Supplemental Material for

"*Emotion Dynamics in Current and Remitted Depression: An Ecological Momentary Assessment Study*"

The EMA Protocol

EMA surveys were administered using the RealLife Exp application or "app" by LifeData Corporation, which is compatible with both iOS and android devices. Through the app, participants were sent 5 surveys daily for 14 consecutive days (70 surveys total). Surveys were sent at random times throughout the day, with a minimum of 110 minutes between survey prompts. To maximize compliance, participants could choose between four pre-set time frames to receive surveys across the day, depending on when they typically woke up. The two earliest timing options were shifted slightly later on weekends to account for later sleep times. The earliest of the four options spanned 6:30am-9:00pm during the week and 8:30am-10:30pm during the weekend, while the latest option spanned 1:00pm-11:45pm every day.

Once a participant received a notification to complete a survey, they had one hour to complete the 1st ("morning") survey of the day and two hours to complete each of the later 4 ("day") surveys before they expired and could no longer be accessed. The morning survey contained extra questions about the day/night before, however, none of these additional items are considered in the current study. If the participant did not complete the survey right away, they would receive up to 3 reminders to do so, every 25-27 minutes (depending on the timing option), until the survey expired.

Research staff monitored EMA participation daily, reaching out to participants at pre-determined points throughout the two weeks (days 2, 5, and 10) to inform them of their progress and answer questions about the app and surveys. Staff would initiate additional contacts if they

noticed very low compliance rates (specifically, < 50% compliance across two days or 0% compliance across one full day) and offer assistance with app issues. Participants received $1 for each of the first 40 surveys they completed and $2 for each of the remaining 30 surveys they completed (maximum earning potential of $100). This pay-by-survey system with a double payment incentive for later surveys was used to maximize compliance.

Data Quality Checks

Due to the high burden on participants and invisible nature (i.e., surveys are completed outside of the lab, unsupervised) of EMA, it is important to take extra steps to evaluate data quality. Currently, there are no widely used conventions for demarcating valid from potentially invalid responses in EMA, and thresholds are recognized to be largely arbitrary and idiosyncratic. However, a few considerations are recommended (Viechtbauer, 2021). For example, low response rates may reflect a participant systematically ignoring responses at inconvenient times, leading to observed data that is a biased representation of that individual's everyday experience. Very fast survey completion times suggest that a participant is clicking through the survey without carefully reading the questions. Very slow survey completion times suggest that a participant got distracted in the middle of completing the survey; such distractions may represent significant events that alter the state of the individual, however, the timing of this change cannot be accounted for. Finally, low variability in responses across surveys suggests careless responding (e.g., always selecting the first or middle response option; Viechtbauer, 2021).

For the current study, we set the following thresholds for filtering data of questionable quality, based in part on previously recommended criteria (Viechtbauer & Constantin, 2019). Participants would be excluded if they completed fewer than 14 surveys (response rate < 20%),

the equivalent of 2.5 days of participation. Individual survey responses would be excluded if the survey completion time was equivalent to an average response of less than 1 second per item (i.e., < 28 seconds for the "day" questions and < 40 seconds for the "morning" questions) or greater than 45 minutes (regardless of survey). Finally, participants with 0 variability in affect responses across both positive and negative domains would be excluded, as it is highly improbably that an individual would experience no fluctuation in affect over the course of 2 weeks and more likely reflects careless responding.

Study Attrition and Inclusion Analyses

Table 1 displays the breakdown of sample characteristics in the original study sample and after attrition/inclusion cut-offs. Of the 609 participants who were initially recruited for the longitudinal study, 418 returned for the age 18 wave. The initial sample had slightly more male participants (332, 54.5%) than female participants, however, male participants were significantly less likely to return for the age 18 wave ($\chi^2(1) = 10.39$, $p = .001$) and the age 18 sample was evenly split between males (209, 50%) and females. Of the 418 participants returning for age 18, 379 participated in EMA and 348 provided sufficient EMA data to be included in the final sample. Participants who refused to complete the EMA study or completed the EMA but did not provide sufficient data to be included in the main analyses did not significantly differ on any of the demographic variables, group status, or primary depression diagnosis.

