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ARTICLE

The Worker Vitality Scale (WVS): Development, psychometric assessment, and validation

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Abstract: Extensive research highlights vitality as a powerful reservoir of energy that empowers leaders and workers to achieve their full potential. This study advances the understanding and measurement of vitality in the workplace by developing the Worker Vitality Scale (WVS), a robust tool that incorporates four key dimensions: physical, psychological, emotional, and spiritual vitality. While previous research has emphasized the generative and dynamic nature of vitality as a resource, this paper introduces the novel dimension of spiritual vitality. The WVS was developed through a rigorous process that included the generation of scale items, face validity testing, and confirmatory factor analysis to establish construct validity and ensure the reliability of the four-factor model. The study also investigates the relationship between the WVS and the PERMA+4 well-being model, demonstrating that the pathways of the PERMA+4 predict the new WVS. By validating the WVS through longitudinal testing and structural equation modeling, this research provides a practical and theoretical framework for promoting vitality across diverse workplace settings. Implications for leaders, practitioners, and organizations include strategies to cultivate a thriving workforce by addressing all dimensions of vitality, including the often-overlooked spiritual component.

Keywords: vitality, positive psychology at work, positive organizational psychology, work-related well-being

1. Introduction

Employees in organizations face constant pressures ranging from teamwork and cultural integration to meeting performance goals and maintaining personal well-being. Meeting these demands requires various resources, with energy being one of the most critical. Vogel (2017) demonstrated through his research on human energy and work that when individuals feel energized and are thriving, their work capabilities are enhanced. Human energy is both generative and dynamic, benefiting employees, teams, and organizations alike. Vitality, defined by Ryan and Frederick (1997) as a sense of positive aliveness and inner energy, is a crucial resource for employees to withstand the pressures of their roles. Employees need vitality to effectively contribute to their teams and organizations without compromising their own well-being.

Vitality remains an underappreciated and underexplored concept within academic research (Lomas et al., 2022). Aiming to advance our knowledge of vitality, this paper focuses on better defining and measuring the concept for people in the workforce. Cannon (2011) notes that truly vital individuals engage in honest, trustworthy, and generative relationships both at home and at work. People who possess a strong sense of vitality have the potential to create a "positive

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ripple effect" throughout their organizations. This concept is supported by theories and empirical research on positive energizers and energy networks theory (Baker et al., 2003; Cameron, 2021) as well as positive relational energy (Cabrera et al., 2024; Owens et al., 2016).

This paper expands the definition of vitality by integrating a novel dimension of spiritual vitality into the established framework of physical, psychological, and emotional energy (Shapiro & Donaldson, 2022). Through the development of the comprehensive Worker Vitality Scale (WVS), we provide evidence that spiritual vitality is not only conceptually distinct but also offers incremental validity, uniquely predicting aspects of well-being beyond the other vitality subfactors. The objective of this research is twofold: first, to validate the WVS as a reliable and robust instrument for measuring vitality; and second, to examine its consistency and relevance over time. Our analysis involved testing several models to determine the most accurate representation of vitality, assessing the scale's stability through longitudinal measurement invariance testing, and exploring its concurrent criterion validity.

Furthermore, we investigated the relationship between the WVS and the PERMA+4 model, which includes positive emotion, engagement, relationships, meaning, achievement, physical health, mindset, environment, and economic security (Donaldson et al., 2020). Our findings reveal that the WVS is a valuable tool for understanding worker vitality in its entirety, providing insights into how different dimensions of vitality interrelate and impact overall well-being. This paper not only highlights the robustness of the WVS but also emphasizes its practical implications for researchers and practitioners seeking to promote a more vibrant and thriving workforce. The findings are highly relevant for leaders, organizations, and practitioners focused on enhancing employee well-being and vitality.

1.1 Vitality

Vitality encompasses an internal resource that includes physical, psychological, and emotional energy (Shapiro & Donaldson, 2022). Unlike mere energy, vitality is linked with positively energized states such as vigor (McNair et al., 1971), activated positive affect (Watson & Tellegen, 1985), and calm energy (Thayer, 1996). While energy alone can also be associated with feelings of anger, anxiety, or arousal (Ryan & Frederick, 1997), vitality specifically refers to the energy individuals can use for goal-oriented activities. Lavrusheva's (2020) review of 93 studies on vitality revealed varying definitions, describing it as an experience, feeling, or disposition. The most accepted definition posits that vitality is the energy available to oneself (Ryan & Deci, 2008), further conceptualized as a higher-order factor with three subcomponents: psychological, physical, and emotional energy (Shapiro & Donaldson, 2022). Vitality is consistently linked to positive outcomes such as better work performance, enhanced stress-coping mechanisms, increased resilience, improved physical well-being, reduced anxiety, and boosted self-confidence (Greenglass, 2006; Penninx et al., 2000; Ryan & Deci, 2008; Ryan & Frederick, 1997). Various factors contribute to vitality, including physical health, well-being, regular physical activity, mental health, and meaningful work environments (Lavrusheva, 2020).

Vitality is an essential resource for employees and leaders. Individuals with high vitality display enthusiasm, aliveness, and energy (Ryan & Frederick, 1997), which enhances their ability to perform work-related tasks (Vogel, 2017). This internal resource of vitality is dynamic and generative, allowing workers to handle challenges better, improve overall performance, and meet role demands (Dubreuil et al., 2014). Furthermore, individuals can harness vitality to effectively manage their inner resources and engage in purposeful actions (Ryan & Deci, 2008).

1.2 Spiritual Vitality

The concept of vitality has been linked to spirituality throughout history including the doctrine of vitalism, which suggests that organisms possess a unique 'spirit' (William & Richardson, 1998). Various cultural perspectives emphasize vitality as not just a physical or psychological phenomenon, but as a profound spiritual energy that flows through and uplifts living beings, connecting them to something greater than themselves (Lomas et al., 2022). Vitality's roots go back to Ancient Greek and Eastern cultures and philosophies, evident in concepts like Chi in China, Ki in Japan, Bayu in Indonesia, and Prana in India (Lavrusheva, 2020). These ancient concepts of vitality share a common theme of a "force flowing through living things" and "spiritual vital energy" (Lavrusheva, 2020, p. 2). Eastern traditions encompass a wide range of practices such as zazen, yoga, pilates, reiki, acupuncture, Zen meditation, tai chi, and herbal treatments, which view vitality as a crucial health-related energy that can be either enhanced or depleted (Deci & Ryan, 1985; Ryan & Frederick, 1997; Thayer, 1987). More current research from Ozcan and Yaman (2020) showed that spiritual orientation is correlated with subject vitality as measured through the Subject Vitality Scale (SVS). Additional studies have shown that spiritual practices like mindfulness, practicing religion, yoga, meditation, and Tai Chi can contribute to vitality (Karr, 2019; Kuzikova & Shcherbak, 2023). Furthermore, multiple measurement tools in vitality include a question with the word spirit in it like the SVS which includes the question "I have energy and spirit." (Porath et al., 2012; Ryan & Frederick, 1997) however, there is currently not a vitality scale that includes the important subfactor of spiritual vitality with multiple items of measurement. This research builds directly on the insights presented Lomas et al. by addressing the critical gap the identified in Western frameworks of vitality, which have largely prioritized physical and psychological dimensions while neglecting the spiritual aspect (Lomas et al., 2022).

To create sound measurement for work vitality that encompassed all four factors: physical, psychological, emotional and spiritual energy, we generated questions by reviewing a range of the items from various vitality scales including the Leader Vitality Scale (Shapiro & Donaldson, 2022). Given the novelty of the spiritual vitality subfactor, we developed additional questions to further explore and define it. The new scale items were first tested for face validity to refine the language of each question. We then utilized Confirmatory Factor Analysis to assess the measurement structure of the Worker Vitality Scale (WVS) and establish construct validity for the 4 hypothesized components of Worker Vitality. We tested the following hypotheses:

H1: Vitality is a higher-order construct comprising 4 sub-factors of physical, psychological, emotional, and spiritual vitality

H2: The 4 sub-factors of worker vitality will be positively correlated with each other

H3: The 4 sub-factors of vitality measure distinct aspects of vitality

1.3 PERMA+4

Lavrusheva's (2020) literature review showed that there are many positive antecedents of vitality, and all are elements of well-being. Well-being is broadly defined as human flourishing and wellness of mind and body (Diener et al., 2009). Seligman (2018) developed the PERMA model for well-being that includes positive emotions, engagement, relationships, meaning, and accomplishment. Donaldson et al. (2020) added four additional elements to the PERMA model: physical health, mindset, environment, and economic security. PERMA+4 has been validated through extensive research and measurement and has been shown to have a strong link to work role performance (see Table 1).

