0.8151 |
| 32 | Reverse | 0.7961 | 41 | Positive | 0.8174 |
| **RES (alpha = 0.7325)** | | | 28 | Reverse | 0.8329 |
| 25 | Positive | 0.6629 | 24 | Positive | 0.8333 |
| 5 | Positive | 0.687 | 12 | Positive | 0.8444 |
| 9 | Reverse | 0.69 | **MTM (alpha = 0.7834)** | | |
| 36 | Reverse | 0.6999 | 23 | Positive | 0.7512 |
| 42 | Positive | 0.7112 | 48 | Reverse | 0.7569 |
| 29 | Reverse | 0.7183 | 46 | Positive | 0.7579 |
| **TEN (alpha = 0.8014)** | | | 40 | Positive | 0.7593 |
| 33 | Reverse | 0.7641 | 6 | Reverse | 0.7619 |
| 38 | Reverse | 0.7655 | 17 | Reverse | 0.7648 |
| 7 | Reverse | 0.7665 | 10 | Positive | 0.7672 |
| 26 | Positive | 0.7696 | 34 | Reverse | 0.7724 |
| 1 | Positive | 0.7706 | 27 | Positive | 0.7742 |
| 16 | Positive | 0.7882 | 45 | Reverse | 0.7811 |

**TABLE 1: Summary of Age Grouping by BIAJS and PR6-50 scores**

| | | PR6-50 | | | BIAJS | | |
|---|---|---|---|---|---|---|---|
| **Age Group** | **N** | **Mean** | **SE Mean** | **StDev** | **Mean** | **SE Mean** | **StDev** |
| **Female** | | | | | | | |
| 18 - 24 | 9 | 0.604 | 0.0511 | 0.1533 | 0.7153 | 0.0552 | 0.1657 |
| 25 - 34 | 58 | 0.6614 | 0.0171 | 0.1306 | 0.7134 | 0.0305 | 0.2321 |
| 35 - 44 | 91 | 0.6563 | 0.0135 | 0.1292 | 0.7115 | 0.0224 | 0.2134 |
| 45 - 54 | 96 | 0.7135 | 0.012 | 0.1178 | 0.7747 | 0.0196 | 0.1918 |
| 55 - 64 | 52 | 0.7197 | 0.0159 | 0.1148 | 0.7825 | 0.0259 | 0.1871 |
| 65+ | 7 | 0.7486 | 0.057 | 0.1507 | 0.7946 | 0.0664 | 0.1757 |
| **Male** | | | | | | | |
| 18 - 24 | 3 | 0.348 | 0.157 | 0.272 | 0.542 | 0.182 | 0.315 |
| 25 - 34 | 17 | 0.6783 | 0.0322 | 0.1328 | 0.6324 | 0.0536 | 0.2208 |
| 35 - 44 | 41 | 0.7201 | 0.021 | 0.1343 | 0.747 | 0.027 | 0.1728 |
| 45 - 54 | 25 | 0.6733 | 0.025 | 0.1251 | 0.6725 | 0.0548 | 0.2738 |
| 55 - 64 | 20 | 0.6935 | 0.0407 | 0.182 | 0.7656 | 0.0415 | 0.1857 |
| 65+ | 6 | 0.7859 | 0.071 | 0.1739 | 0.813 | 0.116 | 0.285 |

## Analysis for PR6 revision

Domain-level representation within the 16-item PR6 can now be revisited to determine if different items provide higher correlation with the domains than the domain related items in the OPR6. To make this determination, we examined the OPR6 domain representative items as correlated against the new domain-level scales developed, then investigated different item combinations from the new domain scales to find more highly correlated item combinations. Where higher correlated item combinations exist, these are replaced to revise the PR6. Item combinations are kept to one positively and one negatively scored item, except for HLT which retains four items as before to represent the various factors included in it.