Supplemental Tables

Table 1

Sample Characteristic and Attrition and Inclusion Analyses

	Attrition and Inclusion[a]			
	Full Study Sample	Returned for Age 18	Participated in EMA	Final Sample[b]
Sample Size	609	418	379	348
Female	277	209(92.1%)*	194(92.8%)	182(93.8%)
Male	332	209(63.0%)*	185(88.5%)	166(89.7%)
Non-White/Hispanic or Latino	123	77(62.6%)	68(88.3%)	61(89.7%)
White/Non-Hispanic or Latino	486	341(70.2%)	311(91.2%)	287(92.3%)
Family Income < $70,000	181	110(60.8%)*	97(88.2%)	87(89.7%)
Family Income $70-$90,000	102	69(67.6%)	63(91.3%)	60(95.2%)
Family Income $90-120,000	123	92(74.8%)	83(90.2%)	78(94.0%)
Family Income > $120,000	116	86(74.1%)	78(90.7%)	69(88.5%)
Group				
Currently Depressed		34	31(91.2%)	30(96.8)
In Remission		109	97(90.0%)	86(88.7%)
Never-Depressed		275	251(91.3%)	232(92.4%)
Primary Depression Diagnosis[c]		143	128	116
MDD		56	50(89.3%)	46(92.0%)
Dysthymia/PDD		12	10(83.3%)	10(100%)
Depression NOS		75	68 (90.7%)	60(88.2%)

Note: Acronyms are defined as follows: MDD = major depressive disorder, PDD = persistent depressive disorder (DSM-5), NOS = not otherwise specified

[a] Attrition/inclusion analyses were conducted using chi-square tests of independence. Cell percentages are of row (demographic group). Family income was only available for 522 participants of the original sample, so percentages are based off of available data

[b] The final sample provided sufficient EMA data to be included in the main analyses (completed >= 14 surveys, variability in EMA survey responses > 0).

[c] When an individual had multiple depression diagnoses, their primary diagnosis was assigned hierarchically (MDD > Dysthymia/PDD > Depression NOS)

*Males (chi-squared = 10.39, p = .001) and participants with an annual family income < $70,000 (chi-squared = 6.91, p = .009) were significantly less likely to return for the age 18 wave. No other attrition/inclusion analyses were significant.

Table 2

Group Differences in Individual Positive Emotions

	Currently Depressed	In Remission	Never-Depressed	F	p
		Home Base			
Happy	2.80(1.16)[a]	3.13(0.85)[ab]	3.34(0.86)[b]	11.52	< .001
Excited	1.90(1.18)[a]	2.13(1.21)[a]	2.50(1.22)	10.58	.001
Cheerful	1.93(1.26)[a]	2.12(1.13)[a]	2.58(1.21)	14.16	< .001
Content or Peaceful	2.47(1.22)	3.02(1.07)[a]	3.18(1.08)[a]	9.93	.002
		Variability			
Happy	1.09(0.40)	0.95(0.29)	0.83(0.30)	24.77	< .001
Excited	1.11(0.43)[ab]	1.14(0.38)[a]	0.97(0.41)[b]	9.26	.003
Cheerful	1.07(0.37)[a]	1.09(0.41)[a]	0.88(0.36)	18.91	< .001
Content or Peaceful	1.08(0.52)[a]	1.09(0.38)[a]	0.88(0.34)	21.30	< .001
		Inertia			
Happy	0.27(0.10)[ab]	0.28(0.09)[a]	0.25(0.08)[b]	8.31	.004
Excited	0.30(0.80)[a]	0.32(0.11)[a]	0.29(0.09)[a]	3.78	.053*
Cheerful	0.29(0.10)[a]	0.26(0.10)[a]	0.26(0.07)[a]	1.28	.257*
Content or Peaceful	0.21(0.11)[a]	0.21(0.11)[a]	0.19(0.08)[a]	1.99	.159*

Note: Group column cells report group mean(standard deviation). Group means sharing the same superscript are not significantly different (Holm-Bonferroni, $p < .05$). The Holm-Bonferroni correction was applied to the F test p-values for the individual positive emotion dynamics, as these were considered part of a Positive Affect family of tests. Thus, within each dynamic, the most significant individual positive emotion F test was held to an alpha of .05/4 = .0125; the second most significant test was held to an alpha of .05/3 = .0167; the third most significant test was held to an alpha of .05/2 = .025; the last test was held to an alpha of .05. Individual positive emotion F tests that did not meet the corrected alpha threshold are indicated with *.

Table 3

P-Values for Pairwise Comparisons of Group Differences in Emotion and Interest Dynamics

