

This supplementary material accompanies the article: Klippel, A., Myin-Germeys, I., Chavez-Baldini, U., Preacher, K. J., Kempton, M., Valmaggia, L., Calem, M., So, S., Beards, S., Hubbard, K., Gayer-Anderson, C., Onyejiaka, A., Wichers, M., McGuire, P., Murray, R., Garety, P., van Os, J., Wykes, T., Moran, C., & Reininghaus, U. (2017). Modeling the interplay between psychological processes and adverse, stressful contexts and experiences in pathways to psychosis: An experience sampling study. *Schizophrenia Bulletin*, 43, 302-315.

Supplementary Table 1. Basic sample characteristics

	FEP (n=51)	ARMS (n=46)	Controls (n=53)	Test statistic	p
Age (years), mean (S.D.)	28.3 (8.6)	23.6 (4.7)	35.0 (12.6)	F=18.6, df=2	<0.001
Gender, n (%)					
Men	28 (54.9)	21 (45.7)	25 (47.2)	$\chi^2=1.0$, df=2	0.612
Women	23 (45.1)	25 (54.4)	28 (52.8)		
Ethnicity, n (%)					
White British	14 (27.5)	17 (37.0)	25 (47.2)	$\chi^2=14.0$, df=10	0.174
Black African	17 (33.3)	7 (15.2)	8 (15.1)		
Black Caribbean	11 (21.6)	7 (15.2)	6 (11.3)		
Asian	1 (2.0)	1 (2.2)	3 (5.7)		
White Other	4 (7.8)	5 (10.9)	5 (9.4)		
Other	4 (7.8)	9 (19.6)	6 (11.3)		
Place of birth, n (%)					
UK-born	32 (62.7)	34 (73.9)	33 (62.3)	$\chi^2=1.9$, df=2	0.396
Non-UK-born	19 (37.3)	12 (26.1)	20 (37.7)		
Level of education, n (%)					
School	17 (33.3)	13 (28.9)	8 (15.1)	$\chi^2=24.3$, df=4	<0.001
Further	25 (49.0)	24 (53.3)	15 (28.3)		
Higher	9 (17.7)	8 (17.8)	30 (56.6)		
Employment status, n (%)					
Unemployed	30 (58.8)	15 (32.6)	5 (9.4)	$\chi^2=28.5$, df=2	<0.001
Other	21 (41.2)	31 (67.4)	48 (90.6)		
OPCRIT Psychotic disorder diagnosis ^a , n (%)					
Schizophrenia	15 (31.3)	–	–		
Delusional disorder	3 (6.3)	–	–		
Schizoaffective disorder	3 (6.3)	–	–		
Manic psychosis	7 (14.6)	–	–	–	–
Depressive psychosis	7 (14.6)	–	–		
Psychotic disorder NOS	13 (27.1)	–	–		
SCID Comorbid affective disorder diagnosis, n (%)					
Mood disorder	–	5 (10.9)	–		
Anxiety disorder	–	15 (32.6)	–	–	–
Mood and anxiety disorder	–	3 (6.5)	–		
Psychotropic medication ^b , n (%)					
Antipsychotic ^c	40 (81.6)	5 (11.9)	0 (0.0)		
Atypical	36 (76.6)	5 (11.9)	0 (0.0)		
Typical	1 (2.1)	0 (0.0)	0 (0.0)		
Atypical and typical	1 (2.1)	0 (0.0)	0 (0.0)	–	–
Antidepressant	11 (22.9)	17 (40.5)	0 (0.0)		
Other	12 (25.0)	4 (9.5)	9 (17.0)		
None	4 (8.2)	22 (52.4)	44 (83.0)		

Note: FEP, First-Episode Psychosis; ARMS, At-Risk Mental State for psychosis; S.D., standard deviation; df, degrees of freedom; OPCRIT, Operational Criteria system; SCID, Structured Clinical Interview for DSM Disorders; Missing values: ^a3, ^b6

^c Antipsychotic medication in ARMS individuals was *not* for a psychotic episode (see exclusion criteria)

Supplementary Table 2. Aggregate ESM scores for stress, negative affect, aberrant salience, threat anticipation and psychotic experiences in FEP, ARMS, and controls