The combination of one original item and one new item for VIS was noted to achieve a slightly higher correlation (0.891) compared to the OPR6 items (0.861). For COM, two new items produced a higher correlation (0.884) compared to the OPR6 items (0.658). An original and new item combination for RES showed a slightly higher correlation

(0.850) than the OPR6 items (0.8633). TEN correlation also improved slightly (0.860) through two new items compared to the OPR6 items (0.853). COL correlation improved through a new two-item combination (0.874) compared to OPR6 items (0.609). HLT correlation improved slightly (0.930) through replacement of one item compared to the OPR6 four items (0.925). MTM correlation improved slightly through the use of two new items (0.786) compared to OPR6 items (0.781).

Revised item combinations were then used to establish an overall revised 16-item PR6. Correlation of the original 16-item OPR6 to the PR6-50 is 0.945, while the revised 16-item PR6 correlates to the PR6-50 at 0.960, representing a small increase in overall accuracy. The new PR6 provides an alpha of 0.8398 (mean = 0.6695, SE = 0.0294, StDev = 0.6066, median = 0.6785).

**Demographic analysis**

Demographic data collected included age, gender, location, and occupation. Gender data revealed no significant differences. Female mean was 0.6858 (StDev = 0.5126, 95% CI 0.6716 to 0.7001), while male mean was 0.6921 (StDev = 0.6307, 95% CI 0.6626 to 0.7216). 73% of participants were in Australia, with participation from various countries as the remainder. No statistically significant differences were found between Australian participants and other participants.

Occupation data indicates potential trends, such as lower scores in Education professionals (n = 147, mean = 0.6715, StDev = 0.5208, 95% CI 0.65002 to 0.6927), compared to Healthcare workers (n = 69, mean = 0.6958, StDev = 0.5363, 95% CI 0.6636 to 0.7281), and Human Resource workers (n = 38, mean = 0.7077, StDev = 0.4871, 95% CI 0.6676 to 0.74767).

Age grouping indicates an overall increase in resilience as age increases. While female resilience increases over age is relatively consistent, male resilience rates appear to decline somewhat past ages 45 through to 64. Males aged 18 – 24 had insufficient data to plot (Fig 1 and Table 1). Additional data is required to further validate.

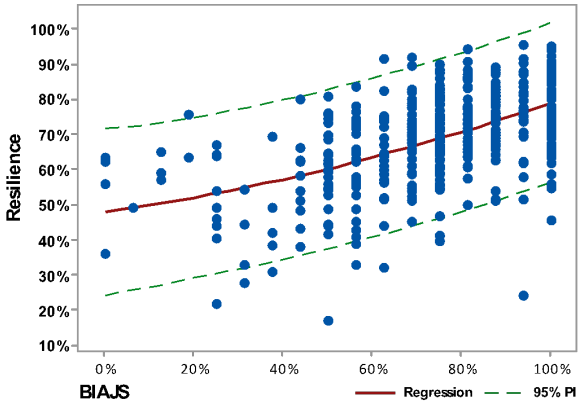


**FIG 3:** Resilience vs BIAJS Regression

**BIAJS analysis**

As an affective job satisfaction scale, the BIAJS provides insight into relationships with resilience and the individual domains of resilience, as well as resilience overall. Analysis of BIAJS results across the PR6-50 population (n=426) provided a mean of 0.7372 (between 0 and 1) with a StDev of 0.2099. Alpha for the BIAJS was high at 0.9174.

Regression analysis of PR6-50 to the BIAJS (Fig 3) yielded an R-Sq of 29.1% (S = 0.115). Correlation result is 0.536, indicating an overall positive relationship between resilience and job satisfaction. Domain-level analysis showed that the strongest relationship between resilience domains and the BIAJS is VIS (correlation = 0.607). Following that, MTM correlated at 0.490, followed by TEN at 0.418. VIS to BIAJS regression showed an R-Sq of 36.9% (S = 0.148).