	Current vs. Never	Remitted vs. Never	Current vs. Remitted
Home Base			
Negative Affect	< .001	.051	.038
Sad, Down, or Depressed	< .001	< .001	.044
Anxious, Worried, or Nervous	.002	.025	.105
Irritated, Annoyed, or Angry	.760	.760	.760
Upset	.033	.574	.092
Positive Affect	.017	.030	.272
Happy	.006	.118	.118
Excited	.032	.032	.376
Cheerful	.011	.007	.470
Content or Peaceful	.003	.265	.033
Unmotivated or Not Interested	< .001	.005	.135
Variability			
Negative Affect	< .001	< .001	< .001
Sad, Down, or Depressed	< .001	< .001	< .001
Anxious, Worried, or Nervous	< .001	< .001	.120
Irritated, Annoyed, or Angry	< .001	< .001	.029
Upset	< .001	< .001	.001
Positive Affect	< .001	< .001	.322
Happy	< .001	.003	.039
Excited	.177	.003	.676
Cheerful	.020	< .001	.740
Content or Peaceful	.007	< .001	.977
Unmotivated or Not Interested	< 001	< .001	.004
Inertia			
Negative Affect	.005	.026	.165
Sad, Down, or Depressed	< .001	.002	.090
Anxious, Worried, or Nervous	1.00	1.00	1.00
Irritated, Annoyed, or Angry	.006	.177	.079
Upset	.110	.110	.540
Positive Affect	.720	.180	.140
Happy	.232	.004	.636
Excited	.736	.025	.736
Cheerful	.290	.800	.290
Content or Peaceful	.700	.560	.940
Unmotivated or Not Interested	< .001	.001	.012

Note: Pairwise comparison's apply Holm-Bonferroni correction for family-wise alpha inflation.

Table 4.

Sensitivity Analysis: Group Differences in Emotion and Interest Dynamics for exclusion criteria of < 7 surveys completed.

	Currently Depressed (N = 30)	In Remission (N = 93)	Never-Depressed (N = 239)	F	p
Home Base					
Negative Affect	1.49(0.72)	1.27(0.50)	1.15(0.39)	16.10	< .001
Sad, Down, or Depressed	1.67(0.84)	1.22(0.53)	1.10(0.34)	34.96	< .001
Anxious, Worried, or Nervous	1.63(0.96)[a]	1.38(0.81)[a]	1.19(0.52)	15.28	< .001
Irritated, Annoyed, or Angry	1.23(0.57)[a]	1.19(0.47)[a]	1.13(0.43)[a]	2.31	.129*
Upset	1.30(0.70)[a]	1.14(0.41)[ab]	1.10(0.36)[b]	5.76	.017
Positive Affect	2.47(1.14)[a]	2.74(0.95)[a]	2.99(0.97)	10.61	.001
Unmotivated or Not Interested	1.87(1.25)[a]	1.60(1.02)[a]	1.28(0.67)	19.68	< .001
Variability					
Negative Affect	0.82(0.37)	0.60(0.29)	0.43(0.30)	54.15	< .001
Sad, Down, or Depressed	1.02(0.41)	0.70(0.39)	0.46(0.36)	75.52	< .001
Anxious, Worried, or Nervous	0.97(0.45)[a]	0.82(0.41)[a]	0.61(0.44)	29.84	< .001
Irritated, Annoyed, or Angry	1.03(0.41)	0.86(0.35)	0.63(0.39)	45.27	< .001
Upset	0.98(0.45)	0.69(0.40)	0.49(0.38)	49.98	< .001
Positive Affect	0.93(0.39)[a]	0.88(0.34)[a]	0.71(0.30)	26.03	< .001
Unmotivated or Not Interested	1.28(0.50)	0.98(0.54)	0.74(0.48)	41.26	< .001
Inertia					
Negative Affect	0.30(0.14)[a]	0.26(0.14)[a]	0.22(0.12)	14.30	< .001
Sad, Down, or Depressed	0.30(0.17)[a]	0.25(0.13)[a]	0.20(0.12)	22.97	< .001
Anxious, Worried, or Nervous	0.21(0.14)[a]	0.21(0.14)[a]	0.19(0.11)[a]	0.903	.343*
Irritated, Annoyed, or Angry	0.19(0.13)[a]	0.15(0.12)[ab]	0.13(0.09)[ab]	10.08	.002
Upset	0.22(0.16)[a]	0.20(0.15)[a]	0.17(0.12)[a]	7.45	.007
Positive Affect	0.36(0.12)[a]	0.35(0.11)[a]	0.33(0.09)[a]	5.36	.021
Unmotivated or Not Interested	0.29(0.13)	0.23(0.13)	0.18(0.10)	31.26	< .001

Note: Group column cells report group mean(standard deviation). Group means sharing the same superscript are not significantly different (Holm-Bonferroni, $p < .05$). The Holm-Bonferroni correction was also applied to the F test p-values for the individual negative emotion dynamics, as these were considered part of a Negative Affect family of tests. Thus, within each dynamic, the most significant individual negative emotion F test was held to an alpha of .05/4 = .0125; the second most significant test was held to an alpha of .05/3 = .0167; the third most significant test was held to an alpha of .05/2 = .025; the last test was held to an alpha of .05. Individual negative emotion F tests that did not meet the corrected alpha threshold are indicated with *. P values for pairwise comparisons can be found in output files posted in the project OSF folder.

