

Daily Life Positive Events Predict Well-Being Among Depressed Adults 10 Years Later

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Abstract

Relatively little is known about the links between the events and emotions experienced in daily life and long-term outcomes among people diagnosed with depression. Using daily diary data from the Midlife Development in the United States, we examined how positive daily life events and emotions influence long-term (10 years later) depression severity and well-being. Participants met criteria for major depressive disorder ($n = 121$) or reported no depression ($n = 839$) over the past 12 months. Participants reported positive events, socializing activities, and negative affect (NA) and positive affect (PA) for 8 consecutive days. Relative to nondepressed adults, depressed adults reported fewer positive events (fewer positive interactions, spending less time with others), lower PA, and higher NA. Among initially depressed adults, higher baseline well-being was related to higher daily PA, lower NA, and fewer days with less reported social time; higher daily PA and positive interactions predicted higher well-being 10 years later ($N = 77$). Variations in day-to-day events and emotions among people with depression may presage psychological functioning years later.

Keywords

daily diary, major depressive disorder, well-being, longitudinal methods, affect

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Depression has been viewed as a chronic and recurrent condition with a poor prognosis (for reviews, see Monroe, Anderson, & Harkness, 2019; Rottenberg, Devendorf, Kashdan, & Disabato, 2018). Now, depression is the leading source of personal and economic disability (World Health Organization, 2018). To combat the burden of depression, most research has focused on reducing depression symptoms (McKnight & Kashdan, 2009), perhaps with the assumption that symptoms correlate with well-being and functioning. As a result, less research has focused on understanding good outcomes after depression (e.g., presence of well-being; Rottenberg et al., 2018). However, a comprehensive review found only moderate correlations of depressive symptoms with well-being (e.g., presence of social relationships) and functional outcomes (e.g., occupational functioning), which suggests that these may be somewhat independent phenomena (McKnight & Kashdan, 2009). Neglecting measures of well-being may hamper the

ability to understand what predicts sustained recovery and well-being after depression (Rottenberg, Devendorf, Panaite, Disabato, & Kashdan, 2019) given that preliminary work has shown that elevated well-being may protect against future depression (Keyes, Dhingra, & Simoes, 2010). This finding is key given that half of people with an initial depressive episode experience a recurrence (Monroe et al., 2019).

Thus, it is important for depression research to specifically investigate predictors of good outcomes such as well-being (e.g., Cuijpers, 2019). In this study, we investigated how daily factors, such as positive events and affect, play a role in long-term well-being among people with depression. Because there is no universal

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definition as to what constitutes long-term, we use *long-term* to denote follow-up data of at least 1 year. Others have used similar timelines (e.g., 7 months, Lemmens et al., 2019; 18 months, Hunkeler et al., 2006).

Major Depression, Well-Being, and Emotions

Why do some depressed adults achieve excellent long-term outcomes (Rottenberg et al., 2018) and avoid a recurrent or chronic course of disorder (Monroe & Harkness, 2011)? An initial investigation into this question found that a substantial minority (nearly 10%) of adults with depression history went on to recover and achieve high levels of psychological well-being at a 10-year follow-up (Rottenberg et al., 2019). This work also uncovered that people with depression vary in their global reports of psychological well-being and that these variations predicted long-term outcomes (Rottenberg et al., 2019). A clear next step in this research program is to clarify what aspects of well-being are important for long-term positive outcomes.

Well-being models propose several mechanisms that may affect long-term mental health (e.g., sustained high functioning for at least 1 year). Hedonic models of well-being emphasize the presence of positive emotions (e.g., happiness) and sensations (e.g., pleasure), the absence of negative emotions (e.g., sadness), and overall life satisfaction (Diener, 2000; Kahneman, Diener, & Schwarz, 1999). Variables under the umbrella of well-being have been expanded to include optimal psychosocial functioning as one cornerstone of mental health (i.e., eudaimonic model of well-being; Disabato, Goodman, Kashdan, Short, & Jarden, 2016; Kashdan, Biswas-Diener, & King, 2008; Keyes & Annas, 2009). Conversely, depression—an affective disorder characterized by low mood and anhedonia, often expressed through withdrawal from activities—is associated with dysregulated hedonic and psychosocial functioning. Although hedonic and social deficits may appear separate, the capacity to feel pleasure likely affects social engagement (Rottenberg & Gotlib, 2004) and interest in other rewarding activities (Lewinsohn & Graf, 1973). Consider, for example, how the symptom of anhedonia may affect engagement in everyday activities (e.g., social engagement, work functioning).

Anhedonia is the diminished interest or pleasure in activities. About 70% of adults with a depression diagnosis experience anhedonia (Shankman et al., 2014), and this symptom may partially account for observations that people with depression often exhibit diminished positive affect, arousal (e.g., Berenbaum & Oltmanns, 1992; Rottenberg, Kasch, Gross, & Gotlib, 2002; Sloan, Bradley, Dimoulas, & Lang, 2002; cf. Dichter, Tomarken, Shelton, & Sutton, 2004), and response to reward (Henriques & Davidson, 2000). Note that the

deleterious role of anhedonia in response to positive (e.g., rewarding) contexts (e.g., receiving good news) has been supported by theoretical (e.g., Rottenberg, 2005; for a review, see Watkins, Grimm, Whitney, & Brown, 2005), clinical (e.g., behavioral activation therapy), and experimental perspectives of depression (see meta-analysis by Bylsma, Morris, & Rottenberg, 2008).

