

Normative values and cut-points for online administration of the Personal Wellbeing Index: A nationally representative study of Australian adults

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Abstract

Background

The Personal Wellbeing Index (PWI) is one of the most widely used measures of subjective wellbeing worldwide, with population norms estimated from randomly recruited phone samples. With survey administration almost exclusively shifting online, updated norms are needed to maintain contemporary relevance. Using an Australian adult sample, we established online population-level norms, individual cut-points for low and at-risk subjective wellbeing, and evaluated the discriminant validity of PWI relative to psychological distress.

Methods

We analysed cross-sectional population-representative data of 9948 Australian adults (≥ 18 years), primarily recruited via a probability-based online panel in June 2025. PWI normative values were derived from the bootstrapped 95% confidence intervals around the population mean. Receiver operating curve analyses were used to identify PWI cut-points to discriminate individuals with elevated mental distress on the 21-item Depression Anxiety and Stress Scale.

Results

The population-weighted mean PWI score was 67.1 percentage points ($sd = 0.7$; 95%CI:65.8–68.4). The PWI showed excellent discriminatory capacity for the depression subscale (area under the curve range:0.79–0.93), with scores of 50 and 65 identifying ‘low’ and ‘at-risk’ subjective wellbeing, respectively. Supporting the dual continua model of mental health, a substantial proportion (8.8%) of individuals experience low wellbeing without elevated depression symptoms, while a smaller group (3.4%) experienced adequate wellbeing ($PWI > 50$) with depression symptoms.

Conclusions

This national study establishes benchmarks for the online-administered PWI to identify low subjective wellbeing in individuals and populations. These findings give policy makers and practitioners a tool to track and monitor wellbeing at both population and individual levels. Our findings found that low wellbeing and signs of depression do not always cooccur suggesting they are distinct aspects of mental health. We recommend measuring subjective wellbeing and mental distress concurrently in population health monitoring and by community mental health services to capture at-risk individuals missed by distress measures alone.

BACKGROUND

Subjective wellbeing, or how one feels about their life, is a key marker of societal progress, increasingly used to complement traditional economic indicators, such as Gross Domestic Product [1, 2]. Throughout the ages and across cultures, subjective wellbeing, henceforth referred to as wellbeing, has been

conceptualised through hedonic and evaluative lenses [3], encompassing both cognitive (e.g. life satisfaction judgments) and affective components (e.g. positive and negative emotional states) [4].

The Organisation for Economic Co-operation and Development's (OECD) recommendations for measuring wellbeing include these core concepts alongside domain-specific life evaluation, for which it recommends the Personal Wellbeing Index (PWI). The PWI assesses satisfaction across seven life domains (e.g. standard of living and community connectedness), generating scores from 0 to 100 percentage points (pp), with higher scores indicating greater wellbeing [1, 5]. This measure has shown acceptable psychometric properties in classical factor analysis [6] and item-response theory approaches [7–12]. Studies also support a unidimensional structure, threshold reliability estimates, and longitudinal stability at both individual and population levels.

However, despite its global use, nationally representative population norms have predominantly been established for telephone administration of the PWI. Comparable norms for online administration are only available in the UK, derived from a small sample of 2,000 adults [13]. This is a significant limitation for benchmarking and group comparisons, given the increasing dominance of online data collection methods [14]. In addition, PWI cut-points for individuals indicating low wellbeing have typically been derived from small non-representative samples (e.g. clinical samples or biased towards older cohorts) [15, 16], limiting meaningful understanding of individuals experiencing low wellbeing.

In Australia, the PWI has been used in one of the longest-running national surveys of subjective wellbeing worldwide, the Australian Unity Wellbeing Index (AUWI) [17]. From 2001 to 2023, the AUWI survey was delivered by phone, with respondents recruited via random-digit dialling, the 'gold-standard' method at the time [18]. Each year from 2003 to 2023, population normative ranges for the phone-delivered PWI were recalculated using the mean and two standard deviation range of all available annual survey means to that point. In 2023, the PWI norm in the Australian population via phone interview was 75.4pp (95%CI: 74.1–76.8) [6].

Due to declining recruitment rates, the AUWI survey transitioned from phone to online data collection in 2024 using both random-digit dialling and Australia's only online probability-based panel, Life in Australia™ [18, 19]. Concurrent data collection revealed a substantial mode effect, with PWI scores via phone interview ($M = 74.7\text{pp}$, $SD = 13.4$) averaging 7.4pp higher than online survey scores ($M = 67.3\text{pp}$, $SD = 17.6$), despite both samples sharing similar socio-demographic characteristics [18]. Similar mode effects have been observed in other wellbeing studies [20, 21], and are primarily attributable to social desirability bias in interviewer-administered surveys and differences in response styles across modes [22, 23]. Despite both methods employing probability-based sampling, these mode-specific biases highlight the need for contemporary population-level PWI norms for online administration.

As subjective wellbeing measurement is increasingly utilised in research and practice [1], there is also a need to interpret individual-level PWI scores in community settings. To date, PWI cut-points representing low wellbeing have been derived from paper-based surveys using homeostatic-protected mood theory. This theory posits that each person's wellbeing is normally maintained within a restricted positive range

around their genetically determined setpoint [24, 25]. These theoretically derived thresholds classify phone-based PWI scores as normal/homeostatic (≥ 70 pp), challenged (50–69pp), or defeated (≤ 49 pp) wellbeing, without reference to clinical conditions or symptomatology [6].

