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Do positive events and emotions offset the difficulties of stressful life events? A daily diary investigation of depressed adults

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ABSTRACT

Can positive events and positive emotions reduce the impact of a stressful event in people with depression? In previous research, studies have found that positive events and positive affect (PA) that co-occur with daily stressors can reduce – or offset – the emotional impact of the stressors. However, this effect has not been examined in people with depression, an emotional disorder characterized by higher levels of negative affect (NA) and lower levels of PA. This study examined whether depression is an individual difference variable in affective offset through testing whether depression reduces or eliminates affective offset. Using a nationally representative sample with daily assessments across eight days, we examined reports of positive events, stressors, and PA and NA from 121 adults with a depression diagnosis versus 839 adults with no depression symptoms. For depressed persons, when a stressor occurred, same day number of positive events, but not PA, offset next day NA. At the same time, depressed participants who reported higher average daily PA also reported lower NA the day after a stressor occurred. Our study provides evidence that some depressed persons exhibit affective offset and some depressed persons do not. We offer several explanations for the heterogeneous reactions of depressed individuals.

1. Introduction

Depression is a highly prevalent emotional disorder (i.e., 8.1% American adults) (Brody et al., 2018) and constitutes the leading cause of disability worldwide (World Health Organization, 2017). Affective disturbance is a core aspect of major depression, characterized by low positive affect (PA; e.g., feelings of joy) and high negative affect (NA; e.g., feelings of irritability) (Rottenberg, 2005). This affective profile may impair an individual's capacity to respond appropriately to daily life positive events (e.g., a promotion) and negative events (e.g., a breakup) and likely aids in "getting stuck in depression" (Kashdan & Rottenberg, 2010; Koval et al., 2012). In this study, we explore the contexts that may hinder or support depressed persons' affective flexibility.

Studies using daily process methodologies, such as daily diaries or experience sampling methods (ESM), find that depression is associated with greater daily NA and with perceiving events as less pleasant, more unpleasant, and more stressful (Bylsma et al., 2011). As a result, people with depression may respond with increased NA to small daily life stressors (Wichers et al., 2007a; Wichers et al., 2007b), which may be inert and inflexible to change, and ultimately may reduce engagement with daily life (Koval et al., 2012). Indeed, people with depression also report fewer day-to-day positive activities relative to people without depression (Bylsma et al., 2011; Lewinsohn & Graf, 1973).

Experiencing positive events and PA is not only desirable (Gray, 1994), it can also moderate emerging distress during stressful experiences. Acording to Fredrickson's (Fredrickson et al., 2000; Fredrickson, 2013) undoing hypothesis within the broaden-and-build theory, positive emotions are protective because they help people broaden their thoughts, urges, and perceptions to enable coping with negative emotions and situations. In this way, PA can dampen negative emotions during a stressful event (Nezlek et al., 2017) and even the day *after* a stressful event (Leger et al., 2020). One outstanding question concerns whether this positive offset is universal, or whether individual differences impact whether such effects are muted among individuals with depression.

Notably, daily process designs find that depressed persons and

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nondepressed persons do not differ in PA after experiencing positive events in daily life, even as depressed persons experience fewer positive events (Bylsma et al., 2011). Engagement in positive events has also been related to lower depressed mood (Lewinsohn & Libet, 1972; Nezlek & Gable, 2001; Starr & Hershenberg, 2017) and larger decreases in daily NA after positive events (termed the "mood brightening effect") (Bylsma et al., 2011), the magnitude of which correlates with the extent to which depressed persons appraise an event as positive (Panaite et al., 2018). Findings to date highlight both the presence of differences between adults with and without depression, as well as heterogeneity among the group of people with depression.

Given indications that people with depression can emotionally benefit when positive events occur, it would be helpful if researchers could identify contexts in which these benefits might be sustained (i.e., prolonged increases in PA and prolonged decreases in NA). To our knowledge, no study of depression has examined positive affective offset, when PA and positive events are associated with reduced NA the day after a stressor. Such data would shed important new light on how depression influences affective dynamics in daily life, particularly in an area that could have therapeutic implications.