Table 1. Elements of PERMA+4

PERMA+4	Definition
Positive emotions	Experiencing happiness, joy, gratitude, etc.
Engagement	Using your strengths to meet challenges; experiencing flow
Relationships	Connecting with others; love and be loved
Meaning	Connect to meaning; find your purpose
Accomplishment	Pursue and accomplish goals; strive for greatness
Physical Health	Biological, functional, and psychological health assets
Mindset	Future-oriented, growth mindset, perseverance
Environment	Spatiotemporal elements, such as access to natural light, nature, physiological safety
Economic Security	Perception of financial security

Note. Donaldson et al., 2020.

Antecedents of vitality can be classified into psychological, physiological dispositions, and external circumstances or life events (Lavrusheva, 2020). The psychological antecedents can all be classified as either well-being or mental health factors, including both positive meaning and emotions. Physiological antecedents include somatic factors of well-being (Lavrusheva, 2020). The PERMA+4 model of well-being most closely aligns with the antecedents of vitality and has been shown to correlate with vitality in leaders (Shapiro & Donaldson, 2022). To further validate the WVS scale, we test the concurrent criterion validity of the WVS with the PERMA+4 along with the incremental validity of the newly added Spiritual Vitality dimension. Additionally, this study, through longitudinal testing and structural equation modeling investigates whether the PERMA+4 factors predict vitality as defined by the four-factor model including spiritual vitality.

H4a: The dimensions of WVS are positively correlated with the dimensions of PERMA+4

H4b: Spiritual Vitality will contribute unique variance to the dimensions of PERMA+4 above and beyond that of the other WVS dimensions

H5: The WVS is predicted by the PERMA+4

2. Methods

2.1 Participants

The dataset comprised 866 data points collected from 433 individuals over two measurement periods, each spaced two weeks apart. Participants were recruited via convenience sampling from Prolific. To be eligible, participants had to meet these criteria: 1) be at least 18 years old, 2) reside in the U.S., 3) work in the U.S., 4) be employed full-time, 5) have a direct supervisor, and 6) have at least one coworker. Each participant received $2.00 per survey, totaling $4.00 for both surveys. Initially, 500 participants completed the first survey (T1), and two weeks later, 433 of them completed the second survey (T2), which corresponds to 86.6% retention from the initial sample.

2.2 Measures

2.2.1 PERMA+4

The PERMA+4 was measured through the Positive Functioning at Work Scale (PF-W) created by Donaldson & Donaldson (2020). The PF-W integrates nine constructs and outcomes of well-being

including positive emotions, engagement, relationships, meaning, accomplishment, physical health, mindset, environment and economic security (Donaldson & Donaldson, 2020). The PF-W consists of 29 items and represents one of the more comprehensive and empirically validated multidimensional well-being at work scales available, demonstrating excellent overall reliability (α = .94) (Donaldson & Donaldson, 2020; Donaldson, et al., 2021). The reliabilities for each of the nine subcategories ranged from acceptable (>.70) to excellent (>.90) (Howe, 1970): positive emotions (α=.93), engagement (α = .88), relationships (α = .90), meaning (α = .91), accomplishment (α = .81), physical health (α=.85), mindset (α=.86), environment (α=.76), and economic security (α = .84) (Donaldson & Donaldson, 2020).

2.2.2 Worker Vitality Scale

The Worker Vitality Scale (WVS) measures the 4 factors of physical, psychological, emotional, and spiritual vitality that serve as the primary constructs of interest in this study. Internal Consistency reliability was found to be excellent across all 4 subscales and the overall scale in the current study (see Table A4 and Tables A8 and A12 in the Appendix) (Howe, 1970).

2.3 Procedure

All analyses and data preparation were conducted using R (version 4.2.2). Data cleaning and preparation was conducted using R's dplyr (version 1.1.2) and tidyverse (version 1.3.2) packages. Outlier treatment was conducted using R's robustHD package (version 0.8.0) (Alfons, 2021). Statistical assumption testing was conducted using R's car (version 3.1.1) and mvnTest (version 1.1.0) packages or homoskedasticity and multivariate normality testing, respectively. Model estimation and reliability testing were conducted using R's lavaan (version 0.6.12) and semTools packages (version 0.5.6).

Of the 866 responses collected, 10 were removed due to participants' inadmissible attention check responses, leaving a total of 856 admissible responses (428 at each time point). Of these responses, approximately 3% (n=28) contained missing values, which were treated using listwise deletion, leaving 828 total responses (414 at each time point) for subsequent analyses. Univariate outliers were defined as values exceeding 3 standard deviations above or below a variable's mean value. This threshold yielded 21 outliers with respect to physical vitality items, 10 outliers with respect to psychological vitality items, 15 outliers with respect to emotional vitality items, 12 outliers with respect to engagement items, 50 outliers with respect to relationship items, 30 outliers with respect to accomplishment items, 17 outliers with respect to physical health items, 29 outliers with respect to mindset items, and 9 outliers with respect to environment items. All univariate outliers were winsorized to within 3 standard deviations of a variable's mean before proceeding to check for multivariate outliers.

Multivariate outlier testing was then conducted using Mahalanobis distances with a chi-square significance threshold of a 0.01. This method yielded 70 multivariate outliers with respect to PERMA+4 scale items and 58 multivariate outliers with respect to Vitality scale items. Multivariate outliers were winsorized by replacing multivariate outliers with vector values representing the closest point on the boundary of an ellipsoid defined by all points with a squared Mahalanobis distance equal to the 99th percentile of a chi-square distribution (functionally equivalent to Mahalanobis distances with a chi-square significance equal to 0.01) (Khan, et al., 2007). This ellipsoid was computed using a median-based approach to data centroid identification (Khan, et al., 2007). This multivariate winsorization process was implemented using the *'winsorize'* function in the *'robustHD'* package in R (Alfons, 2021).

Hypotheses 1-3 were tested using Confirmatory Factor Analysis to assess the measurement structure of the Worker Vitality Scale (WVS) and establish construct validity for the 4 hypothesized components of Worker Vitality. Confirmatory Factor Analysis was also used to assess the measurement structure and construct validity of the PERMA+4 model of well-being to support subsequent structural testing involving PERMA+4 and Worker Vitality. Hypothesis 4 was then tested using cross-sectional, multi-group (where groups were defined as measurement occasions) Structural Equation Modeling with equality constraints to assess the criterion validity of Worker Vitality and its subdimensions with respect to PERMA+4. The goal of this approach was to assess the degree to which the structural relations of interest were 1) statistically significant, 2) substantively meaningful, and 3) stable across time points. Measurement stability of all constructs was established prior to direct testing of Hypothesis 4 via longitudinal measurement invariance testing using multigroup CFA.

Assumption checks involved multivariate normality testing via a Henze-Zirkler test (using the *HZ.test* function in R's *mvnTest* package) test and homoscedasticity testing via a Breusch-Pagan test (using the *ncvTest* function in R's *car* package). All assumption checks were conducted subsequently to pre-treating the data for missingness and outliers. Breusch-Pagan testing indicated a violation of heteroskedasticity ($\chi 2(1)$ =13.54, p=0.0002) and Henze-Zirkler testing indicated a violation of multivariate normality (HZ=1.02, p<0.0001) with respect to the joint distributions of PERMA+4 and Worker Vitality scale items. As such, measurement models were fit utilizing robust maximum likelihood estimation with Huber-White robust standard errors and an asymptotic Yuan-Bentler scaled test statistic (Tomarken & Waller, 2005). One thing to note about this estimation procedure is that Huber-White standard errors are only robust for direct effect coefficients, so when working with mediation models, it is generally preferred to bootstrap standard errors to enhance the accuracy of indirect effect estimates (Tomarken & Waller, 2005; Edwards & Lambert, 2007). Because the cross-lagged structural models used to test Hypothesis 5 contained mediational components, these were fit using standard maximum likelihood estimation with bootstrapped standard errors based on 10,000 bootstrap draws.

3. Results

3.1 Hypotheses 1-3: Convergent and discriminant validity of the Worker Vitality Scale

To test Hypotheses 1-3, three confirmatory factor models were specified and tested. The first of these specified a single factor model to assess the scale's convergent validity with respect to overall vitality. To assess the scale's discriminant validity with respect to Physical, Psychological, Emotional, and Spiritual Vitality, the second model specified 4 lower order factors whose shared variance was explained by a higher order Worker Vitality factor. The third model further specified correlated residuals to capture the presence of unique shared variance among the lower order factors above and beyond that which could be explained by overall Worker Vitality. Models were compared via likelihood ratio testing by applying the *anova* function in R (see Table 2 below), which indicated that a higher order factor model with correlated subfactor residuals provided the best fit to the data (p<0.0001) (Satorra & Bentler, 2001).

