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Comparing the predictive utility of trait affect and average daily affect for the prospective prediction of health outcomes

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ABSTRACT

In preregistered secondary data analyses, we compared the predictive utility of trait affect and average daily affect for predicting three health outcomes across nine years (N = 1,376). Trait positive and negative affect were assessed using a 25-item dispositional questionnaire. Average daily affect was assessed as the mean of eight daily diary reports of the same items. Trait affect and average daily affect both had medium associations with self-reported general health and chronic health conditions. Moreover, both types of affect predicted mortality when adjusting for baseline health and demographics. Effect sizes were comparable for trait compared to daily affect. These findings demonstrate convergent predictive validity of trait and daily affect measures.

1. Introduction

High positive affect and low negative affect are robust predictors of better physical health and greater longevity (Boehm, 2018; Chida & Steptoe, 2008; Cross, Hofschneider, Grimm, & Pressman, 2018). The majority of evidence for associations between affect and long-term health outcomes has come from one-time trait affect questionnaires. These trait questionnaires assess how one feels in general or how one has felt over a period of weeks or months. In contrast, daily diary measures of affect have more commonly been used to predict short-term health outcomes such as daily symptoms (e.g., Charles & Almeida, 2006). Yet, daily measures of affect can be averaged across multiple days to produce a reliable sampling of experienced affect which may also be associated with long-term health outcomes. The present research directly compared the predictive utility of trait affect measures to that of average daily affect measures for predicting physical health outcomes across a nine-year period.

Previous research has found that average daily affect is moderately to highly correlated with trait affect (Diener, Smith, & Fujita, 1995; Watson & Clark, 1999). The majority of these correlations ranged from 0.50 to 0.70, suggesting that trait and daily affect are highly related but not redundant constructs. Moreover, trait and daily affect reports rely on distinct memory processes and knowledge sources (Robinson & Clore, 2002a, 2002b). Given that trait and state affect are partially overlapping and partially distinct constructs, it is an open question whether trait and daily affect are similarly predictive of health outcomes. Although a large body of literature has demonstrated associations between affect, physical health, and mortality (Chida & Steptoe, 2008; Zhang & Han, 2016), the majority of these studies assessed trait affect, whereas only a small number assessed average daily affect (e.g., Carstensen et al., 2011, Steptoe & Wardle, 2011). Steptoe and Wardle (2011) averaged ecological momentary assessments (EMA) over a single day and found that average positive affect, but not average negative affect, was associated with reduced mortality. Carstensen et al. (2011) averaged across three one-week measurement bursts and found that individuals who experienced more positive affect relative to negative affect in daily life had lower mortality risk. A complementary body of research on affective reactivity to daily stressors has also revealed associations between daily affect and long-term health outcomes (e.g., Leger, Charles, & Almeida, 2018; Mroczek et al., 2015; Piazza, Charles, Sliwinski, Mogle, & Almeida, 2013). Together, these findings demonstrate that averaging over multiple EMA or diary measures of affect can produce a measure of affect experience that is associated with long-term health outcomes such as survival. However, the body of research supporting these associations is relatively smaller than the literature on trait affect. Furthermore, we know little about the relative predictive utility of these average daily affect measures compared to trait affect.

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We had competing predictions regarding the relative predictive utility of the two types of affect. On the one hand, trait affect may be more predictive of long-term health outcomes. Given trait measures assess how one generally feels over long periods of time, trait affect may be a better predictor of health outcomes which also unfold over long periods of time (Cross et al., 2018). On the other hand, average daily affect may be more closely tied to experienced affect and thus more predictive of health outcomes (Boehm, 2018). Daily affect ratings are relatively less subject to retrospection biases and do not require respondents to engage in the same complex mental averaging as trait measures. Moreover, average daily affect ratings are computed from multiple measurement occasions and thus may be more reliable than single timepoint trait measures. At the same time, multiple measurements of affect likely are characterized by greater amounts of fluctuation, which would reduce the zero-order correlations among daily assessments of affect, meaning they would be less reliable from a classical reliability standpoint.