Prior work demonstrated that positive events and affect can offset the negative impact of stressors in normative populations (Nezlek et al., 2017), including in a representative sample of US adults (Midlife Development in the United States National Study of Daily Experiences; MIDUS) (Leger et al., 2020). With this as background, we used the MIDUS database to examine individual differences, contrasting offset effects among a representative group of US adults who met criteria for depression diagnosis relative to non-depressed persons that reported no depression symptoms over the past 12 months. Given evidence that the number of positive events has a dose-response effect on affect in people with depression (Panaite et al., 2021), we also evaluated the role of the reported number of positive events on next day NA across groups.

Basic affective scientific work has demonstrated that the experience of positive events and PA can blunt the emotional impact of stressors (Leger et al., 2018, 2020); it is unknown whether such offset effects might hold for depressed people, a group that is often vulnerable to the effects of stress. Thus, we examined a series of questions:

1) Do depressed persons show similar offset effects of positive events on next day NA to non-depressed persons?
2) Do depressed persons show similar offset effects of positive events on next day PA to non-depressed persons?
3) Do depressed persons show similar offset effects of daily PA on next day NA to non-depressed persons?
4) Do depressed persons show similar offset effects of daily PA on next day PA to non-depressed persons?

We expected that depressed and non-depressed groups will both exhibit offset effects. Whether depressed might show smaller offset effects than nondepressed person was a lower confidence prediction. Furthermore, in addressing these questions, we considered two aspects of daily experiences that could impact group differences. First, we know that people's affect and experience of daily positive events and stressors vary day to day and so we tested within person effects. Second, we also know that magnitude of daily affect and experiences differ across people, which we captured by evaluating between person effects. Our analyses were designed to capture these variations both within and between people across depressed and non-depressed samples.

2. Method

2.1. Participants and procedures

We used archival data from Wave 2 of the Midlife Development in the United States study (2004–2006; MIDUS: http://midus.wisc.edu/scopeofstudy.php). Our study focuses on the 960 participants who met the following criteria: 1) were part of the MIDUS main random digit dialing sample and completed a 30-minute phone interview and a battery of self-administered questionnaires (mailed to participants), 2) participated in the National Study of Daily Experiences, which comprised of phone interviews for eight consecutive nights (Ryff & Almeida, 2017), 3) and were either depressed (i.e., with a 12-month depression diagnosis; $n = 121$) or were non-depressed (i.e., no depression, anxiety, panic disorders and symptoms for the prior 12 months; $n = 839$). This sample included a nationally representative, English-speaking, non-institutionalized sample of adults aged 35 years to 84 years who completed a mean of 7.4 ($SD = 1.2$) daily interviews and less than 3% of the sample completed fewer than 50% of the interviews. Group differences are presented in Table 1.

2.2. Measures

2.2.1. Mental health diagnoses and severity

Mental health diagnoses were documented with the Composite International Diagnostic Interview Short Form (CIDI-SF) using DSM-IV criteria (American Psychiatric Association, 1994). Diagnoses for 12-month major depression, generalized anxiety disorder (GAD), and panic disorder (PD) were obtained. The CIDI-SF has demonstrated good classification accuracy compared to the full CIDI instrument for major depression, GAD, and PD (93%, 99%, and 98%, respectively) (Kessler et al., 1998). 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 by adding the scores on individual items.

2.2.2. Trait positive and negative affect

Baseline positive and negative affect were assessed in reference to the past 30-days. Positive affect was assessed with 11 items (e.g., *cheerful*, *good spirits*). Negative affect was assessed with 10-items (e.g., *sad*, *nervous*). Both measures used a Likert scale ranging from 1 (*all of the time*) to 5 (*none of the time*). These measures were developed for the MIDUS study with consideration of items from previously validated affect measures (see for details, Mroczek & Kolarz, 1998). Internal

Table 1
Demographics ($N = 960$).