Table 5

Sensitivity Analysis: Moderating Role of Sex in Group Differences in Emotion and Interest Dynamics

	Depression Group		Sex		Interaction	
	F	p	F	p	F	p
Home Base						
Negative Affect	15.79	< .001	0.35	.553	1.67	.197
Sad, Down, or Depressed	34.21	< .001	0.00	.978	2.64	.105
Anxious, Worried, or Nervous	15.49	< .001	1.57	.211	.067	.796
Irritated, Annoyed, or Angry	1.86	.174	0.62	.432	0.43	.513
Upset	5.03	.023	0.35	.557	0.52	.470
Positive Affect	11.68	.001	0.63	.426	1.79	.181
Unmotivated or Not Interested	19.20	< .001	0.08	.773	0.12	.726
Variability						
Negative Affect	55.19	< .001	12.72	< .001	0.59	.445
Sad, Down, or Depressed	73.15	< .001	8.15	.005	2.34	.127
Anxious, Worried, or Nervous	32.05	< .001	20.91	< .001	.321	.572
Irritated, Annoyed, or Angry	49.62	< .001	6.33	.012	2.73	.099
Upset	52.18	< .001	11.31	.001	1.54	.215
Positive Affect	24.98	< .001	13.79	< .001	0.01	.929
Unmotivated or Not Interested	44.94	< .001	2.79	.096	0.63	.430
Inertia						
Negative Affect	13.93	< .001	4.32	.038	0.05	.820
Sad, Down, or Depressed	23.08	< .001	3.64	.057	0.72	.398
Anxious, Worried, or Nervous	0.72	.397	10.48	.001	0.68	.410
Irritated, Annoyed, or Angry	9.64	.002	0.06	.813	1.01	.315
Upset	7.06	.008	3.91	.049	0.60	.439
Positive Affect	5.54	.019	5.45	.020	0.01	.932
Unmotivated or Not Interested	32.92	< .001	14.30	< .001	1.03	.311

Note: Pairwise comparison's apply Holm-Bonferroni correction for family-wise alpha inflation.

Table 4.

Sensitivity Analysis: Group Differences in Emotion and Interest Dynamics for Home Base and Variability Calculated Using the Mean

	Currently Depressed (N = 30)	In Remission (N = 93)	Never-Depressed (N = 239)	F	p
Home Base					
Negative Affect	1.87(0.51)	1.54(0.45)	1.34(0.39)	48.56	< .001
Sad, Down, or Depressed	2.06(0.64)	1.48(0.51)	1.28(0.38)	76.07	< .001
Anxious, Worried, or Nervous	1.98(0.76)	1.71(0.72)	1.44(0.52)	29.94	< .001
Irritated, Annoyed, or Angry	1.72(0.44)	1.54(0.42)	1.37(0.40)	26.45	< .001
Upset	1.72(0.51)	1.42(0.43)	1.28(0.39)	32.50	< .001
Positive Affect	2.45(0.73)[a]	2.65(0.62)[a]	2.93(0.77)	17.86	< .001
Unmotivated or Not Interested	2.25(0.75)	1.90(0.71)	1.56(0.61)	39.77	< .001
Variability					
Negative Affect	0.66(0.24)	0.51(0.23)	0.36(0.23)	59.68	< .001
Sad, Down, or Depressed	0.86(0.27)	0.60(0.30)	0.41(0.30)	75.90	< .001
Anxious, Worried, or Nervous	0.82(0.33)[a]	0.71(0.32)[a]	0.52(0.34)	34.59	< .001
Irritated, Annoyed, or Angry	0.87(0.28)[a]	0.75(0.27)[a]	0.55(0.31)	50.91	< .001
Upset	0.82(0.32)	0.63(0.34)	0.44(0.31)	50.80	< .001
Positive Affect	0.77(0.25)[a]	0.74(0.23)[a]	0.61(0.21)	27.05	< .001
Unmotivated or Not Interested	1.03(0.34)	0.82(0.36)	0.62(0.36)	46.54	< .001

Note: Group column cells report group mean(standard deviation). Group means sharing the same superscript are not significantly different (Holm-Bonferroni, $p < .05$). The Holm-Bonferroni correction was also applied to the F test p-values for the individual negative emotion dynamics, as these were considered part of a Negative Affect family of tests. Thus, within each dynamic, the most significant individual negative emotion F test was held to an alpha of .05/4 = .0125; the second most significant test was held to an alpha of .05/3 = .0167; the third most significant test was held to an alpha of .05/2 = .025; the last test was held to an alpha of .05. Individual negative emotion F tests that did not meet the corrected alpha threshold are indicated with *.

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