1.1. The present research

The present research used publicly available data from the Midlife in the United States (MIDUS) to examine trait and average daily affect as predictors of self-reported general health, number of chronic health conditions, and mortality across a nine-year period. The MIDUS provided a unique opportunity to directly compare trait and average daily affect because MIDUS 2 contains identical affect items at the trait and daily levels. Previous research using MIDUS data has found associations between trait affect at one or more timepoints and the three health outcomes examined here (e.g., Assari & Lankarani, 2016). We are not aware of any studies using MIDUS data that have reported the simple associations between average daily affect and any of the three health outcomes, nor any research that has directly compared trait affect to average daily affect. A complete list of publications using MIDUS data is available at http://midus.wisc.edu/findings/index.php.

We preregistered the analytic plan and two competing hypotheses[1]. Hypothesis A asserts that trait affect will be more strongly linked with health outcomes compared to average daily affect. Hypothesis A is supported by the idea that trait affect (relative to average daily affect) is a better indicator of general affect experiences over long periods of time and thus is more likely to influence health processes which unfold over long periods of time. Hypothesis B asserts that average daily affect will be more strongly linked with health outcomes compared to trait affect. Hypothesis B is supported by the ideas that average daily affect (relative to state affect) does not rely as heavily on fallible retrospection over long periods of time and is derived from more measurement occasions and thus may be more reliable. It is also plausible that neither Hypothesis A or Hypothesis B will be supported and that trait and daily affect will be similarly predictive of health outcomes, given strong correlations between the two types of measures (e.g., Diener et al., 1995).

2. Method

2.1. Participants and longitudinal study design

The MIDUS includes a large representative sample of participants from the United States assessed during midlife (age 24–74 at study entry). The MIDUS uses a longitudinal panel design in which participants complete comprehensive questionnaires about their well-being and health roughly every nine years. In the present study, we used affect data from MIDUS 2 (Ryff et al., 2004) (collected in 2004-06) to predict health outcomes in MIDUS 3 (Ryff et al., 2013) (2013–15) and mortality through 2018. MIDUS 2 was selected as the baseline measurement occasion because it was the first timepoint at which the full set of positive affect items were assessed in the daily diaries. Participants who had trait and daily affect data in MIDUS 2 were included in the mortality analyses (N = 1,761) participants with affect data and data for at least one health outcome were included in the self-reported general health and chronic health conditions analyses (N = 1,376).

Because the present study involved secondary analyses of existing data, the sample size was predetermined. Sensitivity power analyses showed that we had 90% power to detect small effects on self-reported general health and chronic health conditions as well as small differences in effect sizes between trait and average daily affect for these two outcomes. For mortality, power analyses showed we had 90% power to detect a difference in mortality risk of 45% for an individual 2 standard deviations below the mean on a given affect variable compared to an individual 2 standard deviations above the mean on that same affect variable.

2.2. Measures

2.2.1. Trait affect

Trait affect was assessed in MIDUS 2. Participants were asked to rate how much of the time during the past 30 days they felt each of 11 positive affect items (enthusiastic, attentive, proud, active, confident, in good spirits, cheerful, extremely happy, calm and peaceful, satisfied, and full of life) and 14 negative affect items (restless or fidgety, nervous, worthless, so sad nothing could cheer you up, everything was an effort, hopeless, lonely, afraid, jittery, irritable, ashamed, upset, angry, frustrated)[2]. Response options ranged from 1 (All of the time) to 5 (None of the time). Responses were reverse scored such that higher values reflected greater experienced affect. Mean scores were computed across the affect items for positive and negative affect respectively. Reliability coefficients for trait positive and negative affect were as follows: Omega Hierarchical: 0.84, 0.79; Cronbach's Alpha: 0.94, 0.92.

2.2.2. Average daily affect

Average daily affect was assessed in MIDUS 2. In eight consecutive daily diaries, participants were asked to rate the extent to which they felt the same 11 positive affect items and 14 negative affect items described above. Response options ranged from 0 (None of the time) to 4 (All of the time). Mean scores were computed each day across the affect items for positive and negative affect respectively. Then, mean scores across the eight diaries were computed for positive and negative affect respectively. Reliability coefficients for daily positive and negative affect were as follows: Omega Hierarchical: 0.85, 0.67; Cronbach's Alpha: 0.94, 0.86.