For the WHO-5 Wellbeing Index, another widely used wellbeing measure, receiver operating curve (ROC) analysis has been employed to determine cut-points associated with depression symptoms [26]. ROC analysis can similarly establish PWI cut-points indicative of low wellbeing. At the same time, the method can examine the dual-continua model of mental health [27], whereby wellbeing and mental distress are considered to be related yet distinct dimensions rather than opposite ends of a single continuum. The model suggests that individuals with high wellbeing can experience mental distress, while those with low wellbeing may not necessarily experience simultaneous distress [28]. The latter group are referred to as '*languishing*', with elevated risk of adverse mental and physical health outcomes [29]. This distinction carries significant implications given that the promotion of wellbeing to build positive resources (e.g. belonging), and prevention of mental distress (e.g. addressing risk factors of adverse childhood events), require different approaches and resource allocation strategies [30].

The purpose of this study was to use PWI data from a large nationally representative sample of Australian adults to: 1) establish normative values for the online administration of the PWI, 2) identify cut-points for low and at-risk wellbeing at the individual level, and 3) evaluate the discriminant validity of the PWI relative to psychological distress, consistent with the dual-continua framework of mental health.

METHODS

Study design and participants

This study draws on cross-sectional AUWI survey data collected on 10046 Australian adults in June 2025. Eligible participants were aged 18 years or older and able to read English. Participants were recruited using two online research panels: 1) Life in Australia™ ($n = 7908$, 78.7%), Australia's only online probability-based panel, and 2) LiveTribe ($n = 2138$, 21.3%), a supplementary non-probability panel used to boost sampling in adults aged 18–35 years and reach the targeted sample size of 10,000. The survey was administered to the full Life in Australia™ panel (10,205 members) between 2 and 15 June 2025, yielding a completion rate of 77.5%, and to the LiveTribe panel (34,041 members) between 17 and 28 June, yielding a 6.3% completion rate.

Recruitment to the Life in Australia™ panel, managed by Social Research Centre, occurs via random sampling methods such as address-based sampling and SMS invitation, with characteristics and recruitment methods reported previously [19]. The LiveTribe panel, managed by i-Link Research, uses opt-in sampling methods including print and online marketing initiatives [31]. Participants received an incentive equivalent to AUD\$3–10 for survey completion.

Figure 1 describes the participant flow. A small proportion of the Life in Australia™ sample ($n = 80$, 0.8%) unable to complete the survey online, completed the survey by phone and were excluded from the

analysis to maintain mode consistency. Additionally, participants with missing PWI data (0.2%) were excluded. Full details of the AUWI methodology are published elsewhere [32]. This study received Deakin University ethics approval (HEAG-H 45_2016).

Measures

Subjective wellbeing

The PWI assessed subjective wellbeing across seven domains: standard of living, health, achieving in life, relationships, safety, community connectedness, and future security [6]. Items were rated on an 11-point satisfaction scale (0 = No satisfaction at all, 10 = Completely satisfied) and averaged to produce a composite PWI score rescaled to 0-100, with higher scores representing higher subjective wellbeing. Contrary to the PWI Manual guidelines [6], scale extreme values (0s and 100s) were retained. This decision was made to preserve the full distribution of subjective wellbeing scores and avoid systematic exclusion of genuine extreme experiences.

Depression, anxiety and stress symptoms

The 21-item Depression Anxiety and Stress Scale (DASS-21) was used to measure mental distress symptomology [33]. The DASS-21 has been well validated [34], with Rasch analysis of the subscales demonstrating item-parameter invariance [35]. For our study, ordinal reliability for subscales of depression, anxiety and stress were .97, .94 and .94, respectively. We examined the total score and its three subscales (depression, stress and anxiety; each 7 items).

Data analysis

Weighting of survey results

Data were weighted to population benchmarks [36]. Base weights were assigned according to each participant's combined probability of selection (i.e. enrolment weight) and likelihood of response (i.e. response propensity weight), correcting for sampling design and non-response bias. This was then calibrated to match Australian Bureau of Statistics' most recently available demographic distributions, including age, gender, education, household size, language spoken at home, and geographic location [18].

Bootstrapped sampling to establish PWI normative range for online administration (Aim 1)

Initial PWI scale validation was performed in Stata 16 [37]. Polychoric correlations and confirmatory factor analysis established reliability and internal consistency, and a weighted item-response theory

graded response model evaluated psychometric properties of the polytomous scale (Supplementary Material A) [38]. Convergent validity was supported via a single-stepped robust multiple regression model fitting each PWI item to explain a measure of overall life satisfaction ('How satisfied are you with your life as a whole?') [6].

Population normative means and 95% CIs for the PWI and scale items were estimated in R (version 4.5.2) using survey weights and a weighted non-parametric percentile bootstrap approach [39]. A sensitivity analysis utilising a range of replications (20000 to 100000) and sampling sizes (1000 to 7000, with replacement) was conducted to ensure the stability of estimates and confidence intervals (Supplementary Material B).

PWI cut-points for symptoms of mental distress and evidence for dual continua (Aim 2 and 3)

Composite PWI scores were dichotomised at cut-points ranging from 25 to 75 in 5-point increments. Empirical (non-parametric) ROC analyses examined the discriminative ability of each DASS-21 subscale and total score in classifying low PWI, with area under the curve (AUC) estimated using the DeLong, DeLong, and Clarke-Pearson approach [40]. The subscale or total score with the highest AUC was selected as the primary measure for cut-point recommendations and predictive value analyses.

Equivalent DASS-21 scores at each PWI cut-point were calculated using Youden's Index ($J = \text{sensitivity} + \text{specificity} - 1$), which identified the scores that maximise distance of the ROC from the chance diagonal [41]. The positive predictive value (PPV) and negative predictive value (NPV) were calculated at each PWI cut-point. In this article we present the unweighted results for Aim 2 and 3; sensitivity analyses confirmed weighted results did not meaningfully differ from the unweighted (Supplementary Material C).

RESULTS

Compared to the Australian population [36], our unweighted analytical sample ($n = 9948$; mean age 47.15, $sd = 17.83$) were more likely to identify as female, be university educated, live in more socioeconomically advantaged areas, be full-time employed, or own their homes. Our sample also had fewer participants aged 25–54 years or over 75 years, and from non-English speaking households or born in non-English speaking countries (Table 1).