For instance, self-reported anhedonia increased the risk for chronic depression over a 10-year period (Moos & Cronkite, 1999), and a systematic review of laboratory studies found that diminished affective processing and response to positive stimuli can have a detrimental role on future depression (for a review of longitudinal literature, see Morris, Bylsma, & Rottenberg, 2009). Other work has shown that people with depression who exhibited the lowest behavioral reactivity to an amusing film evidenced worse depression severity 1 year later (Rottenberg et al., 2002). This body of work suggests that deficits in reward processing (e.g., anhedonia) are likely to play important roles in long-term well-being of people with depression. Unfortunately, few studies have empirically tested these questions using a longitudinal design.

Daily Diary Research and Depression

Daily diary research has added further insight into emotion dysregulation features that delineate people with and without depression in daily life. Daily diary designs gather end-of-day estimates from people about their daily activities and emotional experiences. This method has been used extensively in depression research, traditionally to investigate relationships between a person's emotions and number of experienced positive events (see e.g., Hammen & Glass, 1975; Larson, Raffaelli, Richards, Ham, & Jewell, 1990; Lewinsohn & Graf, 1973; Lewinsohn & Libet, 1972; Nezlek, Hampton, & Shean, 2000). Findings have suggested that depressed persons engage in fewer day-to-day positive activities than healthy persons (Lewinsohn & Graf, 1973) despite observations showing that more engagement in day-to-day positive activities correlates with better overall daily affect (Lewinsohn & Libet, 1972; Starr & Hershenberg, 2017) and adjustment for people with depression (Nezlek & Gable, 2001). More recent studies using experience sampling methods (ESM; which include multiple assessments per day) have found that depressed persons tend to report higher daily levels of negative affect (NA) and lower levels of positive affect (PA) overall and fewer subjectively rated positive events of any kind (Bylsma, Taylor-Clift, & Rottenberg, 2011; Thompson et al., 2012).

In trying to understand the role of positive events and daily affect, among people with depression, daily diary research has gleaned puzzling findings that

diverge from conventional expectations. Specifically, researchers hypothesized that people with depression show diminished affective response to positive events. However, research has actually found that depressed and nondepressed persons show similar reactions to intensely positive events (Bylsma et al., 2011; Thompson et al., 2012) and that reactions increase with the intensity of positive events (Panaite, Whittington, & Cowden Hindash, 2018).

Depressed persons often even report a puzzling “mood brightening effect” (Bylsma et al., 2011), which is evidenced by larger decreases in NA in response to highly positive contexts (among other signs of greater sensitivity to rewarding events; Steger & Kashdan, 2009). In a subsequent analysis within a depressed group, the magnitude of the mood-brightening effect was positively correlated with the intensity of judgment of daily events as positive (Panaite et al., 2018). Taken together, this preliminary work suggests that despite a low prevalence rate of positive events, coupled with the experience of generally low PA and high NA, people with depression can benefit at least momentarily when such events occur, evidenced by both increases in PA and decreases in NA in response to positive events. Such variations in moment-to-moment benefits may be relevant for long-term depression severity and well-being.

Daily Emotions, Positive Events, and Long-Term Outcomes

Despite the value of daily diary designs, relatively little published work has investigated the role of daily emotions and positive events in predicting long-term (e.g., > 1 year) depression symptoms and well-being. Relatedly, few studies have examined what types of daily positive events influence these long-term depression outcomes. In our study, as in most ESM studies (e.g., Bylsma et al., 2011; Peeters, Nicolson, Berkhof, Delespaul, & deVries, 2003; Thompson et al., 2012), we define positive events by using participants’ subjective event appraisals.

These positive events are especially relevant when considering behavioral theories of depression (Lewinsohn & Libet, 1972; Lewinsohn, Sullivan, & Grosscup, 1980). Behavioral models of depression posit that low levels of positive reinforcement (e.g., positive events) lead to sustained periods of negative affect (e.g., sadness), which can further increase avoidance behaviors (e.g., solitary activities such as watching TV, sleeping). In addition, behavioral-activation models acknowledge that the quality (intensity) and quantity of positive (e.g., rewarding) interactions with the environment influence depression outcomes (e.g., Lewinsohn et al., 1980). Consequently, behavioral treatments help

clients develop activity schedules and goals to increase the likelihood of positive interactions.

Therapists using behavioral treatments for depression noted that “particular activation strategies that work for one person may not work for another person” (Dimidjian, Martell, Herman-Dunn, & Hubley, 2014, p. 335). Indeed, some types of positive events may have a stronger relationship to depressed individuals’ well-being and symptoms than others. Solitary leisure activities, for example, may represent a common form of avoidance behavior among people with depression and thus be associated with lesser increases in well-being (e.g., Lewinsohn & Graf, 1973). Prior work found that persons who reported more positive social events experienced higher well-being (Steger & Kashdan, 2009). Taken together, these findings suggest that it is important to assess a range of events that may be relevant to long-term well-being among people with depression.

Unfortunately, relatively little work has investigated the role of daily experiences (events and emotions) for the long-term well-being of people with depression. Studies of short-term outcomes offer some precedents. For example, depressed persons showing higher NA decreases and higher PA increases in response to daily positive events exhibited the most improvement in depressive symptoms at a 1-month follow-up (Peeters, Berkhof, Rottenberg, & Nicolson, 2010). Behavioral studies of depression highlight the importance of both quality (intensity) and quantity of positive and reinforcing interactions with the environment for depression course (e.g., Lewinsohn et al., 1980). Note that in a 21-day daily diary study, adjustment covaried more strongly with positive events for participants with depression than they did for participants without depression, which suggests that positive events may have a larger impact on adjustment among people with depression (Nezlek & Gable, 2001). Finally, daily reward reports of PA in response to positive events both predicted fewer depressive symptoms and decreased the likelihood of a recurrent major depressive disorder (MDD) episode over a year later (Wichers, Peeters, Geschwind, et al., 2010). In the current work, we build on these findings by offering a daily diary assessment of emotions and positive events in both intrapersonal and social contexts as they contribute to long-term outcomes in clinically depressed adults. We sought to leverage the flexibility of a daily process design to capture how daily affective processes (for a review, see Bylsma & Rottenberg, 2011) may contribute to long-term health.