2.2.3. General self-reported health

General self-reported health was assessed in MIDUS 3. Participants were asked "Using a scale from 0 to 10 where 0 means 'the worst possible health' and 10 means 'the best possible health,' how would you rate your health these days?" In MIDUS 3, the mean response was 7.38 (SD = 1.58; skewness = -1.04, kurtosis = 4.46).

[1] This paper reports preregistered secondary data analyses. The preregistered analytic plan and R code needed to carry out all analyses can be found at osf.io/wtdmj. Data can be downloaded at the Inter-university Consortium for Political and Social Research (ICPSR). Links to the specific datasets can be found in the public R code.

[2] Results remained the same when using only the 8 negative affect items and 7 positive affect items included in the Positive and Negative Affect Schedule-Expanded Form (PANAS-X; Watson & Clark, 1999), a more common measure of affect.

2.2.4. Chronic health conditions

Number of chronic health conditions was assessed in MIDUS 3. Participants were asked to report which chronic health conditions they experienced in the past 12 months from a set of 30 common conditions. In MIDUS 3, the mean number of chronic health conditions was 3.26 (range 0–20; SD = 3.11; skewness = 1.51, kurtosis = 6.04).

2.2.5. Mortality

Participants were submitted to the National Death Index through October 2018. Mortality status (deceased or alive) and date of death were obtained. Survival time was calculated by subtracting the baseline interview month and year from the month and year of death. Fourteen percent of the sample died during the follow-up period (MIDUS 2 through October 2018).

2.3. Analytic strategy

All analyses were conducted in R version 3.6.1 and R Studio version 1.2.1335. We used the following R packages: pwr (Champely, 2018), powerSurvEpi (Qiu, Chavarro, Lazarus, Rosne, & Ma, 2018), psych (Revelle, 2019), survival (Therneau, 2015), pscl (Jackman, 2020; Zeileis, Kleiber, & Jackman, 2008), and MASS (Venables & Ripley, 2002).

To predict self-reported general health and chronic health conditions, we used a separate linear regression model for each affect measure. In addition, we conducted sensitivity analyses to address the non-normal distributions of these dependent variables. In these sensitivity analyses, we used zero-inflated Poisson regression to predict number of chronic health conditions (a count variable) and ordinal regression to predict self-reported general health (a single Likert item). To predict mortality risk, we used a separate Cox regression model for each affect measure. Mortality risk was modeled as a function of mortality status (deceased or alive) and survival time (in months since MIDUS 2). Survival time was right-censored for participants who were still living in October 2018. We examined associations among the scaled Schoenfeld residuals and time to test the proportional hazard assumption. In a second set of sensitivity analyses, we repeated all models adjusting for baseline health, age, gender, and education.

To compare the effects of trait affect measures to those of average daily affect measures, we preregistered that we would examine whether or not the 95% confidence intervals (CIs) overlapped. For the linear regression models, we also directly tested whether the trait effects differed from average daily effects using the paired.r () function in the psych() package in R. This latter test was not included in preregistered analysis plan. However, we decided to include it because it takes into consideration the correlation between the two affect variables, whereas simply comparing the CIs does not.

3. Results

R code to reproduce all results is available at osf.io/wtdmj. Data are publicly available online at the Inter-university Consortium for Political and Social Research. Intercorrelations among study variables are shown in Table 1.

3.1. Self-reported general health

Higher trait positive affect (β = 0.29, 95% CI = [0.24, 0.34]) and higher average daily positive affect (β = 0.24, 95% CI = [0.19, 0.29]) were associated with better self-reported general health nine years later. Both positive affect measures had medium associations with self-reported general health (Funder & Ozer, 2019) and the 95% CIs overlapped. However, statistical comparison of the two effects suggested that the effect of trait positive affect was slightly larger than the effect of average daily positive affect (t = 2.33, p = .02). Higher trait negative affect (β = −0.23, 95% CI = [−0.28, −0.18]) and higher average daily negative affect (β = −0.17, 95% CI = [−0.22, −0.11]) were associated with worse self-reported general health nine years later. Both negative affect measures had medium associations with self-reported general health (Funder & Ozer, 2019) and the 95% CIs overlapped. However, statistical comparison of the two effects suggested that the effect of trait negative affect was slightly larger than the effect of average daily negative affect (t = 2.75, p = .01).