PWI normative range (Aim 1)

Descriptive statistics for the PWI and its individual items in the online sample are provided in Supplementary Material D, showing standard subjective wellbeing patterns (negative skew and concentration around the mean), properties (factor structure and reliability) [6, 11], and convergent validity to an overall life satisfaction item (Supplementary Material A). Residual correlations revealed local dependencies between the following items: *Standard of living* and *Community connectedness* ($r_p = .26$), *Health* and *Future security* ($r_p = .22$), and *Achieving in life* and *Personal safety* ($r_p = .27$). The

normative mean was stable across all sample sizes and replications conditions in bootstrapped sampling (Supplementary Material B).

Table 1
Sample characteristics of online survey respondents.

Sample characteristics	n (%)	Population Norms ^a (%)
Gender		
Male	4391 (44.2)	48.8
Female	5474 (55.1)	51.2
Non-binary/gender diverse	75 (0.8)	NA
Age group (years)		
18–24	1107 (11.1)	10.8
25–34	1716 (17.3)	18.2
35–44	1622 (16.3)	17.5
45–54	1495 (15.0)	16.3
55–64	1641 (16.5)	15.1
65–74	1631 (16.4)	12.4
75+	727 (7.4)	9.6
Gross household income (\$AUD)		
≤\$33 799	1341 (13.9)	16.3
\$33 800-\$64 999	1822 (18.9)	20.1
\$65 000-\$103 999	2251 (23.4)	19.5
\$104 000-\$155 999	1832 (19.0)	19.8
\$156 000-\$207 999	1169 (12.1)	17.7
≥\$208 000	1222 (12.7)	6.6
Housing tenure		
Renting	2424 (24.3)	29.3
Own outright	3541 (35.5)	30.8
Own with a mortgage	3570 (35.8)	38.1
Note: Totals range from 9963 – 9942 due to missing data. DASS-21 = Depression, Anxiety and Stress Scale – 21 item. NA = Not applicable. SEIFA-IRSAD = Socio-Economic Indexes for Areas - Index of Relative Socio-economic Advantage and Disadvantage. ^a Australian Bureau of Statistics 2021 Census data[36]. ^b Weighted scores.		

Sample characteristics	<i>n</i> (%)	Population Norms^a (%)
Gender		
Other	393 (4.0)	1.8
Education		
Bachelors qualification and above	5465 (55.1)	29.9
Employment status		
Full-time	4333 (43.6)	35.5
Part-time	1830 (18.4)	18.7
Not in labour force	3052 (30.7)	36.8
Unemployed	342 (3.4)	2.9
Language spoken at home		
English	8472 (85.2)	75.9
Other than English	1470 (14.8)	24.1
Indigenous		
Aboriginal and/or Torres Strait Islander	240 (2.4)	3.3
Country of birth		
Australia	7274 (73.3)	65.1
Non-English-speaking	1493 (15.0)	24.7
English speaking	1163 (11.7)	10.2
SEIFA-IRSAD (M (SD))	1013.2 (77.9)	1000 (100.0)
PWI [pp, (M (SD))]	68.1 (17.5)	NA
DASS-21 (Median [IQR])		
Total score	20 [8–38] ^b	
Normal/Mild (0–39)	5570 (56.1)	
Moderate/Severe/Extremely severe (> 39)	4353 (43.9)	
Note: Totals range from 9963 – 9942 due to missing data. DASS-21 = Depression, Anxiety and Stress Scale – 21 item. NA = Not applicable. SEIFA-IRSAD = Socio-Economic Indexes for Areas - Index of Relative Socio-economic Advantage and Disadvantage. ^a Australian Bureau of Statistics 2021 Census data[36]. ^b Weighted scores.		

Sample characteristics	<i>n</i> (%)	Population Norms ^a (%)
Gender		
Depression	6 [2–14] ^b	
Normal/Mild (0–13)	7451 (75.0)	NA
Moderate/Severe/Extremely severe (> 13)	2483 (25.0)	NA
Anxiety	4 [0–10] ^b	
Normal/Mild (0–9)	7542 (75.9)	NA
Moderate/Severe/Extremely severe (> 9)	2400 (24.1)	NA
Stress	10 [4–14] ^b	
Normal/Mild (0–18)	8588 (86.4)	NA
Moderate/Severe/Extremely severe (> 19)	1350 (13.6)	NA
Note: Totals range from 9963 – 9942 due to missing data. DASS-21 = Depression, Anxiety and Stress Scale – 21 item. NA = Not applicable. SEIFA-IRSAD = Socio-Economic Indexes for Areas - Index of Relative Socio-economic Advantage and Disadvantage. ^a Australian Bureau of Statistics 2021 Census data[36]. ^b Weighted scores.		

A sample size of 1000 was selected as the PWI normative reference standard ($M_{PWI} = 67.1pp$, 95% CI = [65.8, 68.4]). This represented an optimal balance between the sample size that is practically achievable in real-world research settings, while providing sufficient statistical stability for reliable comparisons. The normative mean ranges for the PWI and its seven items are provided in Table 2. These ranges provide benchmark parameters for comparing different population groups, they are not designed for individual score comparisons.

Table 2

Bootstrapped sampling normative values for the PWI and its seven items with the standardised sample.

PWI	M (pp)	95% CI (LL, UL)
	67.1	65.8, 68.4
Standard of living	69.5	68.0, 70.9
Health	64.7	63.2, 66.1
Achieving in life	63.5	61.8, 65.1
Personal relationships	70.8	69.1, 72.4
Personal safety	75.7	74.2, 77.1
Community connectedness	63.7	62.1, 65.4
Future security	62.2	60.4, 63.9
<i>Note.</i> Replications = 20000. Sample size = 1000. 95%CI = 95% confidence interval. LL = lower limit. UL = upper limit.		