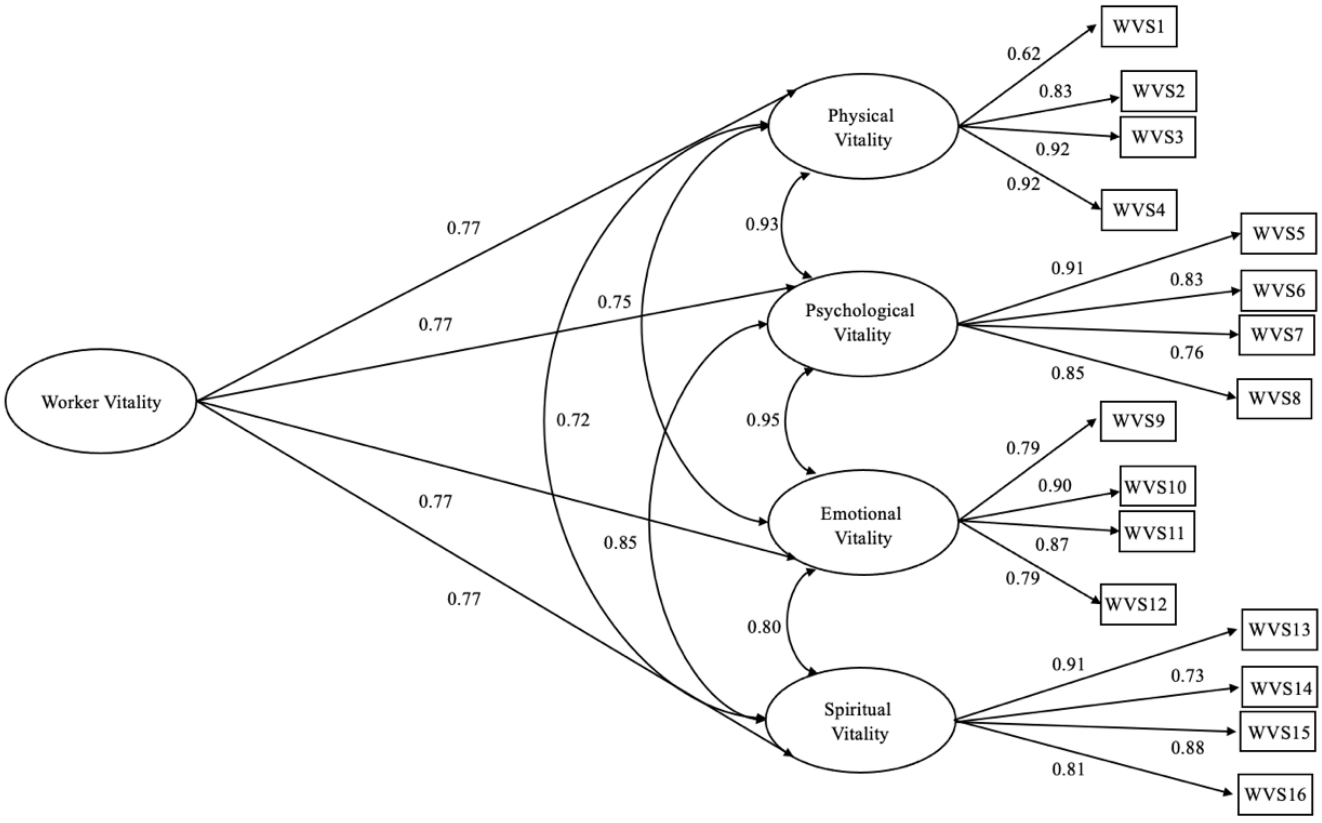
Overall model fit ($\chi 2(94)$=673.47, p<0.0001; AIC=33924; BIC=34123) proved adequate via both incremental (CLI=0.95, TLI=0.94) and absolute (SRMR=0.03, RMSEA=0.09 (90% CI [0.08, 0.10]) fit indices (Bentler, 1992; Byrne, 2001; Hu & Bentler, 1999; MacCallum et al., 1996). All factor loadings were significant at the 0.0001 level. Lower order residuals were all significantly positively correlated at the 0.0001 level, with correlations ranging from 0.72 to 0.95 (see Table 3 below). These results indicate that worker vitality represents a higher order construct comprising physical, psychological, emotional, and spiritual vitality, all of which are positively correlated

with one another, thus supporting Hypotheses 1 and 2. The improved fit of higher order factor models, which explicitly specify distinct subdimensions of Worker Vitality, relative to a single factor model, provides some support for Hypothesis 3. However, the magnitude of residual correlations between the 4 lower order factors in Model 3 (see Table A1 in the Appendix) suggests that the WVS may not adequately distinguish between the Psychological and Emotional subdomains of Worker Vitality, ultimately resulting in mixed support for Hypothesis 3. See Figure 1 for a graphical depiction of Model 3 and summary of standardized model parameters, including factor loadings and residual intercorrelations between lower order factors.

Table 2. Model comparisons

Model	AIC	BIC	CFI	TLI	RMSEA	SRMR	Δχ2	Δdf	p
Higher Order WVS Factor w/ Correlated Lower Order Residuals	33924	34123	0.949	0.935	0.093	0.034	*NA*	*NA*	*NA*
Higher Order WVS Factor	33949	34119	0.947	0.936	0.092	0.035	55.51	6	<0.0001
Single WVS Factor	34374	34525	0.914	0.901	0.115	0.042	327.69	4	<0.0001

Figure 1. Graphical representation of the best observed measurement model for Worker Vitality



Note. All Loadings and correlations are significant at the 0.001 level. Curved arrows correspond to correlations among the residuals of lower-order factors.

In addition to explicit hypothesis testing aimed at assessing the general construct validity of the WVS, we also examined several other psychometric properties of the scale. The following

sections examine the scale's internal consistency reliability, generalizability, and temporal stability before proceeding to continue with explicit hypothesis testing for Hypotheses 4 and 5.

3.2 Internal consistency reliability of the Worker Vitality Scale

Multiple internal consistency statistics were used to assess reliability of the Worker Vitality scale and its four subscales, including both Cronbach's α and McDonald's omega hierarchical (ωh) (Cronbach 1951; McDonald, 1999). Overall, the Worker Vitality scale exhibited excellent internal consistency statistics with respect to both Cronbach's α and McDonald's ωh (Kalkbrenner, 2024) (see Table A2 in the Appendix).

3.3 Measurement invariance generalizability of the Worker Vitality Scale

To assess the degree to which the WVS generalizes broadly across diverse worker populations, groupwise CFA was conducted to assess the degree of measurement invariance present in the observed higher order model of worker vitality across workers leadership status (Leaders vs Non-leaders), gender (Men vs. Women), and race/ethnicity (White vs. Non-White). Group CFA and Measurement invariance testing generally involves four steps in which a factor model is defined for each group being examined before placing increasingly stringent equality constraints on the parameters of each group-specific factor model. Statistical tests are then used to assess whether the imposition of these equality constraints result in a greater-than-chance reduction in the statistical fit between observed and model-implied variance-covariance matrices with respect to the observed variables specified in the model (observed variables must be constant across all examined groups when conducting group CFA, even if the factor models themselves are not are not) (Satorra & Bentler, 2001; Putnick & Bornstein, 2016).

The first step in measurement invariance testing involves the assessment of configural invariance, in which the general form of a factor model is held constant by specifying equivalent patterns of factor to indicator loadings across groups. Because there are generally any number of alternative specifications that can be applied to the form of a factor model across different groups, unless researchers have specific alternative model configurations that they wish to compare against a configural invariant model, configural invariance is generally assessed via conventional model fit statistics such as model CFI, TLI, SRMS, and RMSEA (Hu & Bentler, 1999), rather than via model direct comparison using $\chi 2$ difference/likelihood ratio testing (Putnick & Bornstein, 2016).

The next step then involves the assessment weak factorial, or metric, invariance, in which the actual value of factor loadings specified in a configural invariance model are constrained to be equal across groups. The next step then involves the assessment strong factorial, or scalar, invariance, in which indicator-level intercepts, or the baseline level (i.e., the model-implied expected value of an indicator at the mean of its corresponding construct) of construct indicators are constrained to be equal across groups. The final step involves the assessment of strict invariance, in which the residual variances (i.e., variance in an indicator that is not explained by its relation to its corresponding factor) of all construct indicators are constrained to be equal across groups.

Structural invariance testing further involves assessing groupwise invariance in components of the relational structure between disparate constructs, rather than components of the relational structure between a construct and its indicators (Putnick & Bornstein, 2016). Given that our model contained a higher order factor along with correlated lower order factor residuals, in addition to testing for configural, metric, scalar, and strict invariance, we also tested one additional model, which further constrained the covariances between lower order factor

residuals to equality across leadership groups. Because this structural component of the model represented a key hypothesized aspect worker vitality itself, we decided to test for its invariance across leadership groups despite this representing a test of structural, rather than measurement, invariance.