In sensitivity analyses using ordinal regression, trait and daily affect were comparably predictive of self-reported general health (i.e., the 95% CIs overlapped with one another and did not contain zero) (Supplementary Table 1). In a second set of sensitivity analyses adjusting for baseline self-reported general health and demographics, the effect sizes for both types of affect were somewhat smaller ($0.09 > |\beta| < 0.14$), but results were largely similar for trait compared to daily affect in both linear (Supplementary Table 2) and ordinal regressions (Supplementary Table 1) (95% CIs overlapped).

3.2. Number of chronic health conditions

Higher trait positive affect (β = −0.27, 95% CI = [−0.32, −0.22]) and higher average daily positive affect (β = −0.22, 95% CI = [−0.27, −0.16]) were associated with fewer chronic health conditions nine years later. Both positive affect measures had medium associations with chronic health conditions (Funder & Ozer, 2019) and the 95% CIs overlapped. However, statistical comparison of the two effects suggested that the effect of trait positive affect was slightly larger than the effect of average daily positive affect (t = 2.41, p = .01). Higher trait negative affect (β = 0.29, 95% CI = [0.23, 0.34]) and higher average daily negative affect (β = 0.21, 95% CI = [0.16, 0.27]) were associated with more chronic health conditions nine years later. Both negative affect measures had medium associations with chronic health conditions (Funder & Ozer, 2019) and the 95% CIs overlapped. However, statistical comparison of the two effects suggested that the effect of trait negative affect was

Table 1
Intercorrelations among study variables.

	Trait PA	Daily PA	Trait NA	Daily NA	General Health
Trait PA	–				
Daily PA	0.61	–			
Trait NA	−0.66	−0.45	–		
Daily NA	−0.37	−0.50	0.50	–	
General Health	0.29	0.24	−0.23	−0.16	–
Chronic Conditions	−0.27	−0.22	0.29	0.21	−0.42

Note. PA = positive affect. NA = negative affect.

slightly larger than the effect of average daily negative affect (t = 2.82, p < .01).

In sensitivity analyses using zero-inflated Poisson regression, trait and daily positive affect both predicted fewer chronic health conditions. The 95% CIs around the incident risk ratio (IRR) for the Poisson model and the 95% CIs around the odds ratio (OR) for the zero inflation model overlapped. Higher trait and daily negative affect predicted more chronic health conditions in the zero-inflated Poisson regressions. The 95% CIs around the OR overlapped; However, the 95% CIs around the IRR did not overlap, suggesting that daily negative affect was somewhat more predictive of the number of chronic health conditions (Supplementary Table 3). In a second set of sensitivity analyses adjusting for baseline chronic health conditions and demographics, the effect sizes for both types of affect were somewhat smaller (0.10 > |β| < 0.13), but results were largely similar for trait compared to daily affect in both linear (Supplementary Table 4) and zero-inflated Poisson regressions (Supplementary Table 3) (95% CIs overlapped).

3.3. All-cause mortality

The associations between the scaled Schoenfeld residuals and time were statistically non-significant in all models (*ps* > 0.05), indicating that the proportional hazard assumption was not violated. None of the four affect measures were associated with mortality risk in primary analyses: Trait positive affect (hazards ratio = 0.98, 95% CI = [0.87, 1.10]); Average daily positive affect (hazards ratio = 0.94, 95% CI = [0.83, 1.06]); Trait negative affect (hazards ratio = 1.03, 95% CI = [0.91, 1.16]); Daily average negative affect (hazards ratio = 1.11, 95% CI = [0.99, 1.23]).

In sensitivity analyses adjusting for baseline self-reported general health, baseline chronic health conditions, and demographics, three of the four affect variables were significant predictors of mortality: Trait positive affect (hazards ratio = 0.92, 95% CI = [0.80, 1.06]); Average daily positive affect (hazards ratio = 0.87, 95% CI = [0.76, 0.99]); Trait negative affect (hazards ratio = 1.17, 95% CI = [1.01, 1.36]); Daily average negative affect (hazards ratio = 1.23, 95% CI = [1.09, 1.40]). Although trait positive affect was not a significant predictor of mortality, the 95% CI overlapped with the 95% CI for daily positive affect, as did the 95% CIs for trait and daily negative affect.