PWI cut-points and evidence for dual-continua framework (Aims 2 and 3)

ROC analyses showed the depression subscale consistently achieved the highest AUC values (Supplementary Material C), ranging between acceptable (AUC range .79–.80) and excellent ratings (AUC $\geq$.90) [42]. Henceforth, we selected the depression subscale to identify the recommended PWI cut-point.

The positive predictive value (PPV) represents the probability that an individual scoring at or below a PWI cut-point is truly experiencing low wellbeing with depression symptoms. The negative predictive value (NPV) represents the probability that an individual scoring above a PWI cut-point truly has adequate wellbeing without depression symptoms. As PWI cut-points decreased, PPV declined and NPV increased, representing a trade-off between correctly predicting low wellbeing with distress and adequate wellbeing without distress.

A PWI score of 50 represents a meaningful boundary for low wellbeing, corresponding to the threshold at which scores first align with mild depression symptoms on the DASS-21. This showed good discriminative performance and practical utility, with 14% of the sample falling at or below a score of 50. At this cut-point, practitioners can have high confidence that individuals scoring above 50 have adequate wellbeing without depression symptoms (NPV: 96.0%; 95% CI: 95.5–96.5%), and moderate confidence that scores at or below 50 indicate depression symptoms (PPV: 37.6%; 95% CI: 35.9–39.4%).

Table 3 presents the equivalent depression score at each cut-point and associated performance characteristics. The positive predictive value (PPV) represents the probability that an individual scoring

at or below a PWI cut-point is truly experiencing low wellbeing with depression symptoms. The negative predictive value (NPV) represents the probability that an individual scoring above a PWI cut-point truly has adequate wellbeing without depression symptoms. As PWI cut-points decreased, PPV declined and NPV increased, representing a trade-off between correctly predicting low wellbeing with distress and adequate wellbeing without distress.

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Table 3

Classification performance characteristics across PWI wellbeing thresholds against the Depression subscale on the 21-item Depression Anxiety and Stress Scale.

PWI cut-point (pp)	N at or below PWI cut-point (%)	Equivalent DASS-21 depression score	AUC at cut-point	PPV (%) [95%CI]	NPV (%) [95%CI]
75	56.8	7 (Normal)	.72	82.2 [81.1, 83.4]	62.1 [60.8, 63.4]
70	45.2	7 (Normal)	.74	72.8 [71.4, 74.1]	75.2 [74.0, 76.3]
65	32.6	7 (Normal)	.76	59.1 [57.6, 60.5]	86.9 [86.0, 87.8]
60	25.4	9 (Normal)	.76	53.3 [51.7, 55.0]	90.2 [89.4, 90.9]
55	18.1	9 (Normal)	.78	41.6 [40.0, 43.2]	94.9 [94.4, 95.5]
50	14.0	11 (Mild)	.79	37.6 [35.9, 39.4]	96.0 [95.5, 96.5]
45	9.3	13 (Mild)	.80	29.4 [27.7, 31.3]	97.5 [97.1, 97.8]
40	7.1	13 (Mild)	.81	23.4 [21.7, 25.1]	98.3 [98.0, 98.6]
35	4.4	13 (Mild)	.81	15.1 [13.7, 16.5]	99.1 [98.9, 99.3]
30	3.3	17 (Moderate)	.82	17.0 [15.2, 19.0]	99.1 [98.9, 99.3]
25	2.1	19 (Moderate)	.86	14.1 [12.2, 16.1]	99.6 [99.4, 99.7]

Note: DASS-21 depression subscale scores determined by Youden's Index ($J = \text{sensitivity} + \text{specificity} - 1$), which maximizes the sum of sensitivity and specificity for each PWI cut-point. DASS-21 depression subscale scores range from 0–42, with higher scores indicating greater symptom severity; classification: Normal (0 to 9), Mild (10 to 13), Moderate, (14 to 20), Severe (21 to 27), Extremely Severe (28 and above)[34]. $n = 9934$. 95%CI = 95% confidence interval; PPV = Positive predictive value; NPV = Negative predictive value; AUC = Area under the receiver operating characteristic curve at the optimal cut-point.

Additionally, a PWI score between 50 and 65 (18.6% prevalence) provides a balanced sensitivity and specificity for identifying 'at-risk' wellbeing. At a PWI score of 65, there is better detection of depression symptoms (PPV: 59.1%; 95%CI: 57.6–60.5%), however less accurate detection of adequate wellbeing (NPV: 86.9%; 95%CI: 86.0–87.8%). Analyses for the anxiety and stress subscales and total scale score were consistent with these findings (Supplementary Material E).

A proportion of adults with low wellbeing (PWI $\leq$ 50) did not experience depression symptoms (8.8%; derived as $[1 - \text{PPV}] \times \text{sample prevalence at PWI} \leq 50$), while a smaller group reported adequate wellbeing (PWI $>$ 50) alongside depression symptoms (3.4%; derived as $[1 - \text{NPV}] \times \text{sample prevalence at PWI} > 50$). As cut-points decreased, PPV and NPV followed diverging trajectories, indicating that the PWI more accurately identified adequate wellbeing in the absence of depressive symptoms (NPV = 96.0% at PWI = 50) than low wellbeing in the presence of depression (PPV = 37.6%). This pattern suggests that personal wellbeing and depression symptoms are related but not equivalent constructs.

DISCUSSION

We provide contemporary interpretive benchmarks for the PWI estimates collected via online methods at both the population- and individual-level. Future PWI data collected on different samples of interest can be compared against these population benchmarks (i.e. PWI norms 65.8 to 68.4pp). Data on individuals can also be compared to cut-points for at-risk (PWI scores $>$ 50 to $\leq$ 65pp) and low (PWI scores $\leq$ 50pp) subjective wellbeing. Beyond these benchmarks, our findings provide evidence for the dual-continua framework of mental health and highlight the importance of capturing both wellbeing and mental distress data.