Current Study

In this study, we examined the relationship between depression, positive events, and daily emotions with two cross-sectional and one longitudinal aim.

First, we aimed to replicate cross-sectional findings of lower PA, higher NA, and generally lower rates of reported positive events among people with depression relative to people without depression (Bylsma et al., 2011; Thompson et al., 2012).

Second, given that well-being models and interpersonal theories of depression focus on the importance of socializing (e.g., Disabato et al., 2016), we evaluated the role of positive social as opposed to solitary leisure events on daily well-being. Prior work specifically highlights ties between positive social interactions and positive affect (e.g., Lewinsohn & Graf, 1973; Vittengl & Holt, 1998). Thus, we hypothesized that interpersonal positive events would have a stronger relationship with affect among depressed persons than would solitary positive events.

Finally, we evaluated whether daily positive events, PA, and NA predict long-term depression severity and well-being—specifically, 10 years later. We hypothesized that daily interpersonal (relative to solitary) positive events, more overall daily positive events, higher PA, and lower NA would predict two outcomes 10 years later: clinical improvement (i.e., lower odds of meeting a depression diagnosis) and well-being (i.e., autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, self-acceptance, dispositional affect, and life satisfaction).

Method

Samples and procedures

Data for the current study were extracted from the main random-digit-dialing sample at Waves 2 (2004–2006) and 3 (2013–2014) of the Midlife Development in the United States (MIDUS) study (2011). At Wave 2, the sample comprised a nationally representative, English-speaking, noninstitutionalized participants between the ages of 35 and 84 years ($n = 2,257$). In addition, some participants completed both a 30-min phone interview and a battery of self-administered questionnaires. For this study, we focused on a subsample of participants ($n = 960$) who completed phone interviews for eight consecutive nights for the National Study of Daily Experiences (Ryff & Almeida, 2017). Participants completed an average of 7.4 ($SD = 1.2$) daily interviews. Less than 3% of the sample completed fewer than 50% of the interviews.

Measures

Mental health diagnoses and severity. At both waves, mental health disorders were assessed with the Composite International Diagnostic Interview Short Form (CIDI-SF),

which was based on the revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R*; American Psychiatric Association, 1987). The CIDI-SF assessed 12-month major depression, generalized anxiety disorder (GAD), and panic disorder (PD). The CIDI-SF for major depression, GAD, and PD assessments have good classification accuracy relative to the full CIDI instrument (93%, 99%, and 98%, respectively; Kessler, Andrews, Mroczek, Ustun, & Wittchen, 1998).

Participants met depression criteria if they reported having a period of at least 2 weeks (in the past 12 months) of either depressed mood or anhedonia most of the day or nearly every day and endorsed four additional symptoms to qualify for a major depressive episode. The sensitivity of CIDI-SF classification for major depression is 89.6%, with specificity of 93.9% (Kessler et al., 1998). Depression symptom severity was calculated for participants with a depression diagnosis by totaling positive responses to CIDI-SF items. GAD and PD were also assessed with the screening version of the World Health Organization's (1990) CIDI, Version 10 (Kessler et al., 1998). We created a grouping variable for people without depression, GAD, and PD (non-disordered control = 0) and people meeting depression criteria (depressed = 1) at both waves.

Finally, a substance-use screening test assessed possible substance-use problems. The screening was completed by participants' "yes" or "no" self-report on four items inquiring about emotional or psychological problems from using alcohol, strong desire or urge to use, spending a great deal of time using alcohol, and using more than usual to get the same effect (Selzer, 1971). If participants answered "yes" to any of the four questions, the screen would be deemed positive for substance use over the past 12 months. Given that the screen cannot determine probable substance-use disorder, this information was not used as an exclusion criterion but is presented in Table S1 in the Supplemental Material available online.

Global well-being. At Waves 2 and 3, overall well-being was assessed as part of self-administered questionnaires. A 42-item measure captured Ryff's (1989) six dimensions of psychological well-being (seven items per dimension): (a) autonomy (acting with a sense of volition or willingness), (b) environmental mastery (self-direction and productivity), (c) personal growth (continual self-improvement), (d) positive relations with others (the capacity to love and be loved), (e) purpose in life (an overarching life aim), and (f) self-acceptance (positive self-regard). All items were rated on a Likert scale ranging from 1 (*strongly agree*) to 7 (*strongly disagree*).

In addition, Diener's (1984) tripartite model of subjective well-being was assessed. A five-item measure of

life satisfaction was measured on a Likert scale ranging from 0 to 10 (items addressed satisfaction with life overall, work, health, relationship with spouse/partner, and relationship with children). Furthermore, 30-day PA (e.g., cheerful, good spirits) and NA (e.g., sad, nervous) were assessed, each with six items on a Likert scale ranging from 1 (*all of the time*) to 5 (*none of the time*).

Scale responses were averaged to create each dimension's observed scores. Therefore, to assess global well-being at each wave, each of the nine scores were standardized using z scores and summed together to create a composite score (NA was reverse-scored). In the current study, reliability of the global well-being scale was acceptable for Wave 2 (Cronbach's $\alpha = .88$) and Wave 3 (Cronbach's $\alpha = .88$). Well-being exhibited moderate stability across Wave 2 and Wave 3 ($r = .71$) and a high two-way mixed effects intraclass correlation coefficient (.86).