4. Discussion

In preregistered secondary data analyses, we compared the predictive utility of trait affect to that of average daily affect for predicting self-reported general health, number of chronic health conditions, and mortality over a nine-year period. Trait affect and average daily affect both had medium associations with self-reported general health and number of chronic health conditions. When adjusting for covariates (but not in unadjusted models), daily positive affect and trait and daily negative affect were also associated with mortality risk. The 95% confidence intervals overlapped for all associations. Taken together, these findings suggest that trait affect and average daily affect are comparably predictive of physical health outcomes.

Previous research on the relationships between affect and health have mainly used trait measures of affect (e.g., PANAS; Watson & Clark, 1999). Coupled with previous findings, the present results suggest that when averaged across multiple observations, state (Carstensen et al., 2011; Steptoe & Wardle, 2011) and daily (the present study) measures of affect are also predictive of long-term health outcomes. This is consistent with previous research demonstrating strong correlations between trait and daily affect and convergence of both types of affect with informant reports (Diener et al., 1995). Importantly, these findings do not suggest single observations of state or daily affect would be associated with health outcomes. Single instances of affect experience are likely not powerful enough to influence long-term health outcomes.

A key limitation of the present study is that average daily affect was computed from eight daily diaries. A larger number of measurement occasions may improve the predictive utility of average daily affect. Moreover, the use of experience sampling relative to daily diaries should further reduce retrospection bias and thus may improve predictive utility. Finally, because the present study was conducted in U.S. adults, results may not generalize in other cultures where the association between affect and health may differ (e.g., Kitayama & Park, 2017).

In conclusion, the present study found that trait and average daily measures of positive and negative affect were both predictive of health outcomes nine years later. Trait affect had slightly larger effect sizes compared to average daily affect in some models, but the differences were small. These findings provide initial evidence that both types of affect measures are suitable for predicting long-term health outcomes. This is important, given that researchers may need to choose between trait and average daily affect measures based on other tradeoffs unrelated to predictive utility. For example, trait affect measures are easier to administer whereas daily measures of affect may be subject to less retrospection biases. These results also provide convergent validity evidence suggesting that associations between trait affect and health outcomes are driven by actual experienced affect, rather than potential biases associated with one-time dispositional questionnaires.

5. Author Note

The first author ECW conceptualized the idea for the present study, carried out analyses, and wrote the first draft of the manuscript. The second and third authors EKG and DKM provided substantive input on the preregistration and data analytic strategy, and contributed to manuscript revisions. Correspondence regarding this article should be directed to E.C. Willroth at emily.willroth@northwestern.edu. The MIDUS has been supported by the John D. and Catherine T. MacArthur Foundation Research Network, and the National Institute on Aging (P01-AG020166; U19-AG051426). This work was also supported by three National Institute on Aging grants awarded to D.K. Mroczek (R01-AG018436, R01-AG067622, R01-AG064006).

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jrp.2020.103966.

References

Assari, S., & Lankarani, M. M. (2016). Chronic medical conditions and negative affect; racial variation in reciprocal associations over time. *Frontiers in Psychiatry, 7*. Article 140.

Boehm, J. K. (2018). Living healthier and longer lives: Subjective well-being's association with better health. In E. Diener, S. Oishi, & L. Tay (Eds.), *Handbook of Well-being*. Salt Lake City, UT: DEF Publishers. DOI: nobascholar.com.

Carstensen, L. L., Turan, B., Scheibe, S., Ram, N., Ersner-Hershfield, H., Samanez-Larkin, G. R., ... Nesselroade, J. R. (2011). Emotional experience improves with age: Evidence based on over 10 years of experience sampling. *Psychology and Aging, 26*, 21.

Champely, S. pwr: Basic Functions for Power Analysis. R package version 1.2-2. 2018; https://CRAN.R-project.org/package=pwr

Charles, S. T., & Almeida, D. M. (2006). Daily reports of symptoms and negative affect: Not all symptoms are the same. *Psychology and Health, 21*, 1–17.