Occupation analysis shows that Education and Healthcare workers have proportionately higher job satisfaction than Human Resource workers.

Education workers had a mean of 0.7623 (StDev = 0.1752, 95% CI 0.7337 to 0.7909). Healthcare workers had a mean of 0.7781 (StDev = 0.0225, 95% CI 0.7332 to 0.8230). Human Resources workers had a mean of 0.6842 (StDev = 0.2199, 95% CI 0.6119 to 0.7565) (table 3).

**TABLE 3:** Summary of Occupation by BIAJS and PR6-50 scores

| | | PR6-50 | | | BIAJS | | |
|---|---|---|---|---|---|---|---|
| **Occupation** | **N** | **Mean** | **SE Mean** | **StDev** | **Mean** | **SE Mean** | **StDev** |
| Education & Training | 147 | 0.6715 | 0.043 | 0.5208 | 0.7623 | 0.0145 | 0.1752 |
| Healthcare & Medical | 69 | 0.69585 | 0.0646 | 0.5363 | 0.7781 | 0.0225 | 0.1871 |
| Human Resources & Recruitment | 38 | 0.70765 | 0.079 | 0.4871 | 0.6842 | 0.0357 | 0.2199 |
| Professional - Other | 155 | 0.70615 | 0.0414 | 0.5156 | 0.721 | 0.0194 | 0.2413 |

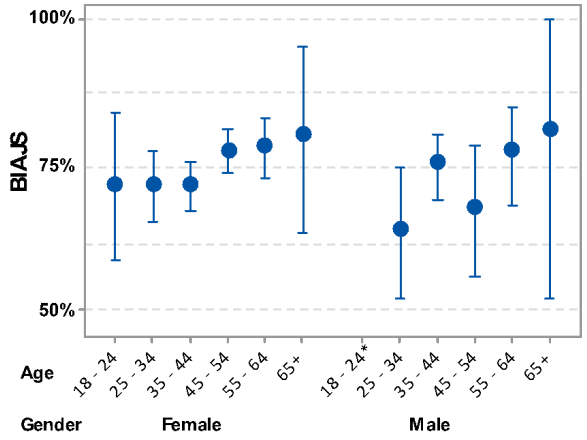


**FIG 4:** Interval plot – BIAJS by age group and gender.
*Insufficient data to plot

Age grouping indicated an overall upwards trend in job satisfaction over age. Trending is similar to resilience scores, with males showing a reduction in job satisfaction scores at ages 45 – 55. Males aged 18 – 24 had insufficient data to plot (Fig 4).

### Consistency analysis

Consistency scores were generated by calculating the absolute value of the first consistency item minus the second, after reversing the negatively scored item. This produced a measure of inconsistency between the items. Dividing results by low inconsistency scores (0, 1, 2) produced an alpha for PR6-50 of 0.9378 (mean = 0.68325, StDev = 0.5488, 95% CI 0.6681 to 0.6984), compared to high inconsistency scores (3, 4) producing an alpha of 0.9356 (mean = 0.6997., StDev = 0.5331, 95% CI 0.6744 to 0.7250).

Consistency measures showed no direct relationships to any of the domains, nor BIAJS. Correlation with resilience was 0.063 (P value = 0.195), indicating no immediate relationship. The consistency measure yields a difference in mean resilience scores, however, analysis of the individual items provided greater clarity regarding underlying relationships. The first item (alcohol consumption) had no correlation with resilience (correlation = 0.005, P value = 0.916), while the second item (worry about alcohol consumption) had a minor inverse relationship with resilience (correlation = 0.114, P value = 0.018).

## DISCUSSION

Building on the original PR6 research, this study showed the development of individual scales for each resilience domain alongside a scale for MTM. The combination of the domain scales gives rise to the full 50-item PR6-50, intended for further research purposes. From these scales, revisions to the OPR6 resulted in the revised 16-item PR6, intended for continued practical use in organisations and clinical practice as a fast resilience measurement that provides insight into each domain of resilience, as well as a forward-looking component through MTM. Domain-level scales may be used together as the full PR6-50, or separately to investigate specific areas.