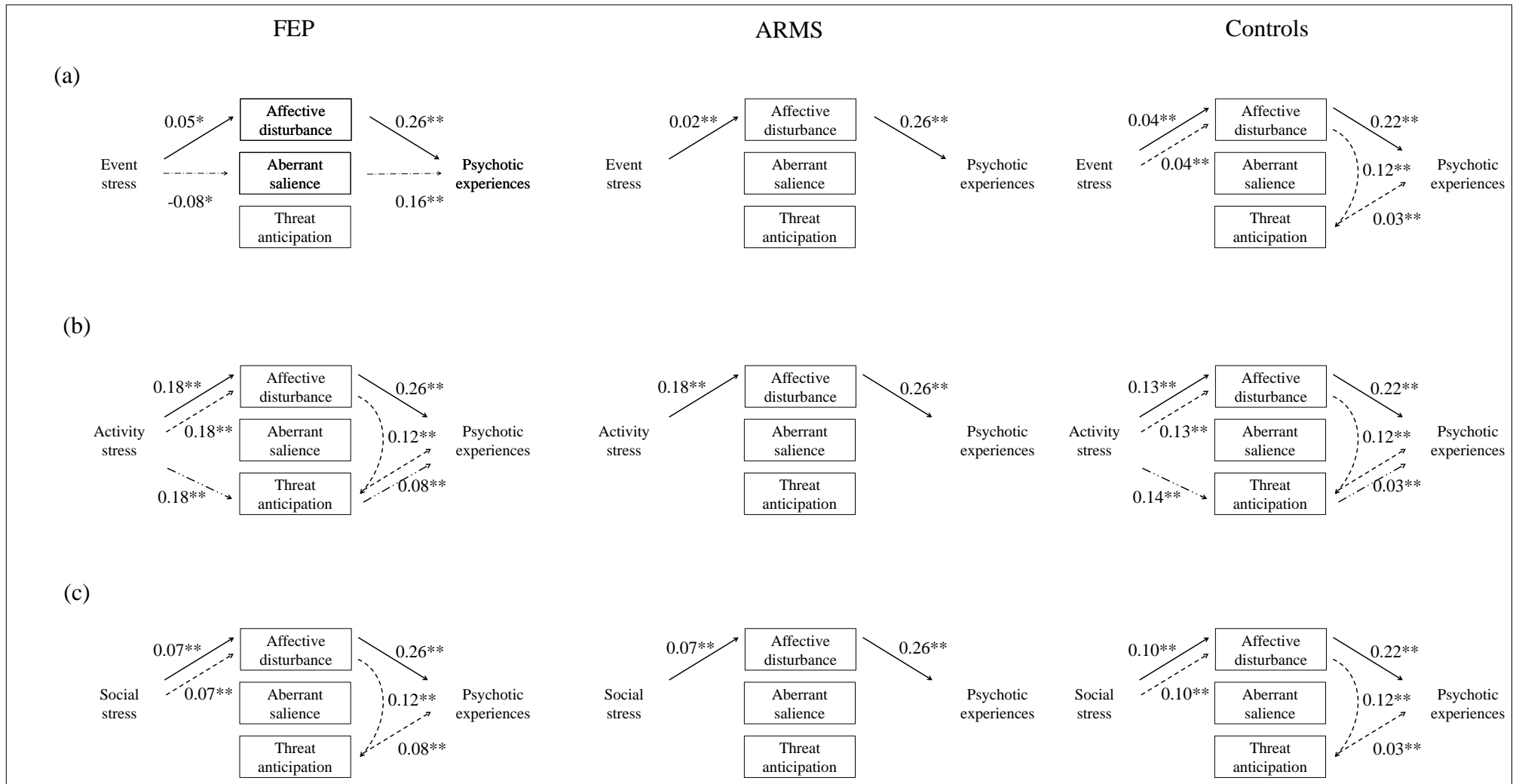
	FEP	ARMS	Controls	FEP vs. controls		ARMS vs. controls	
	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	B (95% CI)	p	B (95% CI)	p
Stress							
Event	3.70 (0.77)	3.53 (0.74)	3.24 (0.69)	0.46 (0.37 – 0.55)	<0.001	0.29 (0.19 – 0.38)	<0.001
Activity	3.42 (0.90)	3.15 (0.78)	3.0 (0.50)	0.43 (0.34 – 0.52)	<0.001	0.15 (0.07 – 0.24)	0.001
Social	3.48 (0.89)	2.91 (0.84)	2.66 (0.72)	0.83 (0.72 – 0.92)	<0.001	0.25 (0.15 – 0.34)	<0.001
Negative affect	3.04 (1.23)	3.0 (1.08)	1.91 (0.70)	1.13 (1.05 – 1.21)	<0.001	1.10 (1.02 – 1.18)	<0.001
Aberrant salience	2.87 (1.27)	2.40 (1.13)	2.19 (1.22)	0.68 (0.59 – 0.77)	<0.001	0.21 (0.12 – 0.31)	<0.001
Threat anticipation	2.62 (1.25)	2.97 (1.33)	1.87 (0.84)	0.75 (0.65 – 0.85)	<0.001	1.11 (1.01 – 1.21)	<0.001
Psychotic experiences	2.55 (1.27)	2.40 (1.13)	1.47 (0.59)	1.08 (1.01 – 1.15)	<0.001	0.93 (0.86 – 1.01)	<0.001