	Non-depressed[a] ($n = 839$)	Depressed ($n = 121$)	p
	M (SD)	M (SD)	
Age	58.56 (12.51)	52.48 (10.73)	<.001
Sex	% (*N*)	% (*N*)	<.001
Male	48.7 (409)	25.6 (31)	
Female	51.3 (430)	74.4 (90)	
Education			.137
Some grade school to some HS	4.3 (44)	8.3 (10)	
GED or HS	24.6 (206)	28.3 (34)	
Some college (no bachelor's)	29.1 (244)	32.5 (39)	
Graduated college to doctorate/ professional degree	41.1 (344)	30.8 (37)	
Comorbidity			
Generalized anxiety disorder	na	18.2 (22)	na
Panic disorder	na	22.3 (27)	na
Trait positive affect	3.64 (0.60)	2.79 (0.74)	<.001
Trait negative affect	1.40 (0.38)	2.25 (0.78)	<.001
Number of positive events	1.11(0.65)	0.96 (0.57)	.023
Number of stressors	0.48 (0.44)	0.73 (0.58)	<.001
% of days with any positive event reported	71.3%	66.0%	.045
% of days with any stressor reported	37.4%	49.7%	<.001

[a] Healthy denotes absence of depression, anxiety, panic symptoms for the prior 12 months; M = mean; SD = standard deviation; HS = high-school; GED = general educational development; na = not applicable.

consistency was excellent for positive affect (α = 0.92) and negative affect (α = 0.91).

2.2.3. Number of daily positive and negative (i.e., stressors) events

Participants were queried on a nightly basis by phone for eight consecutive days about their daily events. Positive daily events were measured by asking participants about the time, the place, and whether others were present during a positive event that occurred in the last 24 h. Events were summed for a daily total of positive events. Similarly, participants were queried about daily stressors and a sum of daily relevant stressors was derived.

2.2.4. Positive and negative event exposure

In addition to frequencies, two dummy coded variables identified whether any positive events (1 = *yes*, 0 = *no*) and any stressors (1 = *yes*, 0 = *no*) were reported each day.

2.2.5. Daily affect

Daily PA and NA were measured using items from the Non-Specific Psychological Distress Scale and the Positive and Negative Affect Schedule (Kessler et al., 2002; Mroczek & Kolarz, 1998; Watson et al., 1988). Participants were asked to report how often they experienced 13 positive emotions (e.g., *cheerful*, *happy*, *active*) and 14 negative emotions (e.g., *worthless*, *hopeless*, *angry*) during the past day. Items were assessed on a 5-point scale from 0 (*none of the time*) to 4 (*all of the time*). Items for each subscale were averaged for each day; higher scores reflect higher PA and NA. Reliability was calculated using two unconditional, intercept only models and was acceptable for NA (α = 0.95) and PA (α = 0.98).

2.3. Analysis plan

Given the hierarchically clustered structure of daily diary data within persons, multilevel analyses were used to test hypotheses. Analyses were conducted in SPSS Version 26 (IBM, 2019). First, we person-mean centered level 1 predictors (current day PA and number of positive events) and covariates (number of stressors). Level 2 covariates (age, education, trait PA, trait NA) were grand-mean centered. Outcomes were lagged next-day NA and PA. We tested *within person effects* by including person centered number of positive events and person-centered PA and their interaction with a stressor in models predicting next day NA and PA. *Between person effects* were tested by including grand mean centered number of daily positive events and PA, and their interactions with a stressor, in models predicting next-day NA and PA, respectively. Models were tested first without and then with covariates. Included covariates were demographic group differences (i.e., age, gender), and consistent with previous research testing similar aims (e.g., Leger et al., 2020), we also included trait affect and number of daily stressors which differentiate our two groups and may impact daily affect dynamics. To further ensure that next-day negative emotion was not influenced by a next-day stressor, we excluded days when individuals experienced a next-day stressor (method used by Leger et al. (2018, 2020)).