These scales represent a refinement of the PR6 and the resilience domains, allowing more accurate measurement of the individual aspects that contribute to overall psychological resilience. Following a multi-stage testing format, all scales show strong internal consistency. Consistency between the OPR6 and revised PR6 allow for continuity of

measurement, while providing a slight increase in overall accuracy for future results. In particular, revised COM and COL domain item combinations provide a stronger correlation to the full domain scales. Building on previous research, the COL items now focus on social skills and willingness to invest in new relationships, showing a higher relationship than prior items. Ongoing research indicate further potential neurobiological factors that contribute to certain domains, such as NPY acting through skills within RES, and also HLT factors.

Within the HLT domain, initial PR6 research indicated that sleep quantity may not be most directly related to resilience. Through this study, additional sleep factors were investigated, including ability to fall asleep, perception of sleep quality (being able to sleep well), and also waking up rested. Our analysis showed that the single sleep factor that most contributed to resilience is waking up rested, while the other factors did not significantly contribute. The overall HLT domain thereby now provides an insight into overall perception of health, nutrition habits, exercise regularity, and restfulness of sleep.

PR6 correlation with BIAJS provides evidence of a positive relationship between resilience and job satisfaction. In particular, the VIS domain showed the strongest relationship with job satisfaction.

A potential relationship may exist between age and resilience, showing that resilience improves with age. However, differences between male and female audiences suggest that additional data is required to draw conclusions. Lower participation at the early and later age groups limit analysis, while some dips through the age ranges were observed. A similar trend was observed with job satisfaction, including differences in gender behaviour. However, overlapping CI ranges preclude any meaningful conclusions thus far. Overall, individuals at any age may exhibit high or low resilience as indicated by current measurements.

In line with the previous paper, there appears to be little difference overall in resilience across gender. Similarly, no statistically significant differences were found in any domain for gender. Occupation does appear to have more significant differences, such as Human Resource workers having more resilience, though lower job satisfaction. Contrast with Education and Healthcare workers (possibly more direct services), where job satisfaction is higher though resilience is lower. Differences between geographical regions provide no conclusive results.

Consistency scores provided a negative result, showing no clear benefit in subdividing responses by low to high consistency ratings. However, differences in items showed that worry about alcohol consumption may have a slight negative relationship with resilience.

## CONCLUSION

This research further adds to the validity of the PR6, and also enables further research through the more comprehensive PR6-50. HLT continues to show a strong correlation with resilience, improving internal consistency while showing additional theoretical mechanistic connections through NPY. This highlights that HLT isn't simply about maintaining physical appearance, but strongly about maintaining a healthy environment for the brain and mind to enable effective functioning of the resilience domains, acting as a foundation for resilience.

The relationship between resilience and job satisfaction may indicate that resilient people enjoy their work to a greater degree than less resilient people. Mechanistically, resilience may assist in creating a mindset through which an individual may derive greater satisfaction from their job, compared to someone with lower resilience. In particular, the strong relationship

between VIS and job satisfaction suggest several possibilities. First, an individual who has more clarity on their own sense of purpose and goals may be more adept at choosing an occupation aligned with their own goals. Second, an individual with this clarity may be able to better connect the goals of their occupation with their own goals, even where an intrinsic relationship might not directly exist.