The results of this measurement invariance testing with respect to leadership status are summarized in Table A3 in the Appendix. While scalar and strict invariance were not supported by likelihood ratio testing, likelihood ratio testing has been shown to be overly sensitive to sample size in tests of measurement invariance, resulting in type I (i.e., assessing a lack of measurement invariance when such invariance is present) error rate inflation for larger samples (Meade et al., 2008). As such, we instead examined changes in CFI, TLI, RMSEA, and RMSEA fit indices across models to determine salience of model fit changes across increasingly stringent invariance classes. Transitions between metric, scalar, and strict invariance models all saw changes of less than 0.01 across all four fit indices, with both the scalar and strict invariance models demonstrating adequate overall fit (Bentler, 1992; Byrne, 2001; Hu & Bentler, 1999; MacCallum et al., 1996). These findings support overall measurement invariance of the Worker Vitality Scale with respect to workers' leadership status in their organization.

Results of measurement invariance testing with respect to gender are summarized in Table A4 in the Appendix. While scalar and strict invariance were not supported by likelihood ratio testing, they were supported with respect to changes in CFI, TLI, RMSEA, and RMSEA fit indices. Transitions between metric, scalar, and strict invariance models all saw changes of less than 0.01 across all four fit indices, with both the scalar and strict invariance models demonstrating adequate overall fit (Bentler, 1992; Byrne, 2001; Hu & Bentler, 1999; MacCallum et al., 1996). These findings support overall measurement invariance of the Worker Vitality Scale with respect to Men and Women in the workplace.

Results of measurement invariance testing with respect to race/ethnicity are summarized in Table A5 in the Appendix. While scalar invariance was not supported by likelihood ratio testing, it was supported with respect to changes in CFI, TLI, RMSEA, and RMSEA fit indices. Transitions between metric, scalar, and strict invariance models all saw changes of less than 0.01 across all four fit indices, with both the scalar and strict invariance models demonstrating adequate overall fit (Bentler, 1992; Byrne, 2001; Hu & Bentler, 1999; MacCallum et al., 1996). These findings support overall measurement invariance of the Worker Vitality Scale with respect to White and non-white Workers.

3.4 Temporal stability testing: WVS and PERMA+4

Having established preliminary evidence of construct validity, we further utilized multigroup CFA to assess longitudinal measurement invariance of the Worker Vitality and PERMA+4 Scales to support subsequent analyses aimed at assessing Hypothesis 5. Longitudinal measurement invariance testing involves the assessment of configural, metric, scalar, and strict invariance with respect to different time points (MacKinnon et al., 2022; Widaman et al., 2010). Establishing longitudinal measurement invariance is an important prerequisite to assessing structural relationships involving multiple waves of construct measurement, such as those discussed below, because it is impossible to meaningfully assess changes in a construct over time by using a given measurement instrument, such as the Worker Vitality Scale, unless we can establish that said measurement instruments are indeed measuring the same construct on the multiple occasions in which they are employed (MacKinnon et al., 2022; Widaman et al., 2010).

The results of longitudinal invariance testing for the Worker Vitality Scale are summarized in Table 3. While scalar invariance was not supported by likelihood ratio testing, it was supported

with respect to changes in CFI, TLI, RMSEA, and RMSEA fit indices. Transitions between metric, scalar, and strict invariance models all saw changes of less than 0.01 across all four fit indices, with both the scalar and strict invariance models demonstrating adequate overall fit (Bentler, 1992; Byrne, 2001; Hu & Bentler, 1999; MacCallum et al., 1996). These findings support overall measurement invariance of the Worker Vitality Scale with respect to time, providing evidence of the scale's measurement stability.

Table 3. WVS measurement stability testing

Invariance Class	CFI	TLI	RMSEA	SRMR	AIC	BIC	$\Delta\chi 2$	Δdf	p
Configural	0.951	0.937	0.086	0.033	34008	34556	*NA*	*NA*	*NA*
Metric	0.950	0.941	0.083	0.038	33989	34465	10.62	15	0.779
Scalar	0.950	0.944	0.081	0.038	33977	34402	10.27	11	0.506
Strict	0.949	0.947	0.079	0.042	33982	34332	37.35	16	0.002
Covariance	0.949	0.948	0.078	0.042	33971	34292	0.44	6	0.998

Furthermore, the Worker Vitality scale exhibited excellent internal consistency statistics with respect to both Cronbach's α and McDonald's ωh both within time 1 and time 2 (see Table A6 in the Appendix) indicating evidence of temporal stability with respect to the internal consistency of the Worker Vitality Scale (Kalkbrenner, 2024). Temporal stability of internal consistency reliability is an important prerequisite to employing path-analytic cross-lagged panel models on composite measures of a construct in much the same way as longitudinal measurement invariance in the case of cross-lagged panel models employed under a structural equation modelling paradigm that involves latent construct measurement, as discussed above (Kearney, 2017).

With respect to PERMA+4, strict longitudinal invariance was both supported by likelihood ratio testing (see Table 4) and also yielded adequate fit statistics, supporting overall measurement invariance and supplying evidence of the PERMA+4 Scale's temporal stability (Bentler, 1992; Byrne, 2001; Hu & Bentler, 1999; MacCallum et al., 1996). Furthermore, the PERMA+4 scale exhibited excellent internal consistency statistics with respect to both Cronbach's α and McDonald's ωh both within time 1 and time 2 (see Table A7 in the Appendix) indicating evidence of temporal stability with respect to the internal consistency of the Worker Vitality Scale (Kalkbrenner, 2024).

Table 4. PERMA+4 measurement stability testing

Invariance Class	CFI	TLI	RMSEA	SRMR	AIC	BIC	$\Delta\chi 2$	Δdf	p
Configural	0.933	0.919	0.060	0.068	67566	68812	*NA*	*NA*	*NA*
Metric	0.933	0.922	0.059	0.070	67525	68639	15.02	28	0.98
Scalar	0.934	0.924	0.058	0.069	67498	68522	10.13	19	0.95
Strict	0.935	0.929	0.056	0.071	67483	68370	43.06	29	0.05
Covariance	0.935	0.932	0.055	0.072	67426	68143	15.07	36	0.999

3.5 Hypothesis 4a: Concurrent validity between Worker Vitality and PERMA+4

Having established preliminary evidence of construct validity and temporal stability for both the Worker Vitality and PERMA+4 scales with respect to the measurement of higher order factor models with correlated lower order factor residuals, we turned our attention to assessing undirected concurrent criterion validity by examining the correlational structure of all constructs measured across the respective scales. Given the observed adequacy of internal consistency metrics for both scales, along with the observed temporal stability of these metrics, we proceeded to create mean composite scores for both Worker Vitality and PERMA+4, along with all of their corresponding subscales. Preliminary evidence of criterion validity for the Worker Vitality and PERMA+4 scales was assessed by examining correlation matrices of the two constructs and their corresponding components at time 1 and time 2. Correlations ranged from 0.17 to 0.96 and were all significant at the 0.01 level for both time 1 and time 2, signaling some preliminary evidence of criterion validity with respect to both the Worker Vitality and PERMA+4 scales, and ultimately supporting Hypothesis 4. See Tables A8 and A9 in the Appendix for a summary of correlations at times 1 and 2, respectively.

3.6 Hypothesis 4b: Incremental validity of Spiritual Vitality

With respect to incremental validation testing of the WVS Spiritual Vitality dimension, we ran hierarchical regression testing to assess the degree to which Spiritual Vitality contributed unique variance prediction to each component of PERMA+4 Well-Being during each timepoint assessed in the current study. Results of this testing for time 1 and time 2 are summarized in Tables 5 and 6, respectively. Summaries of multiple regression coefficients for saturated models (i.e. those predicting components of PERMA4 from all four WVS components simultaneously) are subsequently presented in Tables A10 and A11 in the Appendix, respectively.

Table 5. Summary of time 1 hierarchical regression statistics

DV	Model 1 R^2	Model 2 R^2	ΔR^2	ΔF	p
PERMA+4	0.588	0.594	0.006	6.37	0.012*
Positive Emotion	0.358	0.384	0.026	16.92	< 0.0001**
Engagement	0.119	0.138	0.019	8.92	0.003**
Relationships	0.305	0.308	0.003	1.8	0.181
Meaning	0.231	0.251	0.02	11.19	0.001**
Accomplishment	0.454	0.456	0.003	1.96	0.162
Physical Health	0.559	0.582	0.023	22.45	< 0.0001**
Mindset	0.381	0.384	0.003	2.08	0.15
Environment	0.225	0.236	0.011	5.89	0.016*
Economic Security	0.258	0.258	<0.0001	0.03	0.852

Note. * indicates p < .05. ** indicates p < .01. Model 1: DV ~ Physical Vitality + Psychological Vitality + Emotional Vitality. Model 2: DV ~ Physical Vitality + Psychological Vitality + Emotional Vitality + Spiritual Vitality.