Daily positive events. Nightly over 8 days, participants were queried by phone regarding daily experiences, events, and activities.

Time use on leisure activities. Participants were asked how much time (captured in hours and minutes) over the past 24 hr was spent engaging in leisure activities: "Since this time yesterday, how much time did you spend relaxing or doing leisure time activities?" If necessary, the following clarification was used: "Leisure time activities means actively choosing to do things for yourself. This may overlap with other categories, such as spending time with your children." For present purposes, we transformed the two variables (leisure hours and minutes) into one variable capturing the entire time in minutes.

Time used socializing. Participants were asked whether the time they usually spend with others decreased over the past 24 hr: "Did you spend less time with people in your personal life today compared to usual because of any problems with either your physical health, your emotions, use of alcohol, some combination, or other?" This was a "yes" or "no" question.

Positive interactions. Participants were asked to respond to a "yes" or "no" question: "Did you have an interaction with someone that most people would consider particularly positive (for example, sharing a good laugh with someone, or having a good conversation) since (this time/we spoke) yesterday?"

Number of positive events. To examine the positive events in respondents' daily experiences, respondents

were asked questions regarding the most positive event that occurred in the previous 24 hr, the time the positive event occurred, where the event occurred (e.g., work, home), and who else was involved in these positive events. This yielded a daily sum of relevant positive events.

Daily affect. Daily PA and NA were measured using an adapted inventory of emotions from the Non-Specific Psychological Distress Scale and the Positive and Negative Affect Schedule (Kessler et al., 2002; Mroczek & Kolarz, 1998; Watson, Clark, & Tellegen, 1988). Respondents reported how often during the past day they experienced 13 different positive emotions (e.g., cheerful, happy, active) and 14 different negative emotions (e.g., worthless, hopeless, angry) using a 5-point scale ranging from 0 (*none of the time*) to 4 (*all of the time*). Items for each scale were summed and averaged for each day; higher scores reflected higher PA and NA. Using two unconditional, intercept-only models, we estimated the reliability for negative affect ($\alpha = .95$) and positive affect ($\alpha = .98$).

Statistical method

Given the clustered, nonindependent nature of daily diary data, analyses were performed using multilevel modeling (MLM) for continuous outcomes (i.e., daily affect) and generalized estimating equations (GEE) for dichotomous outcomes (i.e., occurrence of a positive event). We used IBM SPSS (Version 24) to perform analyses. MLM can accommodate within-persons clustering of days by accounting for nonindependence of clustered data and estimating variance at all levels (Nezlek, 2001). MLM analyses used an unstructured covariance matrix with maximum likelihood estimation. GEE analyses were performed with an independent covariance matrix. We corrected for multiple comparisons within each family of analyses using the Benjamini-Hochberg technique (see Benjamini & Hochberg, 1995). Finally, an evaluation of a correlation matrix showed correlations ranging from $r = -.004$ to $r = \pm .57$. As expected, one correlation that exceeded .7 was between baseline and follow-up global well-being ($r = .72$). Models predicting well-being were ran with and without baseline well-being.

Hypothesis 1, concurrent model: number of daily positive events and affect as a function of depression status, depression severity, well-being. Using MLM, we modeled daily PA and NA, number of positive activities, time spent with people in daily life, and time performing leisure activities as a function of group membership (healthy or depressed) by regressing each person

i 's outcome level onto a dummy variable indicating the depression group membership (depression status _{i} : 0 = no depression, 1 = MDD in the past 12 months). At Level 2, the Level 1 intercept was allowed to vary randomly across participants and modeled as a function of individual differences in depressive diagnosis (i.e., MDD over the past 12 months), as shown in the Level 2 model equations below. These models were repeated with depression severity and well-being as predictors while restricting the sample to individuals with a 12-month depression diagnosis. A final model tested whether occurrence of positive events predicted daily NA and PA among individuals with a 12-month depression diagnosis.

Cross-sectional models testing group differences were first run without covariates (with statistics presented in text) and then evaluated including baseline characteristics that were identified to vary across groups (with statistics presented in tables).

Level 1 Model:

$$\text{Continuous outcome}_{it} = \beta_{0i} + r_{it}$$

Level 2 Model:

$$\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{Depression Status}_i) + u_{0i}$$

Hypothesis 2, concurrent model: frequency of positive events as a function of depression status, depression severity, well-being. Using GEE, we examined whether group membership at baseline was associated with odds of a positive event occurring in daily life. GEE is a general linear model used for clustered data that accounts for multiple incidents of daily positive events over the course of the 8-day daily process study, adjusts for the within-subjects correlation present among repeated observations over time, and corrects for missing data by weighting each individual's data according to the number of available observations. Two more models were evaluated with depression severity and well-being as predictors restricting the sample to those with a 12-month depression diagnosis at baseline. Cross-sectional models testing group differences were first run without covariates (with statistics presented in text) and then evaluated including baseline characteristics that were identified to vary across groups (with statistics presented in tables).

The following set of equations summarize the basic models:

$$\text{Mean response model: } E(y_{ij}) = \mu_{ij}$$

is related to the predictor by a link function: $g(\mu_i) = X_i \beta$

Hypothesis 3, longitudinal model: daily positive events and affect predicting depression status, depression severity, and well-being 10 years later among those with a 12-month depression diagnosis at baseline. The analyses for Hypothesis 3 followed a two-step procedure (for a similar approach, see e.g., Caminis, Henrich, Ruchkin, Schwab-Stone, & Martin, 2007; Kuppens et al., 2012). In the first step, estimates of person-level average number of daily positive events, NA, and PA were obtained from two-level (days nested in persons) multilevel analyses performed separately for each variable from the daily diary data. At Level 2 of the models, person-specific (random) intercept and slope values were estimated (intercept and slope estimates were allowed to covary across participants).