Note: ESM, Experience Sampling Method; FEP, First-Episode Psychosis; ARMS, At-Risk Mental State for psychosis; S.D., standard deviation; CI, confidence interval

Supplementary Table 3. Multivariate multilevel model correlations at beep level between the stress variables, negative affect, psychotic experiences, threat anticipation, aberrant salience, controlled for age and gender.

Association	FEP			UHR			Controls		
	CC	SE	95% CI	CC	SE	95% CI	CC	SE	95% CI
Event-related stress & negative affect	0.142	0.023	0.096 - 0.187	0.220	0.023	0.175 - 0.264	0.186	0.020	0.146 - 0.224
Social stress & negative affect	0.217	0.022	0.173 - 0.261	0.294	0.022	0.251 - 0.336	0.322	0.018	0.285 - 0.357
Activity stress & negative affect	0.321	0.021	0.279 - 0.362	0.403	0.020	0.363 - 0.442	0.376	0.018	0.341 - 0.410
Event-related stress & threat anticipation	0.096	0.023	0.050 - 0.142	0.146	0.023	0.010 - 0.191	0.121	0.020	0.082 - 0.161
Social stress & threat anticipation	0.113	0.023	0.067 - 0.159	0.186	0.023	0.140 - 0.230	0.127	0.020	0.087 - 0.166
Activity & threat anticipation	0.173	0.023	0.128 - 0.218	0.278	0.022	0.235 - 0.321	0.223	0.019	0.191 - 0.267
Event-related stress & aberrant salience	-0.091	0.023	-0.137 - -0.045	-0.021	0.024	-0.069 - 0.026	-0.019	0.021	-0.059 - 0.021
Social stress & aberrant salience	-0.022	0.024	-0.068 - 0.025	-0.004	0.024	-0.051 - 0.043	-0.007	0.021	-0.047 - 0.033
Activity & aberrant salience	-0.010	0.024	-0.056 - 0.037	0.053	0.024	0.006 - 0.099	0.013	0.021	-0.027 - 0.053
Event-related stress & psychotic experiences	0.079	0.024	0.033 - 0.125	0.096	0.024	0.050 - 0.143	0.092	0.020	0.052 - 0.132
Social stress & psychotic experiences	0.068	0.024	0.022 - 0.114	0.188	0.023	0.142 - 0.233	0.182	0.020	0.143 - 0.221
Activity stress & psychotic experiences	0.227	0.022	0.183 - 0.271	0.284	0.022	0.241 - 0.327	0.212	0.020	0.173 - 0.250
Aberrant salience & negative affect	0.099	0.023	0.052 - 0.144	0.059	0.024	0.012 - 0.105	0.061	0.020	0.021 - 0.101
Threat anticipation & negative affect	0.249	0.022	0.205 - 0.292	0.830	0.051	0.699 - 0.907	0.265	0.019	0.228 - 0.302
Psychotic experiences & negative affect	0.464	0.019	0.427 - 0.500	0.482	0.018	0.446 - 0.518	0.464	0.016	0.432 - 0.495
Threat anticipation & psychotic experiences	0.262	0.022	0.218 - 0.304	0.214	0.023	0.169 - 0.259	0.237	0.019	0.198 - 0.274
Threat anticipation & aberrant salience	0.018	0.024	-0.028 - 0.065	0.011	0.024	-0.036 - 0.057	0.076	0.020	0.036 - 0.116
Psychotic experiences & aberrant salience	0.311	0.021	0.269 - 0.353	0.335	0.021	0.293 - 0.376	0.286	0.019	0.249 - 0.323