Results at both timepoints suggested unique variance in overall PERMA4 composites along with Positive Emotion, Meaning, Physical Health, and Environment composite scores attributable to Spiritual Vitality. Furthermore, unique variance attributable to Spiritual Vitality was suggested for Engagement at time 1 and Mindset at time 2. Where Spiritual Vitality was shown to contribute unique variance, Multiple Regression coefficients suggested positive associations with all

PERMA4 components except for Physical health, for which associations with Spiritual Vitality were negative after controlling for all other WVS components at both time points. These results collectively suggest a strong degree of incremental validity with respect to the Spiritual Vitality dimension of the WVS, further elaborated in the discussion section below.

Table 6. Summary of time 2 hierarchical regression statistics

DV	Model 1 R^2	Model 2 R^2	ΔR^2	ΔF	p
PERMA+4	0.582	0.588	0.007	6.55	0.011*
Positive Emotion	0.39	0.419	0.029	20.29	< 0.0001**
Engagement	0.07	0.072	0.002	1.01	0.316
Relationships	0.357	0.357	<0.0001	0.08	0.772
Meaning	0.268	0.285	0.016	9.41	0.002**
Accomplishment	0.421	0.425	0.004	3.16	0.076
Physical Health	0.51	0.524	0.014	12.33	< 0.0001**
Mindset	0.385	0.396	0.011	7.45	0.007**
Environment	0.255	0.271	0.016	9.08	0.003**
Economic Security	0.257	0.257	<0.0001	0.02	0.884

Note. * indicates $p < .05$. ** indicates $p < .01$. Model 1: DV ~ Physical Vitality + Psychological Vitality + Emotional Vitality. Model 2: DV ~ Physical Vitality + Psychological Vitality + Emotional Vitality + Spiritual Vitality.

3.7 Hypothesis 5: Predictive validity between PERMA+4 and Worker Vitality

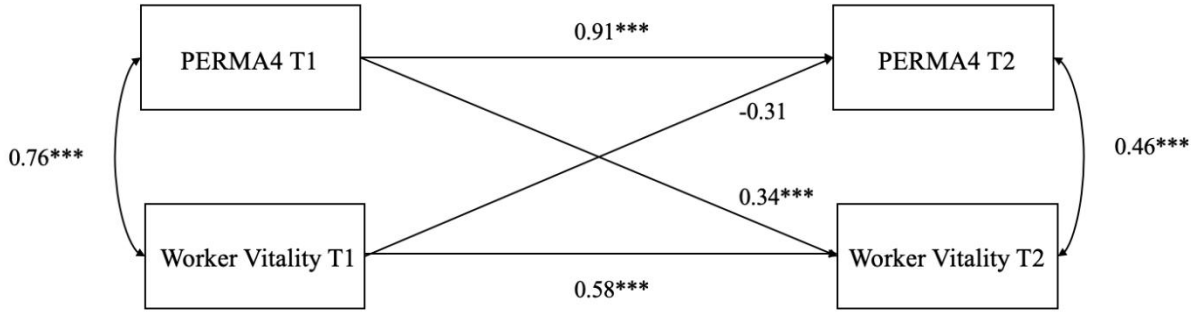
Having established preliminary evidence of concurrent criterion validity between Worker Vitality and PERMA+4, as well as temporal measurement stability for both scales, we turned our attention to more explicit testing of Hypothesis 5 by assessing whether PERMA+4 at time 1 was predictive of Worker Vitality and the four subdimensions of the WVS scale two weeks. We conducted this testing by employing cross-lagged panel models aimed at demonstrating a unidirectional lagged relation from PERMA+4 to Worker Vitality and its subcomponents. Given the observed adequacy and temporal stability of both scales' internal consistency, we employed a path analytic modeling approach using mean composites for all constructs rather than employing latent measurement techniques in an SEM paradigm. We specified and examined a single cross lagged panel model with two time points in which all constructs were allowed to covary cross-sectionally. Cross-lagged paths were specified between overall PERMA+4 and Worker Vitality scales, all while controlling for autoregressive effects with respect to all constructs included in the model.

Overall model fit ($\chi 2(20)$=114.09, p<0.0001; AIC=5015; BIC=5249) proved adequate via both incremental (CLI=0.99, TLI=0.96) and absolute (SRMR=0.07, RMSEA=0.12 (90% CI [0.10, 014]) fit indices. (Bentler, 1992; Byrne, 2001; Hu & Bentler, 1999; MacCallum et al., 1996). This model explained approximately 81% of the composite variance in PERMA+4, 74% of the composite variance in WVS, 66% of the composite variance in Physical Vitality, 70% of the composite variance in Psychological Vitality, 69% of the composite variance in Emotional Vitality, and 65% of the composite variance in Spiritual Vitality at time 2.

PERMA+4 demonstrated significant cross lagged direct effects on Worker Vitality (B = 0.47, 95% CI [0.38, 0.56], $\beta = 0.34$, $p < 0.0001$), Physical Vitality (B = 0.47, 95% CI [0.36, 0.57], $\beta = 0.30$, $p < 0.0001$), Psychological Vitality (B = 0.52, 95% CI [0.42, 0.62], $\beta = 0.34$, $p < 0.0010$), Emotional Vitality (B = 0.41, 95% CI [0.32, 0.51], $\beta = 0.29$, $p < 0.0001$), and Spiritual Vitality (B = 0.53, 95% CI

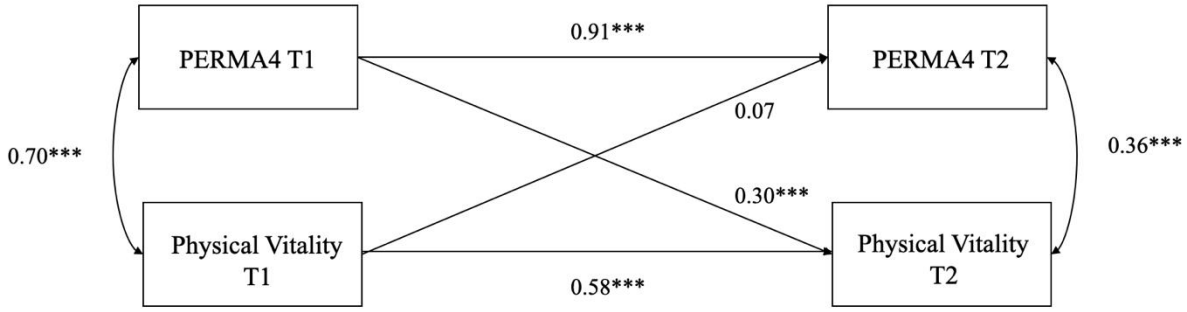
[0.42, 0.64], $\beta = 0.33$, $p < 0.0001$), whereas neither Worker Vitality nor any of its subcomponents exhibited significant cross lagged direct effects on PERMA+4, indicating some preliminary evidence for the relational directionality implied by the cross-sectional mediation models discussed above, supporting all hypotheses. For a graphical depiction of and summaries of model parameters, including standardizes autoregressive and cross-lagged direct effects, as well as cross-sectional intercorrelations between PERMA+4 and Worker Vitality constructs, see Figures 2-6. For a summary of cross-sectional intercorrelations Worker Vitality constructs, see Tables A12 (time 1) and A13 (time 2) in the Appendix.

Figure 2. WVS cross-lagged panel model



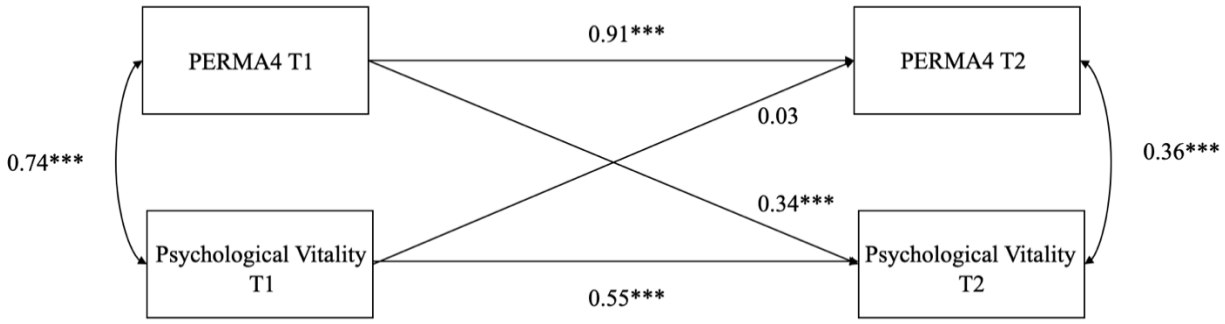
Note. *p< 0.05, **p< 0.01, *** p<0.001.