In the next step, these estimates were used to predict depressive status at follow-up in linear and logistic regression analyses. All analyses included data from the 77 participants with a 12-month depressive disorder at baseline and outcome data 10 years later. Longitudinal models were first tested using the main predictors based on our hypothesis: daily diary affect and events. These results are presented in text. Next, covariates were included on the basis of known predictors of depression course: age, sex, and education. Finally, baseline depression severity and baseline well-being were added to the models as covariates. Full model statistics are presented in tables.

Missing data and attrition. There was a 36% attrition rate at the 10-year follow-up. An analysis of baseline differences between individuals with and without data at follow-up resulted in null findings; there were no statistically significant differences in age, gender, baseline depression severity, or global well-being ($ps > .05$) among those that did and did not have complete Wave 3 data.

Results

Demographics and clinical characteristics

Of the participants interviewed, 960 met our inclusion and exclusion criteria. Participants met primary group membership as either nondepressed (no depression, anxiety, or panic disorders for the prior 12 months; $n = 839$) or with a 12-month depression diagnosis ($n = 121$). On average, participants with a depression diagnosis, relative to nondepressed, were younger (depressed: $M = 52.48$ years, $SD = 10.73$; nondepressed: $M = 58.56$ years, $SD = 12.51$; $p < .001$) and more likely to be women (depressed: 74.4%, $n = 90$; nondepressed: 51.3%, $n = 430$; $p < .001$); groups were indistinguishable

on the basis of educational attainment (depressed: 8.3% some high school, 28.3% high school diploma/GED, 32.5% some college, 30.8% college graduate or professional degree; nondepressed: 4.3% some high school, 24.6% high school diploma/GED, 29.1% some college, 41.1% college graduate or professional degree; $p > .05$). Finally, depressed participants were more likely to screen positive for problematic alcohol use over the past 12 months (14.5%, $n = 17$) compared with the nondepressed participants (2.9%, $n = 23$; $p < .001$). Among participants meeting criteria for depression, 18.2% ($n = 22$) and 22.3% ($n = 27$) also reported GAD and PD, respectively. Group differences are presented in Table S1.¹ Age, sex, and positive alcohol screen were entered as control variables in the following group analyses.

Baseline group differences in daily positive events and affect

First, we evaluated events and affect individually to understand the relationship between group membership on each of the variables of interest. Groups did not differ on total leisure time spent daily ($b = -6.41$, $SE = 10.63$, $t = -0.60$, $p = .547$). Persons with a 12-month major depression diagnosis reported higher mean levels of NA ($b = 0.27$, $SE = .02$, $t = 12.33$, $p < .001$), lower mean levels of PA ($b = -0.57$, $SE = .07$, $t = -8.57$, $p < .001$), and fewer positive events on average ($b = -0.13$, $SE = .06$, $t = -2.20$, $p = .028$) in daily life relative to healthy persons in the prior 12 months. Individuals with a 12-month diagnosis of depression also had lower odds of a positive interaction with someone in their personal life ($b = -0.24$, $SE = .11$, Wald $\chi^2 = 4.83$, $p = .028$, $OR = .79$) and higher odds of reporting having spent less time with people in their personal life ($b = 1.10$, $SE = .21$, Wald $\chi^2 = 26.77$, $p < .001$, $OR = 2.99$) relative to healthy persons.

Next, using a GLM multivariate analysis of variance, we evaluated the group membership effect on the daily events and affect concurrently. The multivariate test indicated an overall group effect, $F(6, 928) = 27.35$, $p < .001$; Wilks's $\Lambda = .850$, partial $\eta^2 = .15$. The tests of between-subjects effects indicated a group main effect on average NA, $F(1, 933) = 154.51$, $p < .001$, partial $\eta^2 = .14$; average PA, $F(1, 933) = 69.07$, $p < .001$, partial $\eta^2 = .07$; number of days when less time with people was reported, $F(1, 933) = 24.61$, $p < .001$, partial $\eta^2 = .03$; and number of days when a positive interaction was reported, $F(1, 933) = 6.34$, $p < .012$, partial $\eta^2 = .01$; the tests were significant when variables were entered concurrently. In summary, although groups did not differ on time spent on leisure activities and number of positive events, depressed persons reported higher

NA, lower PA, spending less time with people, and fewer days with a positive interaction relative to control participants ($ps < .042$). Results remained unchanged after including age, gender, and alcohol-screen score as covariates. Covariates were chosen according to baseline group differences. For complete models, see Table S2 in the Supplemental Material.

Does depression severity and global well-being relate to daily positive events and affect among persons with a depression diagnosis?

Among persons with a 12-month depression diagnosis, depression severity did not predict daily positive events or affect, $F(6, 109) = 0.82$, $p = .56$; Wilks's $\Lambda = .957$, partial $\eta^2 = .04$ (see Table S3 in the Supplemental Material). However, individuals with higher global well-being reported lower daily NA ($b = -0.02$, $SE = .01$, $t = -5.01$, $p < .001$) and higher daily PA ($b = 0.06$, $SE = .01$, $t = 6.65$, $p < .001$) and had lower odds of spending less time with people ($b = -0.09$, $SE = .02$, Wald $\chi^2 = 16.75$, $p < .001$, $OR = .92$). The global well-being effect continued to be statistically significant in a multivariate model, $F(6, 99) = 9.30$, $p < .001$, Wilks's $\Lambda = .639$, partial $\eta^2 = .36$. An investigation of between-subjects effects showed that the same effects remained statistically significant: NA, $F(1, 104) = 25.71$, $p < .001$, partial $\eta^2 = .20$; PA, $F(1, 104) = 51.83$, $p < .001$, partial $\eta^2 = .33$; and fewer days with less time with people, $F(1, 104) = 15.52$, $p < .001$, partial $\eta^2 = .13$. Results remained unchanged after including age, gender, and alcohol-screen score as covariates. Covariates were chosen according to baseline group differences. For full model results, see Table S4 in the Supplemental Material.