Chida, Y., & Steptoe, A. (2008). Positive psychological well-being and mortality: A quantitative review of prospective observational studies. *Psychosomatic Medicine, 70*, 741–756.

Cross, M. P., Hofschneider, L., Grimm, M., & Pressman, S. D. (2018). *Subjective well-being and physical health. Handbook of well-being*. Salt Lake City, UT: DEF Publisher. DOI: nobascholar.com.

Diener, E., Smith, H., & Fujita, F. (1995). The personality structure of affect. *Journal of Personality and Social Psychology, 69*, 130.

Funder, D. C., & Ozer, D. J. (2019). Evaluating effect size in psychological research: Sense and nonsense. *Advances in Methods and Practices in Psychological Science, 2*, 156–168.

Jackman S (2020). pscl: Classes and Methods for R Developed in the Political Science Computational Laboratory. United States Studies Centre, University of Sydney, Sydney, New South Wales, Australia. R package version 1.5.5, https://github.com/atahk/pscl/.

Kitayama, S., & Park, J. (2017). Emotion and biological health: The socio-cultural moderation. *Current Opinion in Psychology, 17*, 99–105.

Leger, K. A., Charles, S. T., & Almeida, D. M. (2018). Let it go: Lingering negative affect in response to daily stressors can impact physical health years later. *Psychological Science, 29*, 1283–1290.

Mroczek, D. K., Stawski, R. S., Turiano, N. A., Chan, W., Almeida, D. M., Neupert, S. D., & Spiro, A. III, (2015). Emotional reactivity and mortality: Longitudinal findings from the VA Normative Aging Study. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 70*, 398–406.

Piazza, J. R., Charles, S. T., Sliwinski, M. J., Mogle, J., & Almeida, D. M. (2013). Affective reactivity to daily stressors and long-term risk of reporting a chronic physical health condition. *Annals of Behavioral Medicine, 45*, 110–120.

Qiu, W., Chavarro, J., Lazarus, R., Rosne, B., Ma, J. powerSurvEpi: Power and Sample Size Calculation for Survival Analysis of Epidemiological Studies. R package version 0.1.0; 2018; https://CRAN.R-project.org/package=powerSurvEpi.

Revelle, W. (2019). psych: Procedures for Psychological, Psychometric, and Personality Research. Northwestern University, Evanston, Illinois. R package version 1.9.12, https://CRAN.R-project.org/package=psych.

Robinson, M. D., & Clore, G. L. (2002a). Belief and feeling: Evidence for an accessibility model of emotional self-report. *Psychological Bulletin, 128*, 934.

Robinson, M. D., & Clore, G. L. (2002b). Episodic and semantic knowledge in emotional self-report: Evidence for two judgment processes. *Journal of Personality and Social Psychology, 83*, 198.

Ryff, C. . . Williams, D. Midlife in the United States (MIDUS 2), 2004-2006. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2017-11-20. https://doi.org/10.3886/ICPSR04652.v7

Ryff, Carol, Almeida, David, Ayanian, John, Binkley, Neil, Carr, Deborah S., Coe, Christopher, . . . Williams, David. Midlife in the United States (MIDUS 3), 2013-2014 . Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2019-04-30. https://doi.org/10.3886/ICPSR36346.v7

Steptoe, A., & Wardle, J. (2011). Positive affect measured using ecological momentary assessment and survival in older men and women. *Proceedings of the National Academy of Sciences, 108*, 18244–18248.

Therneau, T. A. Package for Survival Analysis in S. Version 2.38; 2015; URL: https://CRAN.Rproject.org/package=survival.

Venables, W. N., & Ripley, B. D. (2002). *Modern Applied Statistics with S* (Fourth edition). New York: Springer.

Watson, D., & Clark, L. A. (1999). The PANAS-X: Manual for the positive and negative affect schedule-expanded form.

Zeileis, A., Kleiber, C., & Jackman, S. (2008). Regression Models for Count Data in R. *Journal of Statistical Software, 27*(8) http://www.jstatsoft.org/v27/i08/.

Zhang, Y., & Han, B. (2016). Positive affect and mortality risk in older adults: A meta-analysis. *PsyCh Journal, 5*, 125–138.