Level-1 Model:

$$\text{Next Day Affect } (NA/PA)_{ij} = \beta_{0j} + \beta_{1j}{}^{*}(\text{Current day PA}/\text{Number of positive events}_{i}) + \beta_{2j}{}^{*}(\text{Current day stressor}_{j}) + \beta_{3j}{}^{*}(\text{Current day PA}/\text{Number of positive events}{}^{*}\text{Current day stressor}_{ij}) + r_{ij}$$

Level-2 Model:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\,(\text{Depression Status}) + \gamma_{02}\,(\text{Control Variables}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}\,(\text{Depression Status}) + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}\,(\text{Depression Status}) + u_{2j}$$

$$\beta_{3j} = \gamma_{30} + \gamma_{1}\,(\text{Depression Status}) + u_{3j}$$

3. Results

3.1. Do depressed persons show offset effects of positive events on next day NA similarly to non-depressed persons?

Within person analyses of the impact of number of positive events on days with a stressor on next day NA among depressed relative to non-depressed participants resulted in a three-way interaction ($b = -0.08$, $SE = 0.02$, $t(3206.64) = -3.61$, $p < .001$) (see Table 2); follow up tests indicate that the offsetting effect that positive events has on next day NA was stronger among depressed individuals relative to controls. Results remained unchanged when control variables were introduced in the main model.

Between-person analyses of the relationship between average number of positive events and daily stressors on next day NA among depressed relative to non-depressed participants resulted in a nonsignificant three-way interaction (see Table 2). Results remained unchanged when control variables were introduced in the main model.

3.2. Do depressed persons show offset effects of positive events on next day PA similarly to non-depressed persons?

Within person analyses revealed that while number of current day positive events offset the impact of current stressor on next-day PA ($b = 0.04$, $SE = 0.02$, $t(3044.78) = 2.13$, $p = .033$), this effect did not differ across groups (see Table 2). Results remained unchanged when control variables were introduced in the main model.

Between-person analyses reflected that people with higher average number of positive events reported higher levels of next-day PA ($b = 0.11$, $SE = 0.04$, $t(1058.06) = 2.71$, $p = .007$), and this effect was observed across groups. Finally, no relationships were observed among average number of positive events, current stressors, and next day PA across groups (see Table 2). Results remained unchanged when control variables were introduced in the main model.

3.3. Do depressed persons show offset effects of daily PA on next day NA similarly to non-depressed persons?

Within person analyses revealed that the offsetting effect of daily PA differed between depressed and non-depressed people ($b = 0.08$, $SE = 0.04$, $t(3243.38) = 2.13$, $p = .034$). Specifically, unlike thee non-depressed who exhibited an offset effect, depressed participants reported higher next day NA (see Table 3). When control variables were included in the model, trait NA became the leading independent predictor of next day NA across groups ($b = 0.16$, $SE = 0.01$, $t(755.65) = 10.76$, $p < .001$), and for those with depression, the presence of a

Table 2
The relationship between number of positive events on days a stressor is reported and next day affect.

	DV = next day NA				DV = next day PA			
	B	SE	*t*	*p*	B	SE	*t*	*p*
Within person effects								
Intercept	0.07	0.01	11.72	.000	2.89	0.03	113.69	.000
Current day number of positive events	0.004	0.004	0.90	.366	−0.01	0.01	−1.09	.275
Current day stressor	0.01	0.01	2.59	.010	−0.03	0.02	−1.92	.055
Depression group	0.14	0.02	7.49	.000	−0.49	0.08	−6.41	.000
Current day number of positive events * current day stressor	−0.01	0.01	−1.80	.071	0.04	0.02	2.13	.033
Current day number of positive events * depression group	0.08	0.01	5.54	.000	0.04	0.04	1.00	.316
Current day stressor * depression group	0.04	0.02	2.41	.016	−0.01	0.05	−0.11	.911
Current day number of positive events * current day stressor * depression group	−0.08	0.02	−3.61	.000	−0.06	0.06	−1.02	.307
Between-person effects								
Intercept	0.08	0.01	6.24	.000	2.77	0.05	54.77	.000
Mean daily number of positive events	−0.003	0.01	−0.33	.745	0.11	0.04	2.71	.007
Depression group	0.22	0.04	5.83	.000	−0.63	0.15	−4.16	.000
Mean daily number of positive events * current day stressor	−0.01	0.01	−1.01	.314	0.02	0.03	0.78	.437
Mean daily number of positive events * depression group	−0.09	0.04	−2.45	.014	0.17	0.14	1.24	.215
Mean daily number of positive events * current day stressor * depression group	−0.004	0.03	−0.14	.890	0.02	0.09	0.18	.860

Note: Models do not include covariates.