How do daily positive events relate to daily affect among persons with depression?

First, we ran a series of bivariate analyses among depressed participants. Results reflected that less daily time spent with people was associated with higher NA ($b = 0.51$, $SE = .05$, $t = 9.92$, $p < .001$), whereas positive interactions were associated with lower NA ($b = -0.07$, $SE = .03$, $t = -2.27$, $p = .023$). Although on days people reported higher NA they also reported spending less time with others, a greater variety of positive events was associated with daily PA levels. First, mirroring NA findings, less time with others was associated with lower PA ($b = -0.76$, $SE = .07$, $t = -10.60$, $p < .001$), and positive interactions were associated with higher PA

Table 1. Daily Positive Events as They Relate to Daily Positive and Negative Affect Among Persons With Depression ($N = 121$)

Parameter	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Model for positive affect				
Intercept	2.18	.08	27.75	< .001 ^a
Leisure time	< -0.001	< .001	-1.04	.298
Less time with people	-0.71	.07	-10.03	< .001 ^a
Positive interaction	0.08	.05	1.46	.144
Number of positive events	0.09	.03	3.12	.002 ^a
Model for negative affect				
Intercept	0.41	.04	9.67	< .001 ^a
Leisure time	< -0.001	< .001	-0.52	.605
Less time with people	0.51	.05	9.84	< .001 ^a
Positive interaction	-0.05	.04	-1.25	.211
Number of positive events	0.01	.02	0.29	.775

Note: *b* = unstandardized estimate; *SE* = standard error.

^aBased on the Benjamini-Hochberg technique, $\alpha \leq .031$ for significance testing.

($b = 0.21$, $SE = .04$, $t = 5.21$, $p < .001$). Higher overall number of positive events ($b = 0.14$, $SE = .02$, $t = 5.84$, $p < .001$) was associated with higher PA among depressed participants.

Next, we conducted two multivariate multilevel models to understand the effect of various events on NA and PA separately. Our first model evaluated the role of different positive events on daily PA. Taken together, less time with people and number of positive events remained significant predictors of PA such that less daily time spent with people was associated with lower PA ($b = -0.71$, $SE = .07$, $t = -9.99$, $p < .001$) and an increased number of positive events was associated with higher PA ($b = 0.08$, $SE = .03$, $t = 2.33$, $p = .020$). For NA, less daily time spent with others was the only predictor of high NA among depressed people ($b = 0.51$, $SE = .05$, $t = 9.84$, $p < .001$). Finally, neither leisure time nor positive interactions had a statistically significant relationship to PA or NA ($ps > .031$; see Table 1).

How do daily positive events and affect relate to depressed persons' status, severity, and general well-being 10 years later?

Finally, among initially depressed persons, preliminary bivariate analyses suggested that higher NA was associated with both higher depression severity ($\beta = -.33$, $t = 3.22$, $p = .002$) and higher odds of a depression diagnosis ($b = 1.92$, $SE = .75$, Wald $\chi^2 = 6.61$, $p = .01$, $OR = 6.81$) at 10-year follow-up. PA alone was not associated with depression severity or diagnosis 10 years later, nor were any of the positive events. For example, having a positive interaction ($\beta = -0.23$, $t =$

-2.26 , $p = .027$) was not related to lower depression severity, nor did it predict lower odds of a depression diagnosis ($b = -0.22$, $SE = .11$, Wald $\chi^2 = 4.18$, $p = .04$, $OR = .80$) at 10-year follow-up. When predictors were entered concurrently, NA was no longer related to depression severity ($\beta = 0.33$, $t = 2.26$, $p = .027$) or odds of a depression diagnosis ($b = 2.22$, $SE = .99$, Wald $\chi^2 = 4.99$, $p = .025$, $OR = 9.19$) at the 10-year follow-up. Introduction of age, gender, education, and baseline depression severity as control variables that could possibly have a role in depression outcomes did not change the results (for full models, see Tables 2 and 3).

Next, we evaluated the role of daily events and affect in follow-up global well-being among depressed individuals. Increased average leisure time ($\beta = -0.33$, $t = -3.03$, $p = .003$) over the 8-day assessment period and higher daily NA ($\beta = -0.45$, $t = 4.28$, $p < .001$) predicted lower well-being at the 10-year follow-up. More days with a positive interaction ($\beta = 0.33$, $t = 3.04$, $p = .003$), number of positive events ($\beta = 0.30$, $t = 2.67$, $p = .009$), and higher PA ($\beta = 0.46$, $t = 4.45$, $p < .001$) individually predicted higher well-being at follow-up. Reporting more days with less social time ($\beta = 0.23$, $t = 2.04$, $p = .045$) was not related to well-being 10 years later.