Our online normative values for the PWI in the Australian population were lower than the previously recorded phone normative value range (74.1–76.8 points) [6], in line with an expected mode effect [22]. Despite similar study designs and collection periods, our online weighted population-based normative value range for the PWI (65.8–68.4 points) is also marginally lower than observed in the UK population (range 68.0–71.4 points) [13]. This could be explained by the mode effect in the UK study including phone-based responses for participants without internet access (3.2%, personal communication) in their overall mean calculations, which were excluded from the present study (0.8%).

Our PWI cut-point of 50 for individuals with low wellbeing scores aligns with homeostatic protective mood theory and its defined range of 'defeated' wellbeing, indicating that participants who scored at or below 50 were experiencing 'homeostatic defeat' in their capacity to maintain personal wellbeing [6]. However, current homeostatic protective theory thresholds were derived from studies employing variable methodologies, non-representative populations and multiple survey modes, limiting their precision [24, 25]. Future research utilising a longitudinal, representative study design to establish wellbeing set-points would validate if the present study's cut-points correspond to theoretically defined homeostatic defeat.

Our findings extend the literature examining the classification performance of wellbeing measures against psychological distress. Consistent with previous research reporting a proportion of individuals

with low wellbeing and low distress [43–45], our results suggest the relationship between wellbeing and distress is not on a single continuum. We observed that 8.8% of the population had ‘low’ wellbeing (PWI ≤ 50 pp) without depressive symptoms. These people may be missed by mental health surveillance systems that rely on distress measures [27, 46], yet are often described as ‘*languishing*’, with elevated risk of future mental illness and poorer health outcomes [29]. We also found that 3.4% of the population reported adequate wellbeing (PWI >50 pp) with concurrent depressive symptoms; this type of co-endorsement is among the clearest evidence of the dual-continua model [47]. Together, these findings support the interpretation that subjective wellbeing and mental distress represent related but distinct dimensions of mental health.

Our results have direct implications for population health monitoring. Surveillance systems that focus predominantly on mental distress or disorder – such as Australia’s National Study of Mental Health and Wellbeing [48] – may fail to detect individuals who are languishing without clinical symptomatology. Incorporating subjective wellbeing measures alongside distress measures would provide a more complete picture of population mental health to better identify groups at risk of being overlooked. This early identification is crucial for prevention efforts, as it enables targeted intervention before distress escalates to clinical levels.

Several limitations warrant acknowledgement. First, although population weighting procedures were used to mitigate sampling bias, selection bias may have been introduced in the 18–34-year-old cohort. Population quotas for this age group were not reached through the probability-based sample, resulting in a heavier reliance on recruitment from the non-probability-based sample. Second, the generalisability of our findings to Aboriginal and Torres Strait Islander peoples is limited due to distinct understandings of wellbeing held by Indigenous Australians that are not captured by the PWI [49]. Finally, we assessed psychological distress using the self-reported DASS-21 and acknowledge the absence of gold-standard structured clinical interviews. Thus, these findings should be interpreted as relating to symptoms of depression, not diagnoses.

Our study also includes important strengths. The recruitment of a large, population-representative sample addresses sampling biases of previous studies [15, 16]. Additionally, our validation using item response theory for an online survey mode and comprehensive analytical approach examining classification performance, together with the established temporal invariance [7, 8], further supports the PWI as a robust assessment of subjective wellbeing.

For community settings, online administrated PWI cut-points of 50 and 65pp can be used respectively, as indicators of ‘low’ and ‘at-risk’ levels of wellbeing warranting attention. The online population norms (65.8–68.4pp) further enable practitioners and researchers to benchmark mean PWI scores against the broader Australian population. For health policy, our findings support balanced investment in primary prevention and early intervention alongside treatment services. While consistent with the Australian Government’s new staged-care approach to mental health, these results provide further evidence that

funding extending upstream for early intervention to prevent disorder onset is likely to be more economical than treating disorders [50].

CONCLUSION

This study establishes contemporary online population norms for the PWI and identifies practical cut-points to measure low wellbeing based on depression symptoms. These new benchmarks enhance the interpretability of the PWI in an era of increasing online data collection. Importantly, the results support the dual-continua model, demonstrating that subjective wellbeing and mental distress are related but distinct dimensions, underscoring the need to measure both in public health frameworks and provide separate investment for each.

Abbreviations

AUC: Area Under the Curve

AUWI: Australian Unity Wellbeing Index

DASS-21: Depression, Anxiety and Stress Scale – 21 item

NPV: Negative Predictive Value

OECD: Organisation for Economic Co-operation and Development

pp: Percentage points

PPV: Positive Predictive Value

PWI: Personal Wellbeing Index

ROC: Receiver Operating Curve

SEIFA-IRSAD = Socio-Economic Indexes for Areas - Index of Relative Socio-economic Advantage and Disadvantage

WHO-5: World Health Organisation 5-item Wellbeing Index

Declarations

Ethics approval and consent to participate

Ethics approval was obtained from Deakin University Research Ethics Committee (HEAG-H 45_2016). The study was conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study.

Consent for publication

Not applicable.

Availability of data and materials

Data is available upon request by submitting a contact form through the Australian Unity Wellbeing Index Data Dashboard page (<https://auwi.deakin.edu.au/>).

Competing interests

Authors AW, GF, KL, SK and TC are supported by the Deakin-Australian Unity Industry Research Partnership. All other authors declare no competing interests.