Figure 3. Physical Vitality cross-lagged panel model



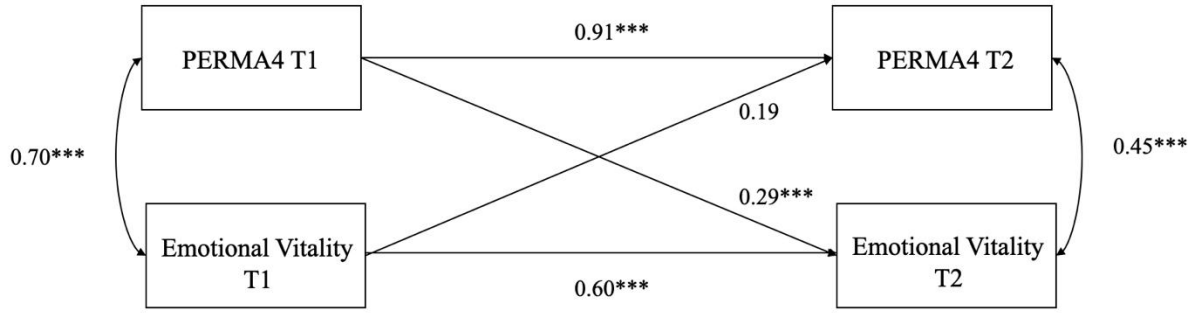
Note. *p< 0.05, **p< 0.01, *** p<0.001.

Figure 4. Psychological Vitality cross-lagged panel model



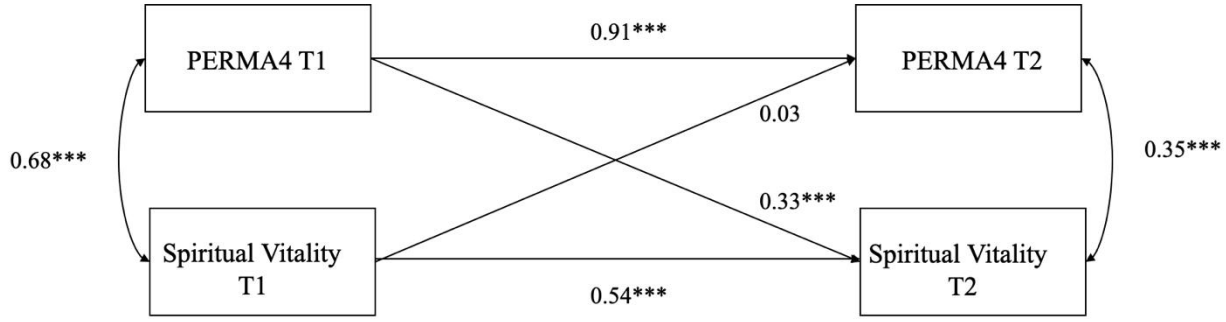
Note. *p< 0.05, **p< 0.01, *** p<0.001.

Figure 5. Emotional Vitality cross-lagged panel model



Note. *p< 0.05, **p< 0.01, *** p<0.001.

Figure 6. Spiritual Vitality cross-lagged panel model



Note. *p< 0.05, **p< 0.01, *** p<0.001.

4. Discussion

Our study identified four key subfactors of vitality—physical, psychological, emotional, and spiritual—that are broadly applicable to all workers, offering compelling evidence for its effectiveness as a comprehensive Worker Vitality Scale (WVS). Our research builds upon the foundational insights of Lomas et al., who highlighted the multidimensional nature of vitality to encompass spirit (Lomas et al., 2022). While their work provided a rich conceptual framework for understanding vitality across cultures, it remained largely descriptive, focusing on the historical and linguistic roots of vitality without formalizing these dimensions into measurable constructs. By integrating their insights into our empirical work, we address this gap by operationalizing spiritual vitality as a distinct, measurable component within the Worker Vitality Scale (WVS).

We explored three different models to see which best captured the concept of worker vitality. The first model treated Physical, Psychological, Emotional, and Spiritual Vitality constituting a single overall Worker Vitality factor. The second model treated these four factors as distinct, but interrelated through their connection to a higher order, overall Worker Vitality factor. The third model went a step further by considering additional unique correlations among the four factors beyond those accounted for by overall Worker Vitality. Our analysis showed that the third model was the best fit for our data, accounting not only for the effect of overall Worker Vitality on the four vitality subfactors, but also acknowledging additional, unique connections among them. The results ultimately support the notion that worker vitality is a complex, multi-faceted construct that can be adequately assessed with the Worker Vitality Scale (WVS).

After confirming that the WVS exhibited a baseline degree of construct validity, we sought out to establish its criterion validity (the degree to which it correlates with distinct but

theoretically related constructs) with respect to PERMA+4, an extensively validated measure of wellbeing (Donaldson & Donaldson, 2021). Because we utilized longitudinal data to make these assessments, it was crucial to first assess the temporal stability of both scales' measurement structures before proceeding with explicit structural testing. As such, we carried out a series of measurement invariance tests for both scales with respect to measurement waves included in the study. These tests ultimately supported the temporal stability of both scales' measurement structures, residual covariance structures, and internal consistency reliabilities. Both scales demonstrated excellent internal consistency metrics at both measurement waves, supporting the notion that both scales are stable and reliable tools for measuring their respective constructs.

After confirming the temporal stability of both scales, we moved forward with assessing their concurrent criterion and predictive validity by specifying a series of cross-lagged panel models. These models demonstrated that PERMA+4 serves as a significant predictor both of overall Worker Vitality and of each Vitality subfactor up to two weeks into the future.

Beyond predictive validity, this study also provides evidence for the incremental validity of the newly introduced Spiritual Vitality dimension. Across both time points, Spiritual Vitality contributed unique variance to several components of PERMA+4, including Positive Emotion, Meaning, Physical Health, and Environment, beyond the effects of physical, psychological, and emotional vitality. These findings indicate that Spiritual Vitality is not merely a conceptual addition to the vitality framework but a statistically distinct and consequential dimension that explains meaningful variance in well-being outcomes that the other vitality factors do not fully capture.

Notably, the pattern of incremental contributions was highly consistent across time points, providing additional support for the stability and robustness of this dimension. The strongest positive effects emerged for Positive Emotion and Meaning, aligning with longstanding theoretical assertions that spiritual experiences and orientation are linked to deeper purpose, emotional uplift, and connectedness. Interestingly, Spiritual Vitality demonstrated a negative association with Physical Health after controlling for the other vitality dimensions. This counterintuitive pattern warrants further study, as it may reflect complex interactions among meaning-making processes, perceived health, coping strategies, or boundary conditions in worker populations.

Taken together, these results strengthen the argument that Spiritual Vitality represents a psychometrically valid, empirically distinct, and theoretically important contributor to worker well-being. They also directly address a longstanding gap in Western approaches to vitality, which have historically overlooked the spiritual dimension despite its prominence in Eastern frameworks and in emerging cross-cultural scholarship. The incremental validity evidence positions Spiritual Vitality as a vital addition to comprehensive models of worker functioning and provides a strong empirical foundation for future research exploring how spiritual resources support thriving at work. The results of this multi-wave test of concurrent criterion validity establish a crucial psychometric property of the WVS that serves to position the scale as a powerful tool for supporting replicable science surrounding the study of Vitality and Well-Being.

These findings suggest that PERMA+4 is a strong predictor of Worker Vitality, highlighting the importance of considering overall well-being when assessing worker vitality. This supports the use of PERMA+4 in understanding and enhancing worker vitality, providing a solid foundation for further research and application in workplace well-being initiatives.

Our findings suggest that WVS has great promise for helping researchers develop a deeper understanding of the ways vitality can be defined and measured in future positive psychology research in the workplace. Previous measures of vitality have not included all four important

factors that the WVS encompasses. The WVS gives researchers and practitioners a more expanded way to research and evaluate the four factors of vitality including antecedents and outcomes of the individual factors. These findings have important implications for how we understand and measure worker vitality. The validation of the WVS suggests that efforts to improve worker vitality should address all four dimensions – physical, psychological, emotional, and spiritual. The strong connections among these dimensions indicate that improving one area can positively influence the others. By accurately measuring vitality, practitioners can help safeguard employees against burnout and enhance their performance, well-being, and positive functioning both at work and beyond. Moreover, the WVS serves as a valuable tool for personal development, enabling workers to assess and monitor changes in their vitality over time.

4.1 Strengths, limitations and future directions

This study possesses several strengths that enhance its robustness and contribute to its validity. The comprehensive approach to validation, including preliminary evidence of construct validity and generalizability across leadership status, gender, and race/ethnicity, along with a thorough examination of both concurrent and predictive criterion validity, reinforces the credibility of the findings. The longitudinal design, assessing correlations at two distinct time points and employing cross-lagged panel modeling to test the longitudinal prediction of Worker Vitality by PERMA+4, adds to the study's strength by demonstrating the stability and consistency of these relationships over time. Additionally, the large sample size and significant p-values across multiple constructs provide robust statistical support for the conclusions drawn. These strengths collectively underscore the study's methodological rigor and its significant contributions to the understanding of worker well-being and vitality.