When predictors were included concurrently in our longitudinal analysis, higher average PA ($\beta = 0.30$, $t = 2.66$, $p = .010$) was related to higher global well-being. Higher average NA ($\beta = -0.32$, $t = -2.16$, $p = .034$) was no longer related to follow-up well-being. When baseline well-being was introduced in the model, NA and PA no longer predicted follow-up well-being ($ps > .017$), but more frequent positive interactions became a predictor of higher well-being ($\beta = 0.27$, $t = 2.40$, $p = .017$) as well as more days when less time with people

Table 2. Predictors of Depression Status 10 Years Later ($N = 77$)

Variable	<i>b</i>	<i>SE</i>	Wald χ^2	<i>p</i>	<i>OR</i>	95% CI (<i>OR</i>)
Age	0.004	.03	0.03	.861	1.00	[0.96, 1.05]
Gender	0.16	.58	0.07	.791	1.17	[0.37, 3.67]
Education	-0.31	.29	1.09	.295	0.74	[0.42, 1.30]
Depression severity	0.15	.26	0.35	.556	1.16	[0.70, 1.92]
Leisure time	-0.002	.003	0.58	.446	0.99	[0.99, 1.00]
Less time with people	-0.23	.33	0.50	.478	0.79	[0.42, 1.50]
Positive interaction	-0.17	.18	0.89	.345	0.84	[0.59, 1.21]
Number of positive events	0.49	.68	0.52	.471	1.63	[0.43, 6.16]
PA	-0.09	.39	0.06	.807	0.91	[0.43, 1.93]
NA	2.18	.99	4.79	.029	8.82	[1.26, 61.94]

Note: Significance level is set to $\alpha < .017$ based on Benjamini-Hochberg technique. *SE* = standard error; *OR* = odds ratio; CI = confidence interval; PA = positive affect; NA = negative affect.

was endorsed ($\beta = 0.28$, $t = 2.80$, $p = .007$). Introduction of age, gender, education, and baseline depression severity changed the results in that reporting positive interactions no longer related to follow-up well-being (see Table 4).

Discussion

Why do some persons with depression achieve excellent long-term outcomes (Rottenberg et al., 2018)? In the current study, we shed light on this question with an 8-day daily process design examining the relationship between daily well-being (PA and NA), involvement in daily positive events, and long-term positive outcomes for depression, including symptom reduction and elevated psychological well-being.

People with depression reported fewer positive opportunities, lower PA, and higher NA. These findings

replicated prior work using daily assessments of affect and positive events (Bylsma et al., 2011; Thompson et al., 2012) and clinical self-reports from people with depression (Lewinsohn & Libet, 1972). Moreover, cross-sectional well-being among people with depression was positively associated with more daily time spent with others, which was in turn associated with lower daily NA and higher daily PA. Positive event domains (e.g., leisure time) were unrelated to NA and PA. This pattern may indicate that interpersonal events may be more central to daily well-being in depression relative to other positive events (for more, see Steger & Kashdan, 2010).

Positive event frequency was also cross-sectionally associated with higher daily PA and, to a lesser extent, lower NA. Prior work demonstrated that depressed patients' engagement in a greater number of positive events was associated with better overall daily affect

Table 3. Daily Life Predictors of Depression Severity 10 Years Later ($N = 77$)

Variable	Unstandardized coefficients		Standardized coefficients			Collinearity statistics	
	<i>b</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	Tolerance	VIF
Age	-0.001	0.03	-0.003	-0.03	.978	.86	1.16
Gender	0.19	0.73	0.03	0.26	.792	.89	1.13
Education	-0.33	0.37	-0.11	-0.88	.381	.76	1.33
Baseline depression severity	0.25	0.33	0.09	0.78	.437	.88	1.13
Leisure time	-0.001	0.003	-0.04	-0.36	.721	.79	1.26
Less time with people	-0.21	0.40	-0.07	-0.52	.604	.66	1.52
Positive interaction	-0.21	0.23	-0.15	-0.89	.374	.39	2.56
Number of positive events	0.58	0.88	0.11	0.66	.509	.38	2.61
PA	-0.19	0.49	-0.05	-0.39	.694	.67	1.50
NA	2.43	1.15	0.31	2.11	.038	.51	1.96

Note: Significance level is set to $\alpha < .017$ based on Benjamini-Hochberg technique. *SE* = standard error; VIF = variance inflation factor; PA = positive affect; NA = negative affect.

Table 4. Daily Life Predictors of Well-Being 10 Years Later ($N = 77$)

Variable	Unstandardized coefficients		Standardized coefficients			Collinearity statistics	
	<i>b</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	Tolerance	VIF
Age	-0.12	0.05	-0.17	-2.31	.025	.81	1.23
Gender	-0.38	1.10	-0.02	-0.35	.732	.89	1.12
Education	0.54	0.56	0.08	0.98	.331	.75	1.33
Baseline depression severity	-0.88	0.49	-0.13	-1.77	.081	.80	1.25
Baseline well-being	0.59	0.08	0.73	7.25	< .001 ^a	.44	2.28
Leisure time	-0.01	0.01	-0.15	-1.95	.055	.76	1.32
Less time with people	1.81	0.68	0.26	2.65	.010 ^a	.48	2.09
Positive interaction	0.86	0.37	0.27	2.29	.026	.33	2.99
Number of positive events	-1.09	1.39	-0.09	-0.79	.435	.33	3.04
PA	-0.24	0.83	-0.03	-0.28	.778	.49	2.06
NA	-4.02	2.05	-0.21	-1.96	.054	.39	2.56

Note: *SE* = standard error; VIF = variance inflation factor; PA = positive affect; NA = negative affect.