Table 3
The relationship between PA on days a stressor is reported and next day affect.

	DV = next day NA				DV = next day PA			
	B	SE	*t*	*p*	B	SE	*t*	*p*
Within person effects								
Intercept	0.07	0.01	11.63	<.000	2.89	0.03	113.42	<.000
Current day PA	0.01	0.01	1.25	.212	−0.08	0.02	−3.33	.001
Current day stressor	0.01	0.01	2.38	.017	−0.02	0.02	−1.40	.162
Depression group	0.14	0.02	7.54	<.000	−0.49	0.08	−6.50	<.000
Current day PA * current day stressor	−0.03	0.02	−1.64	.101	0.22	0.04	5.10	<.000
Current day PA * depression group	−0.003	0.02	−0.13	.900	0.29	0.06	4.84	<.000
Current day stressor * depression group	0.04	0.02	2.49	.013	−0.01	0.05	−0.20	.838
Current day PA * Current day stressor * Depression group	0.08	0.04	2.13	.034	−0.40	0.10	−3.98	<.000
Between-person effects								
Intercept	0.29	0.03	11.64	<.000	0.04	0.03	1.19	.235
Mean daily PA	−0.08	0.01	−9.09	<.000	0.99	0.01	94.44	<.000
Depression group	0.35	0.05	6.42	<.000	0.11	0.07	1.54	.125
Mean daily PA * current day stressor	−0.01	0.01	−1.09	.275	0.03	0.02	1.69	.092
Mean daily PA * depression group	−0.10	0.02	−5.10	<.000	−0.04	0.03	−1.46	.144
Mean daily PA * current day stressor * depression group	−0.10	0.02	−4.78	<.000	0.06	0.05	1.38	.168

Note: Models do not include covariates.

stressor was related to higher next day NA relative to those without depression ($b = 0.04$, $SE = 0.02$, $t(3152.68) = 2.25$, $p = .025$).

Between-person analyses reflected that people with higher average levels of daily PA reported lower next-day NA after they experienced a current day stressor. Results showed a three way interaction of mean level PA, current day stressor, and group membership on next day NA ($b = -0.10$, $SE = 0.02$, $t(3510.95) = -4.78$, $p < .001$), such that depressed people with higher mean levels of PA reported lower NA the day after a stressor at a higher degree relative to the non-depressed group (see Table 3). Results remained unchanged when control variables were introduced in the main model.

3.4. Do depressed persons show offset effects of daily PA on next day PA similarly to non-depressed persons?

In *within person analyses*, the interaction of the person-centered PA, daily stressor, and group membership was a significant predictor of next day PA ($b = -0.40$, $SE = 0.10$, $t(3067.23) = -3.98$, $p < .001$) (see Table 3). Specifically, depressed participants with higher PA on days with a stressor manifested a lower offset effect on next day PA relative to controls. Results remained unchanged when control variables were introduced in the main model.

Between-person analyses suggest that people with higher average levels of PA reported higher levels of next day PA ($b = 0.99$, $SE = 0.01$, $t(3786) = 94.44$, $p < .001$); however, we found no variability across people or across groups in the relationship between mean PA, current stressor, and next-day PA (see Table 3). Results remained unchanged when control variables were introduced in the main model.

4. Discussion

Nonclinical studies have demonstrated that the experience of positive events and positive affect can blunt the emotional impact of stressors (Leger et al., 2018, 2020). One key question is whether such effects are universal or whether there are systematic individual differences in affective offset. In the present study, we examined whether offset effects hold for depressed people, a group that is often vulnerable to the effects of stress. This study advanced our understanding of how depression influences affective dynamics in everyday life in two ways.