One consideration of the current study surrounds the hypothesized substructure of Vitality and the Worker Vitality Scale's ability to distinguish between its four theorized subcomponents. Despite statistical evidence supporting four subfactors of Worker Vitality over a simpler structure in which all items of the WVS loaded onto a single Vitality factor, high residual correlations between subcomponents like Emotional and Psychological vitality may imply more mixed evidence surrounding the scale's ability to differentiate between the two constructs. Research has shown that such inflated correlations may result from several factors related to the use of traditional survey methods for data collection, such as self-report and mono-method bias (Donaldson et al. 2021). As such, future research may benefit from employing mixed methods to conduct multitrait-multimethod analyses to gather more explicit confirmatory evidence of the Worker Vitality Scale's discriminant validity.

One particularly exciting feature of the current study is the specific employment of cross-lagged panel modeling to analyze the relational structure between PERMA+4 and Worker Vitality across time. This analytic approach is a powerful tool for causal inference, ultimately establishing preliminary evidence of the causal direction between PERMA+4 and Worker Vitality. The current study demonstrated greater evidence for such directionality flowing from PERMA+4 to Worker Vitality than the reverse. As such, this work goes beyond establishing evidence for concurrent criterion validity to explicitly supporting the predictive criterion validity of PERMA+4 and Worker Vitality.

Although this study offers a rigorous and multifaceted validation of the Worker Vitality Scale (WVS), several limitations warrant consideration. First, while cross-lagged panel models (CLPMs) provided preliminary evidence for the temporal ordering between PERMA+4 and Worker Vitality, traditional CLPMs cannot disentangle stable trait variance, occasion-specific state variance, and autoregressive carryover effects (Lucas, 2023; Nesselroade, 1991). As a result,

cross-lagged paths may conflate these sources of variability, limiting the degree to which directional associations can be interpreted as causal. More advanced longitudinal models, such as Random-Intercept CLPMs or STARTS models, require at least three measurement waves and full latent-variable estimation but allow researchers to partition trait, state, and autoregressive components more precisely. Future work employing multi-wave, SEM-based longitudinal designs—potentially estimated through Bayesian methods to overcome common convergence issues (Lüdtke et al., 2018)—would enable more rigorous tests of the temporal dynamics linking well-being and vitality.

Second, although the present study controlled for autoregressive effects, it did not undertake a comprehensive examination of potential confounds that could drive associations between PERMA+4 and Worker Vitality. As with all non-experimental longitudinal designs, the relationships observed remain correlational. Stronger causal inference will require experimental manipulations, naturalistic interventions, or longer-term longitudinal studies that can more effectively isolate and rule out competing explanations.

Third, this study focused on establishing the structural, concurrent, predictive, and incremental validity of the newly developed WVS—particularly the incremental contribution of Spiritual Vitality relative to other WVS dimensions. In doing so, we intentionally limited our scope to validating the scale against PERMA+4 as a theoretically proximal and conceptually relevant well-being framework. The study did not evaluate whether the WVS predicts broader workplace outcomes such as job satisfaction, performance, or productivity. Although these outcomes were not the focal constructs of the current validation effort and would require separate data collection, examining the WVS's incremental validity relative to established vitality measures in predicting meaningful workplace outcomes is an important next step. Future research should test whether the WVS—particularly the spiritual dimension—explains unique variance in distal outcomes beyond what is captured by existing vitality scales.

Fourth, this study did not explore potential mechanisms through which PERMA+4 components may exert their influence on Worker Vitality. Mediation models assessing the indirect effects of individual PERMA+4 components on vitality dimensions may illuminate pathways of influence and further refine theoretical understanding. This represents another promising direction for future research.

Finally, although measurement invariance testing demonstrated that the WVS functions equivalently across gender, leadership status, race/ethnicity, and time, the study's sampling frame was limited to U.S.-based full-time workers. Cultural norms and values influence the experience and expression of vitality, particularly spiritual vitality; therefore, future cross-cultural validation studies are essential to establishing global generalizability.

4.2 Conclusion

Employees face unique challenges and demands on their energy resources and need to maintain their vitality and well-being to meet the requirements of their work and personal lives. Vitality can provide a foundation of energy resources that enable employees to perform at their full capacity and protect them from burnout. This study introduces an expanded measure of overall vitality with four sub-factors: physical vitality, psychological vitality, emotional vitality, and spiritual vitality. Our study supports the WVS as a comprehensive measure of worker vitality and highlights the importance of a holistic approach to employee well-being. By recognizing and fostering the various dimensions of vitality, organizations can create a more supportive and thriving work environment. We are hopeful that over time the WVS will become a useful measure for assessing employee vitality and for developing a better understanding of employee well-

being, positive functioning at work, and positive organizational psychology 2.0 (Donaldson et al., 2021).

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Ethical approval

The studies involving human participants were reviewed and approved by Internal Review Board at Claremont Graduate University. The patients/participants provided their written informed consent to participate in this study.

AI statement

AI was used to improve the grammar and readability of our work. All original ideas, theoretical frameworks, empirical analyses, and final interpretations were conceived, verified, and approved by the authors.

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article. Data will be shared upon request.

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Appendix

Table A1. Residual correlations between subdimensions of Worker Vitality

	WVS Physical	WVS Psychological	WVS Emotional	WVS Spiritual
WVS Physical	-			
WVS Psychological	0.93	-		
WVS Emotional	0.75	0.95	-	
WVS Spiritual	0.72	0.85	0.80	-

Note. All Residual correlations were significant at the 0.0001 level.

Table A2. Reliability Measures

Reliability Measure	WVS Physical	WVS Psychological	WVS Emotional	WVS Spiritual	WVS
Cronbach's Alpha	0.89	0.90	0.90	0.91	0.97
Hierarchical Omega	0.91	0.91	0.90	0.89	0.97

Table A3. Measurement invariance testing across leadership status

Invariance Class	CFI	TLI	RMSEA	SRMR	AIC	BIC	$\Delta\chi 2$	Δdf	p
Configural	0.950	0.936	0.086	0.034	33921	34468	*NA*	*NA*	*NA*
Metric	0.948	0.939	0.084	0.041	33905	34382	14.29	15	0.504
Scalar	0.947	0.940	0.084	0.041	33919	34344	35.89	11	<0.0001
Strict	0.945	0.943	0.082	0.047	33934	34283	46.28	16	<0.0001
Covariance	0.945	0.944	0.081	0.047	33922	34242	0.05	6	1.000

Table A4. Measurement invariance testing across Gender

Invariance Class	CFI	TLI	RMSEA	SRMR	AIC	BIC	$\Delta\chi 2$	Δdf	p
Configural	0.946	0.931	0.089	0.036	33794	34342	*NA*	*NA*	*NA*
Metric	0.945	0.935	0.086	0.040	33772	34249	7.74	15	0.934
Scalar	0.940	0.932	0.088	0.046	33829	34254	79.21	11	<0.0001
Strict	0.936	0.934	0.087	0.054	33871	34220	73.55	16	<0.0001
Covariance	0.935	0.934	0.087	0.083	33869	34190	10.07	6	0.122

Table A5. Measurement invariance testing across Race/Ethnicity

Invariance Class	CFI	TLI	RMSEA	SRMR	AIC	BIC	$\Delta\chi 2$	Δdf	p
Configural	0.947	0.932	0.089	0.034	33987	34534			
Metric	0.946	0.936	0.087	0.047	33977	34454	20.54	15	0.152
Scalar	0.944	0.938	0.085	0.057	33982	34407	26.77	11	0.005
Strict	0.947	0.945	0.080	0.057	33967	34316	16.87	16	0.394
Covariance	0.945	0.944	0.081	0.061	33956	34276	0.45	6	0.998

Table A6. WVS time-wise reliability measures

Time 1 Reliability Measure	WVS Physical	WVS Psychological	WVS Emotional	WVS Spiritual	WVS
Cronbach's Alpha T1	0.89	0.89	0.90	0.90	0.97
Hierarchical Omega T1	0.91	0.90	0.90	0.89	0.97
Cronbach's Alpha T2	0.90	0.91	0.91	0.91	0.97
Hierarchical Omega T2	0.90	0.91	0.91	0.89	0.98

Table A7. PERMA+4 time-wise reliability measures

Time 1 Reliability Measure	PE	E	PR	M	A	PH	MI	WE	ES	PERMA+4
Cronbach's Alpha T1	0.93	0.77	0.89	0.92	0.75	0.85	0.83	0.59	0.86	0.94
Hierarchical Omega T1	0.94	0.78	0.90	0.95	0.77	0.86	0.89	0.45	0.87	0.95
Cronbach's Alpha T2	0.93	0.80	0.91	0.93	0.73	0.83	0.84	0.60	0.85	0.94
Hierarchical Omega T2	0.93	0.80	0.91	0.90	0.75	0.82	0.84	0.47	0.89	0.93

Table A8. Composite correlations between PERMA+4 and Leader Vitality Scales at time 1

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.PERMA+4														
2.PE	.87**													
3.E	.51**	.45**												
4.R	.78**	.67**	.34**											
5.M	.79**	.76**	.41**	.59**										
6.A	.78**	.65**	.42**	.56**	.63**									
7.PH	.65**	.41**	.19**	.41**	.35**	.52**								
8.MI	.87**	.81**	.41**	.64**	.71**	.69**	.45**							
9.ENV	.64**	.50**	.17**	.42**	.44**	.39**	.41**	.50**						
10.ES	.61**	.41**	.17**	.35**	.31**	.35**	.44**	.46**	.29**					
11.WVS	.76**	.63**	.24**	.57**	.49**	.64**	.68**	.62**	.51**	.49**				
12.Physical	.68**	.53**	.17**	.50**	.39**	.57**	.70**	.53**	.48**	.48**	.93**			
13.Psych	.74**	.60**	.22**	.56**	.48**	.62**	.67**	.60**	.48**	.50**	.96**	.88**		
14.Emotion	.74**	.61**	.26**	.59**	.50**	.64**	.64**	.60**	.48**	.43**	.93**	.81**	.88**	
15.Spiritual	.69**	.62**	.23**	.50**	.49**	.58**	.52**	.58**	.49**	.41**	.90**	.75**	.82**	.81**

Note. * indicates $p < .05$. ** indicates $p < .01$.