We note that two VIS items (ability to stay motivated, and belief in ability to achieve goals) provide a 0.764 correlation with the PR6-50, providing a useful proxy for overall resilience purely from the VIS domain. Bandura (1988) viewed self-efficacy as one's belief in their own ability to do well, indicating that this might lead someone to put in greater effort to succeed. This, alongside the high correlation of VIS to job satisfaction, led us to propose that VIS is the most critical domain of resilience. Purpose, meaning and clear goals can therefore be seen as central to the implementation of the other domains of resilience, providing direction and guidance to navigate uncertainty. Difficult decisions and adverse situations can be managed through having greater clarity of personal goals and purpose, which is what VIS would provide. Therefore, all the other domains of resilience effectively work in service of the VIS domain, enabling the realisation of one's own raison d'etre. This is further supported by the basic needs, where VIS plays a role in all four of the basic needs – a greater influence than any of the other domains. The other resilience domains thereby provide additional skills and techniques through which an individual can realise their own purpose and goals, fulfilling the basic needs. Acceptance & Commitment Therapy (ACT) developed by Hayes (1999) aligns with the importance of VIS. To this effect, ACT incorporates the concepts of determining what is most important (Harris, 2006), followed by goal setting in alignment with values (Robb, 2007).

Bandura's (1988) work on social cognitive theory identifies factors influencing self-efficacy that connect to the resilience domains, further showing how interaction between the domains contribute to a belief in an ability to succeed. This fuels self-efficacy, underscoring the high correlation of the 'belief in ability to achieve goals' item to overall resilience. The first factor influencing self-efficacy is *experience*, relating to achieved skill mastery through practice. Experience bears close relation to the RES domain regarding mastery of planning for various challenges, COM in relation to practicing emotion regulation skills, TEN in practicing being persistent. The second factor is *modelling*, relating to how seeing others succeed increases our own self-efficacy. Seeing others fail then reduces our self-efficacy. Here, people within our proximity affect our own resilience, where seeing others with low resilience may reduce ours, or vice versa. The third factor is *social persuasion*, relating to direct encouragement or discouragement from others. Support networks that we build through the COL domain therefore needs scrutiny to determine the constructive nature of the network, screening at least for the removal of discouragement. The fourth factor is *physiological factors*, relating to the stress response (sweating, shakes, shallow breathing) and health factors (pain, fatigue), and how they influence our willingness to strive. These are present in the COM and HLT domains, providing a path to manage these symptoms proactively through focused training. All these factors affect self-efficacy, leading back towards the VIS domain supporting a healthy self-image and ability to achieve goals through a deep sense of resilience.

The positive relationship between age and resilience may suggest that wisdom gained over time aids in building the various skills that contribute to the resilience domains. It is not a given, however, that age necessarily increases resilience. The possibility exists that people from previous generations have higher resilience

due to cultural differences at the time. A longitudinal study is required to confirm that age is a causative factor in increasing resilience, and not generational differences. In addition, an individual at any age can show high or low resilience. There is no linear path that individuals progress on. Rather, someone may develop resilience at an early age, or they may never fully develop resilience. This highlights the critical need for resilience education across all the domains to build skills within those who may not build these skills naturally.

We note that the inability of the consistency measurement to provide a meaningful way to adjust for positive impression management may be in the item interpretation. However, the negative result does provide an interesting insight into the relationship between alcohol consumption and resilience. The total lack of relationship between alcohol consumption and resilience indicates that amount of alcohol consumed appears to not affect resilience (precluding alcoholism, which was not measured), while *worrying* about alcohol consumption appears to have an effect. Some level of anxiety or concern about one's level of control over alcohol consumption may indicate broader concerns about one's sense of control (as a basic need), affecting confidence as well as the implementation of the domains of resilience. However, the intention of this research was not specifically set out to measure the effects of alcohol consumption on resilience, so additional research is needed to investigate.

Further research is being conducted with younger age participants, which also includes intervention testing to validate ability to improve resilience early in life. Other future research includes deeper investigation into occupational and gender differences, as well as digital intervention methodologies for various cohorts. Ongoing testing of the six domains of resilience and their contribution to various improved outcomes are of interest. We propose the PR6 be adopted to a greater extent in organisational and clinical application, alongside the PR6-50 for further research application.

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