^aBased on Benjamini-Hochberg technique, $\alpha \leq .017$ for significance testing.

characterized by endorsement of more happy states and fewer unhappy states (Lewinsohn & Libet, 1972). Some of the differential relationship between positive events and PA and NA may be a function of pleasantness intensity. For example, prior work suggests that the intensity of mood-brightening effects observed in prior studies (i.e., decreases in NA in response to positive events; Bylsma et al., 2011; Thompson et al., 2012) may vary as a function of appraisals (Panaite, Koval, Dejonckheere, & Kuppens, 2019). However, when clinically depressed, the frequency of positive events may be less important to predicting how positive events felt than how positive events are appraised (Hammen & Glass, 1975). Unfortunately, in the current study, we did not collect participants' judgments of event pleasantness or meaningfulness. Likewise, it is possible that NA may be more resistant to change, requiring greater thresholds of manageability or internal controllability by depressed adults compared with healthy adults (Peeters et al., 2003). To test whether thresholds differ for which types of positive events elicit long-term benefits and which types of negative events elicit long-term problems for depressed adults, future research will require fine-grained subjective assessments (including metaemotion and metacognition).

Our findings demonstrate the importance of daily affect for long-term outcomes in depression. Note that this is the first study to show that higher daily PA and positive events predicted higher overall well-being 10 years later. Conversely, higher daily NA was related to higher depression severity and lower well-being 10 years later. Daily life PA appeared to be linked to benefits 10 years later among those with depression. Note that the role of positive interactions remained a

significant predictor of well-being at 10 years even after controlling for global well-being at baseline. This finding supported our hypothesis that some daily events, in the aggregate, can have a greater impact on depressed individuals' long-term functioning. This finding is commensurate with short-term observations of depression within a behavioral framework in which scheduling activities that are high in reward potential are a means to increase positive reinforcement (Dimidjian et al., 2014).

Our data potentially offer greater specificity than prior reports in which overall well-being at one time point was predictive of depression at a future time point (Keyes et al., 2010; Rottenberg et al., 2019; Wood & Joseph, 2010). Note that in our data set, better hedonic functioning captured through daily experiences of PA and positive events was related to more benign depression outcomes over the long term. Although our study does not elucidate the specific mechanisms of change, it has been shown that experience of positive affect facilitates a variety of positive outcomes (for a meta-analysis, see Lyubomirsky, King, & Diener, 2005) potentially by facilitating sociability, engaging in social interactions, and appraising these activities as more rewarding (see Lyubomirsky et al., 2005). Conversely, anhedonia is implicated in a worse course of depression given that it has been shown to increase the risk of chronicity over a 10-year period (Moos & Cronkite, 1999).

We report on clinically meaningful outcomes over a long follow-up period. These study features reinforce the clinical significance of these findings. Indeed, these findings bolster approaches such as behavioral activation therapy (e.g., Hopko, Lejuez, Ruggiero, & Eifert,

2003) and the development of skills such as savoring (e.g., Bryant & Veroff, 2017). Broadly, our findings are in keeping with behavioral and interpersonal theories of depression. Behavioral theories conceptualize depression within a person's life context. Behavioral models of depression predict that low levels of positive reinforcement can increase feelings of sadness, which can further increase avoidance behaviors (e.g., solitary activities such as watching TV, sleeping). Behavioral avoidance tends to exacerbate depressed moods by decreasing social contact and engagement in pleasurable activities (Dimidjian, Martell, Addis, Herman-Dunn, & Barlow, 2008). Depressed moods can also elicit support from others, and our findings suggest that when this is successful, long-term mood benefits emerge (Allen & Badcock, 2003; Rottenberg & Gross, 2003). The idea that sustaining engagement with significant others and in pleasurable activities may lead to long-term well-being is at the core of behavioral-activation techniques in therapy.

A few limitations restrict the scope of our findings. For example, although sample size was relatively high for a daily process study, we did not have a sufficient sample of depressed persons to predict thriving as a categorical outcome at follow-up (for a review on high functioning after depression, see Rottenberg et al., 2018). In fact, the smaller remaining sample with follow-up data likely increased the possibility for Type II error in this study. It would be important to understand the boundaries of our findings and whether there may be optimal combinations of emotional well-being that could ultimately lead to thriving in depression. As noted above, details about the daily positive life events were relatively generic and other descriptors such as appraisals of the positive events were not part of the design, therefore limiting an understanding of the exact contexts that may be beneficial among depressed persons. Finally, although end-day reports are valuable for capturing day-level data and have been shown to be valid for this purpose, we cannot rule out recall bias as an explanation of our well-being findings. In such a scenario, longitudinal results would reflect enhanced capacity to recall positive events rather than actual occurrence of more positive events for depressed persons. Although such a scenario cannot be ruled out, it appears improbable because depressed persons should, if anything, be biased against the recall of positive events.

Despite the noted limitations, our findings add to new efforts (Rottenberg et al., 2018, 2019) to understand the roots of long-term positive outcomes among persons with depression. To expand this line of inquiry, two key future questions are to understand how these positive outcomes (a) play out across different phases of depression (e.g., by shortening depression episodes, or by

increasing periods of recovery, or both) and (b) play out differently across persons (whether some persons benefit differentially from particular changes in daily routines). In this work, it will be valuable to move beyond categorizing people as having or not having a depression diagnosis to explore heterogeneous routes from symptom reduction to the onset of sustainable well-being.

Transparency

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Author Contributions

V. Panaite (with instrumental support from A. R. Devendorf) developed the study concept, performed the data analysis, and drafted the manuscript. All of the authors contributed to the conceptualization of the study and the interpretation of results and provided critical revisions. All of the authors approved the final manuscript for submission.

Declaration of Conflicting Interests


The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

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Supplemental Material

Additional supporting information can be found at <http://journals.sagepub.com/doi/suppl/10.1177/2167702620956967>

Note

1. Code used for the main analyses is available in the Supplemental Material.

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