Table A9. Composite correlations between PERMA+4 and Leader Vitality Scales at time 2

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.PERMA+4														
2.PE	.86**													
3.E	.60**	.50**												
4.R	.78**	.64**	.41**											
5.M	.78**	.77**	.47**	.57**										
6.A	.76**	.62**	.45**	.56**	.56**									
7.PH	.65**	.39**	.30**	.40**	.33**	.54**								
8.MI	.86**	.79**	.43**	.68**	.71**	.65**	.48**							
9.ENV	.57**	.45**	.28**	.34**	.37**	.36**	.33**	.41**						
10.ES	.64**	.42**	.22**	.40**	.33**	.38**	.43**	.47**	.26**					
11.WVS	.77**	.61**	.36**	.55**	.48**	.67**	.71**	.61**	.48**	.48**				
12.Physical	.71**	.54**	.33**	.50**	.39**	.60**	.72**	.54**	.46**	.48**	.92**			
13.Psych	.74**	.58**	.33**	.52**	.47**	.67**	.71**	.61**	.44**	.49**	.95**	.86**		
14.Emotion	.71**	.57**	.32**	.54**	.46**	.62**	.66**	.58**	.44**	.42**	.93**	.78**	.86**	
15.Spiritual	.69**	.59**	.36**	.50**	.48**	.59**	.54**	.55**	.45**	.41**	.91**	.76**	.81**	.81**

Note. * indicates p < .05. ** indicates p < .01.

Table A10. Summary of time 1 multiple regression statistics

DV	Vitality Component	β	SE	t	p
PERMA4	Phys	0.203	0.063	3.23	0.001**
	Psych	0.302	0.078	3.857	<0.0001**
	Emotional	0.171	0.068	2.528	0.012*
	Spiritual	0.15	0.06	2.523	0.012*
Positive Emotion	Phys	0.044	0.077	0.567	0.571
	Psych	0.2	0.096	2.072	0.039*
	Emotional	0.115	0.083	1.376	0.17
	Spiritual	0.302	0.073	4.114	<0.0001**
Engagement	Phys	0.104	0.091	1.14	0.255
	Psych	-0.006	0.114	-0.056	0.955
	Emotional	0.036	0.099	0.361	0.718
	Spiritual	0.26	0.087	2.986	0.003**
Relationships	Phys	0.108	0.082	1.321	0.187
	Psych	0.117	0.102	1.143	0.254
	Emotional	0.265	0.088	2.998	0.003**
	Spiritual	0.104	0.078	1.342	0.181
Meaning	Phys	-0.102	0.085	-1.204	0.229
	Psych	0.223	0.106	2.101	0.036*
	Emotional	0.127	0.092	1.38	0.168
	Spiritual	0.271	0.081	3.345	0.001**
Accomplishment	Phys	0.047	0.073	0.653	0.514
	Psych	0.443	0.09	4.898	<0.0001**

DV	Vitality Component	β	SE	t	p
	Emotional	0.122	0.078	1.553	0.121
	Spiritual	0.097	0.069	1.4	0.162
Physical Health	Phys	0.463	0.064	7.281	<0.0001**
	Psych	0.339	0.079	4.275	<0.0001**
	Emotional	0.242	0.069	3.53	<0.0001**
	Spiritual	-0.287	0.061	-4.738	<0.0001**
Mindset	Phys	0.004	0.077	0.047	0.963
	Psych	0.375	0.096	3.898	<0.0001**
	Emotional	0.166	0.083	1.988	0.047*
	Spiritual	0.106	0.073	1.443	0.15
Environment	Phys	0.229	0.086	2.668	0.008**
	Psych	-0.002	0.107	-0.018	0.986
	Emotional	0.097	0.093	1.048	0.295
	Spiritual	0.199	0.082	2.427	0.016
Economic Security	Phys	0.241	0.085	2.839	0.005**
	Psych	0.34	0.106	3.218	0.001**
	Emotional	-0.077	0.092	-0.841	0.401
	Spiritual	0.015	0.081	0.186	0.852

Note. * indicates p < .05. ** indicates p < .01. All coefficients represent standardized estimates. As such, intercept estimates are equal to zero and are thus omitted for brevity.

Table A11. Summary of time 2 multiple regression statistics

DV	Vitality Component	β	SE	t	p
PERMA4	Phys	0.087	0.067	1.305	0.193
	Psych	0.243	0.085	2.854	0.005*
	Emotional	0.333	0.071	4.72	<0.0001*
	Spiritual	0.151	0.059	2.56	0.011*
Positive Emotion	Phys	-0.052	0.08	-0.659	0.51
	Psych	0.153	0.101	1.518	0.13
	Emotional	0.262	0.084	3.125	0.002*
	Spiritual	0.317	0.07	4.504	<0.0001*
Engagement	Phys	-0.129	0.101	-1.282	0.201
	Psych	0.019	0.128	0.145	0.884
	Emotional	0.273	0.106	2.582	0.01*
	Spiritual	0.089	0.089	1.003	0.316
Relationships	Phys	-0.02	0.084	-0.24	0.81
	Psych	0.162	0.106	1.519	0.129
	Emotional	0.45	0.088	5.099	<0.0001*
	Spiritual	0.021	0.074	0.29	0.772
Meaning	Phys	-0.219	0.088	-2.481	0.014*
	Psych	0.195	0.112	1.736	0.083
	Emotional	0.316	0.093	3.401	0.001*
	Spiritual	0.239	0.078	3.068	0.002*

DV	Vitality Component	β	SE	t	p
Accomplishment	Phys	0.025	0.079	0.318	0.751
	Psych	0.183	0.101	1.823	0.069
	Emotional	0.354	0.083	4.249	<0.0001*
	Spiritual	0.124	0.07	1.778	0.076
Physical Health	Phys	0.475	0.072	6.588	<0.0001*
	Psych	0.233	0.092	2.551	0.011*
	Emotional	0.234	0.076	3.09	0.002*
	Spiritual	-0.223	0.064	-3.512	<0.0001*
Mindset	Phys	-0.04	0.081	-0.487	0.626
	Psych	0.229	0.103	2.221	0.027*
	Emotional	0.277	0.085	3.24	0.001*
	Spiritual	0.196	0.072	2.73	0.007*
Environment	Phys	0.206	0.089	2.312	0.021*
	Psych	0.002	0.113	0.016	0.987
	Emotional	0.116	0.094	1.236	0.217
	Spiritual	0.237	0.079	3.013	0.003*
Economic Security	Phys	0.194	0.09	2.158	0.032*
	Psych	0.37	0.114	3.234	0.001*
	Emotional	-0.059	0.095	-0.619	0.537
	Spiritual	0.012	0.08	0.146	0.884

Table A12. CLPM-implied correlations between WVS composite measures at time 1

Variable	WVS	WVS Physical	WVS Psychological	WVS Emotional	WVS Spiritual
WVS	-				
WVS Physical	0.92	-			
WVS Psychological	0.96	0.86	-		
WVS motional	0.93	0.79	0.87	-	
WVS Spiritual	0.91	0.77	0.83	0.82	-

Note. All estimates are significant at the 0.0001 level.

Table A13. CLPM-implied residual correlations between WVS composite measures at time 2

Variable	WVS	WVS Physical	WVS Psychological	WVS Emotional	WVS Spiritual
WVS	-				
WVS Physical	0.85	-			
WVS Psychological	0.86	0.67	-		
WVS motional	0.82	0.58	0.62	-	
WVS Spiritual	0.76	0.51	0.52	0.55	-

Note. All estimates are significant at the 0.0001 level.