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Author contributions

GF, TC, KL, SK, MFT, CO, DH designed the study. GF, TC, KL, SK directed the study's implementation. GF, TC, SK conducted the literature review. AW, MFT, SK, MI, RD, MK designed the analytical strategy and provided findings interpretation. SK drafted the initial manuscript and conducted the data analysis. All reviewed and provided feedback for the manuscript.

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References

1. OECD. OECD guidelines on measuring subjective well-being. (2025 update) Paris: OECD Publishing; 2025. https://www.oecd.org/content/dam/oecd/en/publications/reports/2013/03/oecd-guidelines-on-measuring-subjective-well-being_g1g28641/9789264191655-en.pdf. Accessed 23 July 2026.
2. Sollis K, Campbell P, Drake N. Australia's Wellbeing Framework: Is It Really 'Measuring What Matters'? *Aust J Soc Issues*. 2025;60(2):511–31. <https://doi.org/10.1002/ajs4.70029>.
3. Graham C, Laffan K, Pinto S. Well-being in metrics and policy. *Science*. 2018;362(6412):287–8. <https://doi.org/10.1126/science.aau5234>.
4. Veenhoven R. Happiness. Also known as life satisfaction and subjective well-being. In: Land KC, Michalos AC, Sirgy MJ, editors. *Handbook of Social Indicators and Quality of Life Research*. 1st ed. Dordrecht: Springer Netherlands; 2012. pp. 63–77.
5. Cummins RA. Subjective wellbeing, homeostatically protected mood and depression: A synthesis. *J Happiness Stud*. 2010;11(1):1–17. <https://doi.org/10.1007/s10902-009-9167-0>.
6. International Wellbeing Group. *Personal Wellbeing Index Manual: 6th Edition, Version 2.0* Melbourne, Australia: Australian Centre on Quality of Life. Accessed: Deakin University; 2024. <https://acqol.com.au/resources/personal-wellbeing-index/>.
7. Anglim J, Weinberg MK, Cummins RA. Bayesian hierarchical modeling of the temporal dynamics of subjective well-being: A 10 year longitudinal analysis. *J Res Pers*. 2015;59:1–14. <https://doi.org/10.1016/j.jrp.2015.08.003>.
8. Liu L, Sun J-m, Wang Z. Comparing subjective well-being longitudinally: Measurement invariance of the Personal Wellbeing Index across time. *J Happiness Stud*. 2024;25(1):1. <https://doi.org/10.1007/s10902-024-00719-w>.
9. Jovanović V, Cummins RA, Weinberg M, Kaliterna L, Prizmic-Larsen Z. Personal Wellbeing Index: A cross-cultural measurement invariance study across four countries. *J Happiness Stud*. 2019;20(3):759–75. <https://doi.org/10.1007/s10902-018-9966-2>.
10. Żemojtel-Piotrowska M, Piotrowski JP, Ciecuch J, Adams BG, Osin EN, Ardi R, et al. Measurement invariance of Personal Well-Being Index (PWI-8) across 26 countries. *J Happiness Stud*. 2017;18(6):1697–711. <https://doi.org/10.1007/s10902-016-9795-0>.
11. Misajon R, Pallant J, Bliuc A-M. Rasch analysis of the Personal Wellbeing Index. *Qual Life Res*. 2016;25(10):2565–9. <https://doi.org/10.1007/s11136-016-1302-x>.
12. Richardson B, Fuller Tyszkiewicz MD, Tomin AJ, Cummins RA. The psychometric equivalence of the Personal Wellbeing Index for normally functioning and homeostatically defeated Australian adults. *J Happiness Stud*. 2016;17(2):627–41. <https://doi.org/10.1007/s10902-015-9613-0>.
13. Bond M, Frings D, Stenning A, Morton J. National estimates of subjective wellbeing in the UK using the Personal Wellbeing Index. *J Happiness Stud*. 2026;27(2):33. <https://doi.org/10.1007/s10902-026-01017-3>.
14. Piccitto G, Liefbroer AC, Emery T. Does the survey mode affect the association between subjective well-being and its determinants? An experimental comparison between face-to-face and web mode. *J Happiness Stud*. 2022;23(7):3441–61. <https://doi.org/10.1007/s10902-022-00553-y>.

15. Bittar R. Subjective wellbeing maintenance: Investigating depression as suppressed Homeostatically Protected Mood. Geelong, Australia: Deakin University; 2009.
16. Gargiulo RA, Stokes MA. Subjective well-being as an indicator for clinical depression. *Soc Indic Res.* 2009;92(3):517–27. <https://doi.org/10.1007/s11205-008-9301-0>.
17. Deakin Lifespan Institute. Australian Unity Wellbeing Index (AUWI): Deakin University. 2026. <https://lifespan.deakin.edu.au/our-research/project/australian-unity-wellbeing-index-auwi/>. Accessed 30 June 2026.
18. Capic T, Frykberg G, Khor S, Fuller-Tyszkiewicz M, Cummins R, Olsson C et al. Australian Unity Wellbeing Index 2024: Technical Report: Deakin University; 2024. <https://acqol.com.au/publications/surveys/>. Accessed 23 July 2026.
19. Kaczmirek L, Phillips B, Pennay D, Lavrakas PJ, Neiger D. Building a probability-based online panel: Life in Australia™ Canberra, Australia: Social Research Centre, Australian National University; 2019. <https://polis.cass.anu.edu.au/files/docs/2025/6/19-050-MP-ONLINE-Publish.pdf>. Accessed 23 July 2026.
20. Blanchflower DG, Bryson A, Cui AJ. An evaluation of biases in wellbeing estimates using interviewers versus online data collection in the Global Flourishing Study. National Bureau of Economic Research Working Paper Series. 2025;No. 34599 <https://doi.org/10.3386/w34599>
21. Zager Kocjan G, Lavtar D, Sočan G. The effects of survey mode on self-reported psychological functioning: Measurement invariance and latent mean comparison across face-to-face and web modes. *Behav Res Methods.* 2023;55(3):1226–43. <https://doi.org/10.3758/s13428-022-01867-8>.
22. Kocar S, Biddle N, Phillips B. The effects of mode on answers in probability-based mixedmode online panel research: Evidence and matching methods for controlling self-selection effect in a quasi-experimental design Canberra, Australia: Social Research Centre, Australian National University; 2021. https://polis.cass.anu.edu.au/files/docs/2025/6/The_Effects_of_Mode_on_Answers.pdf. Accessed 23 July 2026.
23. Pennay D, Phillips B, Neiger D, Ward A, Slamowicz S, Lethborg A. Results from the 2022 Australian Comparative Study of Survey Methods Canberra, Australia: Social Research Centre, Australian National University; 2024. <https://srcentre.com.au/wp-content/uploads/2023/12/ACSSM-Analytical-Report-20231005.pdf>. Accessed 23 July 2026.
24. Capic T, Li N, Cummins RA. Confirmation of subjective wellbeing set-points: Foundational for subjective social indicators. *Soc Indic Res.* 2018;137(1):1–28. <https://doi.org/10.1007/s11205-017-1585-5>.
25. Cummins RA. Subjective well-being, homeostatically protected mood and depression: A synthesis. In: Delle Fave A, editor. *The Exploration of Happiness: Present and Future Perspectives*. 1st ed. Dordrecht: Springer Netherlands; 2013. pp. 77–95.
26. Topp CW, Østergaard SD, Søndergaard S, Bech P. The WHO-5 Well-Being Index: A systematic review of the literature. *Psychother Psychosom.* 2015;84(3):167–76. <https://doi.org/10.1159/000376585>.