Note. CC, correlation coefficient; SE, standard error; 95% CI, 95% confidence interval



Supplementary Figure 1. Display of individual path coefficients for significant indirect effects (i.e., the product of individual path coefficients; shown in Table 3) of (a) event-related stress, (b) activity-related stress, and (c) social stress on psychotic experiences via affective disturbance (————>), aberrant salience (- - - - ->), threat anticipation (- - - - ->), and via affective disturbance *and* threat anticipation (- - - - ->). Findings are displayed separately for FEP individuals, ARMS individuals, and controls. * P<0.05; ** P<0.001

Online Supplementary Methods

Statistical analysis

ESM data have a multilevel structure, such that multiple observations are nested within subjects. Multilevel moderated mediation models were fitted in MPlus, Version 7,³⁸ to control for within-subject clustering of multiple observations,^{39, 42} using the MLR estimator, which allows for the use of all available data under the relatively unrestrictive assumption that data is missing at random if all variables associated with missing values are included in the model. In a two-level model, multiple observations (level-1) were treated as nested within subjects (level-2). The total effect of stressful contexts and experiences (event-related, activity-related, and social stress) in daily life (level-1) on intensity of psychotic experiences (level-1) was apportioned into direct and indirect (or, synonymously, mediating) effects through negative affect, aberrant salience, and enhanced threat anticipation (level-1) using the product of coefficients strategy. This strategy quantifies the point estimate of the indirect effect as the product of the coefficient of independent variable on mediator variable (path a) and the coefficient of mediator variable on dependent variable (path b). We used statistical software by Selig and Preacher⁴¹ for computing Monte Carlo confidence intervals and assessing statistical significance of indirect effects, given their advantages over rival methods in the context of multiple multilevel mediation models.^{40, 42} Group (FEP, ARMS, controls) was used as the moderator variable (level-2) of direct and conditional indirect effects in all analyses based on a multilevel moderated mediation approach, in which the moderator variable is the predictor of the a and b paths (see above) and the strength of the indirect effect of the level-1 independent variable depends on the level-2 moderator variable.^{40, 54} This allowed us to test whether conditional indirect effects were greater in a) FEP than in controls, b) ARMS than in controls, and c) FEP than in ARMS by computing differences in conditional indirect effects using the model constraint command in MPlus³⁸ and calculating

respective Monte Carlo confidence intervals.^{40, 39} We first fitted separate simple moderated multilevel mediation models (including variables associated with missing values (i.e., age, group)¹²): 1) with one independent variable for event-related stress, activity-related stress, or social stress, one mediator variable for negative affect, threat anticipation or aberrant salience, and one outcome variable for psychotic experiences; 2) with one independent variable for negative affect, one mediator variable for threat anticipation or aberrant salience, and one outcome variable for psychotic experiences; and 3) with enhanced threat anticipation as independent variable, aberrant salience as mediator variable, and psychotic experiences as outcome variable. Based on evidence of mediation via negative affect, threat anticipation and aberrant salience in these models, we next fitted a multiple multilevel moderated mediation model to examine the relative contribution of direct effects and specific indirect effects via these pathways simultaneously.⁴² All analyses were adjusted for age, gender, ethnicity, level of education, employment status and, based on findings from previous ESM research,¹² area-related stress and outsider status as potential confounders by including these variables as predictors of each mediator and dependent variable.