First, our findings underscore the benefits of daily positive events for improving both positive and negative mood across groups. More importantly, our findings also support the benefits of positive events on days with stressors among depressed persons, who may be more sensitive to effects of stressors (e.g., Wichers et al., 2007b). Specifically, number of positive events was associated with lower next day NA, but comparable next day PA for depressed participants relative to non-

depressed. These findings converge with prior observations of "mood brightening" – reflected by a larger decrease in momentary NA in response to positive events – and comparable PA among depressed relative to non-depressed persons (Bylsma et al., 2011). In previous work, the magnitude of the mood brightening effect within a depressed sample varied with the intensity of the reported positive events (Panaite et al., 2018). Current findings add to this work by supporting that number of positive events may also have an additive effect for depressed individuals.

Next, we found that while PA had an offsetting effect for non-depressed persons evidenced by both lower next day NA and higher next day PA, for depressed persons, PA, unlike number of positive events, did not offset the impact of a stressor on next day affect. Instead, after stressors depressed people reported a higher next day NA and a lower next day PA relative to non-depressed. This fits with other demonstrations that PA is often short lived (e.g., Panaite et al., 2019) by people with depression and that the experience of NA can be decoupled from environmental contexts (e.g., emotional inertia, Koval et al., 2012, p. 20). A lack of offset may also result from a restricted range of PA among depressed people, who tend to report low levels of PA (Bylsma et al., 2011). Meanwhile, our within group analyses demonstrated important differences among persons with depression. Specifically, for those depressed people who reported higher PA over the course of the study, PA on days with a stressor was related to lower next day NA. This is our second contribution; current findings add to accumulating work on the value of investigating depression heterogeneity in understanding long term positive outcomes in depression (Panaite et al., 2021; Rottenberg et al., 2019).

One key question is why depressed people would exhibit heterogeneity in affective offset. One possibility is that a minimum level of PA is necessary to experience affective offsetting. Another possibility in this sample is that some individuals may have no longer met criteria for major depression at the time of the study and experienced an increase in PA as a result of depression lifting. It is also possible that those individuals experiencing more positive events and high average PA may be more successful at deploying emotion regulation strategies over time to quickly suppress the impact of a stressor on next day NA (e.g., see for review, Rottenberg, 2017). Consistent with the undoing hypothesis of the broaden-and-build model of PA and with functional models of psychological flexibility, higher PA even during a period of depression may provide key resources needed to more adaptively respond during stressors (e.g., Fredrickson et al., 2000).

In sum, depression is associated with some alterations in affective dynamics, in that reported PA did not appear to impact next day negative or positive affect at an individual level, while number of daily positive events on days with stressors appeared to relate to lower next day NA. Furthermore, consistent with prior work, we found variability across persons with depression (e.g., Panaite et al., 2021), in that those with higher average PA experienced lower NA the day after a stressor was reported. These findings suggest that while depression is characterized by psychological inflexibility (Houben et al., 2015; Kashdan & Rottenberg, 2010), there is increasing evidence that depression is heterogeneous in how it impacts individuals and their affective repertoire (Panaite et al., 2021).

Therefore, it does not appear that depression is invariably associated with reduced affective reactivity (e.g., ECI) (Gray, 1994; Rottenberg, 2005, 2017). Individuals that experience higher number of positive events and higher than group average PA tend to experience lower NA the day after a stressor. Future research should utilize multiple methods with high temporal precision longitudinally to further clarify trajectories of hedonic processes in depression, and especially to better understand the boundaries of positive mood induction through exposure to positive events.

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Availability of data and material

We thank the Midlife Development in the United States study for making the data publicly available. MIDUS 2: https://www.icpsr.umich.edu/web/ICPSR/studies/4652/summary. MIDUS 2 Daily Stress Project (Daily Diary): https://www.icpsr.umich.edu/web/ICPSR/studies/26841.

Disclaimer

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Declaration of competing interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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