27. Keyes CL. Mental illness and/or mental health? Investigating axioms of the complete state model of health. *J Consult Clin Psychol*. 2005;73(3):539–48. <https://doi.org/10.1037/0022-006X.73.3.539>.
28. Magalhães E. Dual-factor models of mental health: A systematic review of empirical evidence. *Psychosoc Interv*. 2024;33:89–102. <https://doi.org/10.5093/pi2024a6>.
29. Burns RA, Windsor T, Butterworth P, Anstey KJ. The protective effects of wellbeing and flourishing on long-term mental health risk. *SSM - Mental Health*. 2022;2:100052. <https://doi.org/10.1016/j.ssmmh.2021.100052>.
30. VanderWeele TJ, Johnson BR, Bradshaw M, Goodman DM, Kubzansky LD, Lomas T, et al. Mental illness, mental health, and mental well-being. *npj Mental Health Res*. 2026;5(1):11. <https://doi.org/10.1038/s44184-026-00193-7>.
31. i-Link Business Solutions. i-Link Research: i-Link Business Solutions. 2024. <https://www.i-linkresearch.com/>. Accessed 28 July 2027.
32. Frykberg G, Capic T, Greenwood C, Khor S, Cummins RA, Fuller-Tyszkiewicz M et al. Australian Unity Wellbeing Index 2024 full report: Australians' subjective wellbeing and the housing and financial divide from 'boomers' to 'zoomers' Geelong, Australia Deakin University; 2024. <https://acqol.com.au/publications/surveys/>. Accessed 23 July 2026.
33. Lovibond PF, Lovibond SH. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav Res Ther*. 1995;33(3):335–43. [https://doi.org/10.1016/0005-7967\(94\)00075-U](https://doi.org/10.1016/0005-7967(94)00075-U).
34. Lovibond SH, Lovibond PF. Manual for the Depression Anxiety Stress Scales. 2nd ed. Sydney: Australia Psychology Foundation, University of New South Wales; 1995.
35. Shea TL, Tennant A, Pallant JF. Rasch model analysis of the Depression, Anxiety and Stress Scales (DASS). *BMC Psychiatry*. 2009;9(1):21. <https://doi.org/10.1186/1471-244X-9-21>.
36. Australian Bureau of Statistics. Counting persons, place of usual residence [Census Tablebuilder]: Australian Bureau of Statistics. 2021. <https://www.abs.gov.au/statistics/microdata-tablebuilder/tablebuilder> Accessed 14 February 2024.
37. StataCorp. Stata statistical software: Release 16. In: StataCorp, editor. 16.1 ed. College Station, TX: StataCorp LLC; 2020.
38. Samejima F. Graded response model. In: van der Linden WJ, Hambleton RK, editors. *Handbook of Modern Item Response Theory*. 1st ed. New York, NY: Springer New York; 1997. pp. 85–100.
39. Wood M. Bootstrapped confidence intervals as an approach to statistical inference. *Organ Res Methods*. 2005;8(4):454–70. <https://doi.org/10.1177/1094428105280059>.
40. DeLong ER, DeLong DM, Clarke-Pearson DL. Comparing the areas under two or more correlated receiver operating characteristic curves: A nonparametric approach. *Biometrics*. 1988;44(3):837–45. <https://doi.org/10.2307/2531595>.
41. Youden WJ. Index for rating diagnostic tests. *Cancer*. 1950;3(1):32–5. [https://doi.org/10.1002/1097-0142\(1950\)3:1%3C32::AID-CNCR2820030106%3E3.0.CO;2-3](https://doi.org/10.1002/1097-0142(1950)3:1%3C32::AID-CNCR2820030106%3E3.0.CO;2-3).

42. Hosmer DW Jr, Lemeshow S, Sturdivant RX. Applied Logistic Regression. Hoboken, NJ: Wiley; 2013.
43. Christiansen CH, Christensen KB, Høgh S, Renault KM, Emborg MS, Frokjaer VG, et al. Measuring psychological well-being in a Danish pregnancy cohort using the self-reported WHO-5 index. BMC Psychol. 2025;13(1):41. <https://doi.org/10.1186/s40359-025-02343-6>.
44. Lam LT, Lam MK. The categorisation of the Short Warwick Edinburgh Mental Wellbeing Scale scores: an exploration from an epidemiological perspective. Front Psychiatry. 2025;16:1674009. <https://doi.org/10.3389/fpsy.2025.1674009>.
45. Ritsner MS, Lisker A, Grinshpoon A. Predicting 10-year quality-of-life outcomes of patients with schizophrenia and schizoaffective disorders. Psychiatry Clin Neurosci. 2014;68(4):308–17. <https://doi.org/10.1111/pcn.12135>.
46. Iasiello M, van Agteren J. Mental health and/or mental illness: A scoping review of the evidence and implications of the dual-continua model of mental health. Evid Base: J Evid Reviews Key Policy Areas. 2020(1):1–45.
47. Tay L, Kuykendall L. Why self-reports of happiness and sadness may not necessarily contradict bipolarity: A psychometric review and proposal. Emot Rev. 2017;9(2):146–54. <https://doi.org/10.1177/1754073916637656>.
48. Australian Bureau of Statistics. National Study of Mental Health and Wellbeing: Australian Bureau of Statistics. 2023. <https://www.abs.gov.au/statistics/health/mental-health/national-study-mental-health-and-wellbeing/2020-2022>. Accessed 30 June 2026.
49. Butler TL, Anderson K, Garvey G, Cunningham J, Ratcliffe J, Tong A, et al. Aboriginal and Torres Strait Islander people's domains of wellbeing: A comprehensive literature review. Soc Sci Med. 2019;233:138–57. <https://doi.org/10.1016/j.socscimed.2019.06.004>.
50. National Mental Health Commission. The economic case for investing in mental health prevention. Summary. Canberra Australian Government. 2019. <https://www.mentalhealthcommission.gov.au/publications/economic-case-investing-mental-health-prevention-summary> Accessed 23 July 2026.

Figures

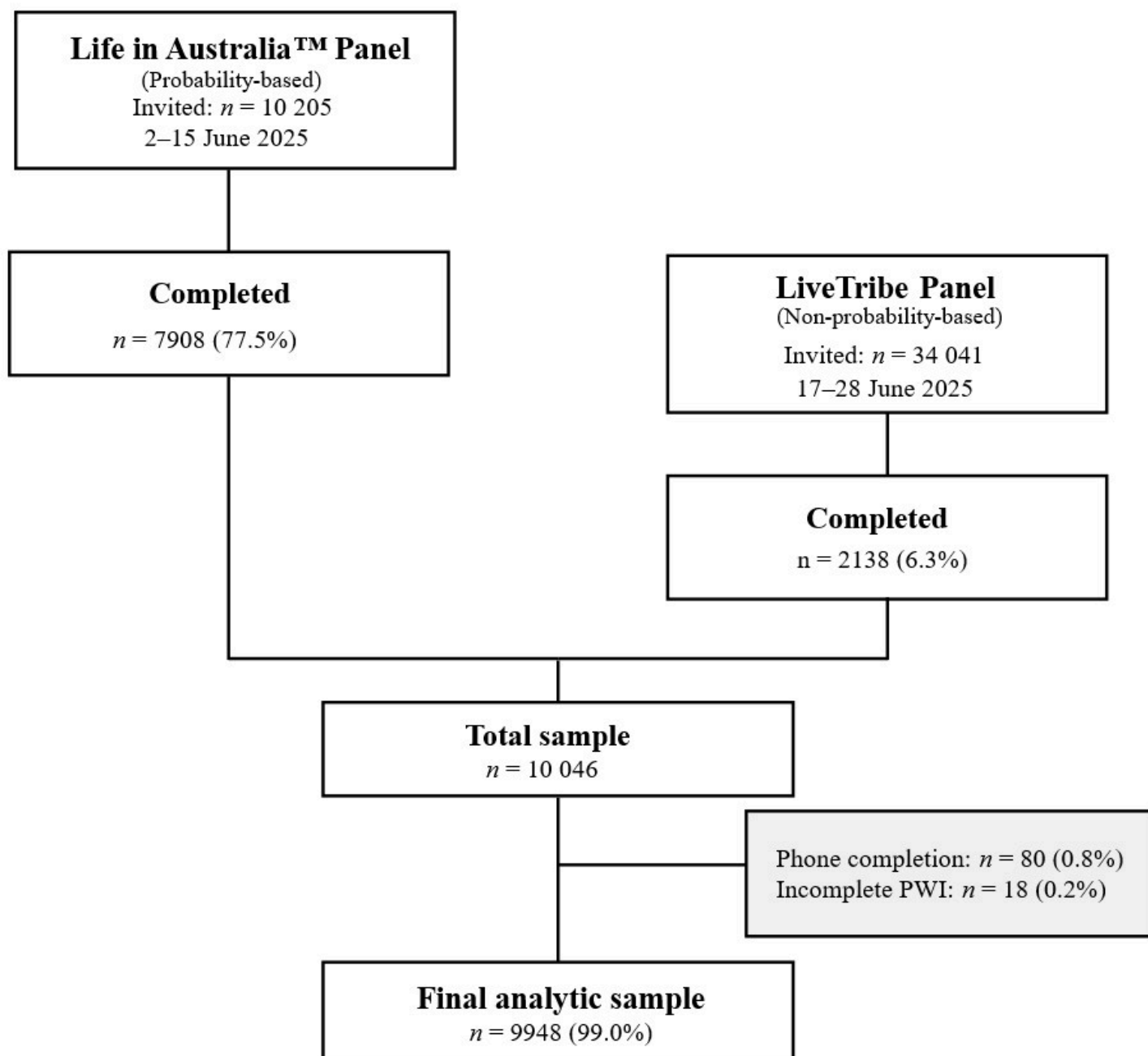


Figure 1

Participant flow chart.

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